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 the co-existence and borrowers' choice between formal and informal credit in a setting with imperfect debt 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 a collateral requirement. If social capital is sufficiently large, we show that informal loans have zero interest and require 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, since physical collateral is divisible unlike the social capital pledged in informal credit, default on formal loans is less costly to both sides than default on informal loans. Therefore, formal and informal credit can co-exist based on the loan riskiness, measured by the loan size to borrower's wealth ratio. Borrowers choose formal credit for riskier (larger) loans while informal credit is used for smaller projects with zero or low default risk. Empirical results using data on rural Thai households are consistent with the predicted choice pattern and terms of formal versus informal credit.

Keywords: Family loans, Informal credit, Social capital, Limited enforcement
JEL Classification: D14, G21, O16, O17

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1 Introduction

Informal financing is the prevalent form of credit used by households and small businesses in developing countries. A large fraction of informal credit originates from family, friends or neighbors.[1] A common explanation for the abundance of informal credit is that it has information or enforcement advantages that mitigate market imperfections originating from moral hazard, adverse selection, or limited commitment. In developing countries, the widespread inability of households to pledge collateral or high transaction costs (due to lack of credit history, financial illiteracy, lack of property titles, inefficient courts, etc.) cause many of the poor to be rationed out of formal credit markets.[2] This leaves informal loans, primarily based on social links, as these households' only option.[3]

The above argument implicitly presumes a shadow cost of informal credit – if borrowers had a choice, they would prefer to use formal credit but are unable to do so because of market imperfections. This presumption looks broadly consistent with the evidence, both across countries and over time. The fraction of informal credit in total lending is generally lower in countries with larger financial sectors and shrinks as the formal financial sector develops.[4]

In our data, Figure 1 illustrates the change in use of informal credit around the 1998 Thai financial crisis, for a panel of 872 rural households observed between 1997 and 2001.[5] Prior to the 1998 financial crisis, informal loans from neighbours or relatives made up roughly 21 percent of all loans in the sample. This fraction rose to 31 percent during the crisis, then gradually reverted to its pre-crisis level. This is consistent with the idea that many households use family or neighbours as "lender of last resort" at times when obtaining credit from other sources is harder.

Yet, the existing literature offers little systematic guidance as to why households seem reluctant to borrow from friends and family if alternative sources are available.[6] One possible explanation could be that formal lenders such as banks have a comparative advantage in lending (e.g., expertise, risk diversification, etc.) but this seems implausible for small sums of money. Turning to friends or relatives does appear preferable in many circumstances as they are often better informed about the personal circumstances of the borrower and have lower monitoring or enforcement costs. This is the 'peer monitoring' argument of Stiglitz (1990). For small loans, risk aversion or liquidity constraints are also less likely to be a problem. So, if relatives can do everything a bank can, (e.g., charge interest or require collateral) but, in addition,

[1] For example, Paulson and Townsend (2004) report that about 30% of households-run businesses in their 1997 Thai survey have outstanding loans from other households while only 3% have loans from commercial banks. Banerjee and Duflo (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.

[2] See Ghosh et al. (2000) for a review.

[3] The recent spread of microfinance provides another source of credit to poor households based on social collateral.

[4] Detailed and reliable data on interpersonal informal loans in developed countries are scarce, which may partly be due to negative tax implications (in the US, for example, interpersonal loans are subject to a tax if the interest 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 their downpayments in 2011.

[5] These data are part of the Townsend Thai Project, a detailed dataset based on micro surveys of Thai households. See http://cier.uchicago.edu/ for details.

[6] An exception is Lee and Persson (2013) discussed below.

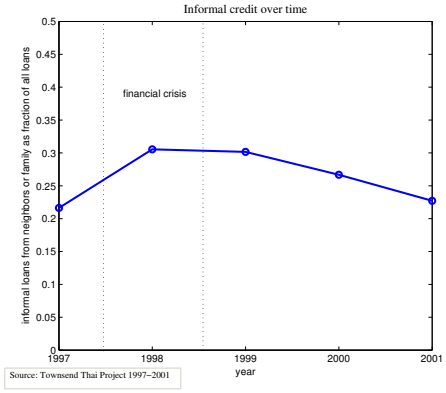


Figure 1: Informal loans in rural Thailand

leverage the social capital as a means of enforcing compliance, why use formal credit at all?

This puzzle is even more pronounced since loans from family or friends typically have very favorable terms. For example, in a survey of financial management practices among the poor, Collins et al. (2010, ch. 2) report that family loans are most frequently interest free. Similarly, in the 2004 survey on informal finance conducted by the Global Entrepreneurship Monitor (GEM), between 60 and 85 percent of investors were relatives or friends of the entrepreneur they financed and the majority were willing to accept low or negative returns (Bygrave and Quill, 2006). These regularities are also present in the Thai data we use, in which the median interest rate for loans from relatives is zero and 90 percent of loans from relatives or neighbors require no collateral. [7]

To sum up, the notion that informal loans based on social capital pose fewer contracting problems, together with the evidence that informal loans have more favourable terms, leads to the conclusion that borrowers should prefer informal over formal credit, unless informal lenders have insufficient funds. But if formal and informal credit are both viable options, why would many households choose formal credit? Also, why is formal credit preferred in developed countries even for relatively small amounts?

We answer these questions by highlighting the costs and benefits of formal and informal loans from the borrower's perspective and by pointing out an inherent disadvantage of informal credit. Throughout the paper we use the term *informal credit* to refer to loans that rely on personal relationships and can use social sanctions as means of contract enforcement. The primary example we have in mind is loans from family, friends or neighbours although other sources such as credit cooperatives, ROSCAs, or some agricultural credit associations may also fit the description. In contrast, we use the term *formal credit* to refer to loans for which a social relationship between the lender and borrower is absent and/or not used to enforce repayment. A leading example is a bank loan.

We build a model the results of which match the stylized facts discussed above - co-existence of formal and informal credit, more favorable terms for informal credit, yet preference for formal loans under

[7] see Figure 3 in Section 2 below.

broad conditions. The main trade-off between formal and informal credit in our model is as follows. Informal credit uses 'social collateral' measured by the value of friendship or kinship ties between the borrower and the lender. This social collateral can serves as a substitute for physical collateral and the threat of losing it enables informal borrowers to commit not to behave opportunistically (no strategic default). Using the social collateral is always feasible and allows for favorable loan terms. At a first sight, this makes informal credit very attractive, especially for poor households without collateralizable assets and for small loans. Using the social collateral comes at a cost, however. Unlike physical assets, 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 social collateral is lost, with utility cost for both parties. These cost are incurred whenever there is a positive endogenous probability of default and increase in that probability. In our setting default is more likely for more leveraged borrowers (with higher loan size to wealth ratio). The social capital could be also (partially) lost if an informal lender refuses a loan when asked. In contrast, in formal credit the physical collateral can be adjusted with the loan size and (at least partially) compensates the lender upon default. Overall, this means that for informal credit can be more 'expensive' in utility terms than formal credit and sub-optimal to use, even in the face of its more favourable loan terms.

We show that even though informal lenders are able to use the same instruments as formal lenders (require collateral, charge interest), if the social capital shared with their borrowers is sufficiently large, they would refrain from doing so and instead rely solely on the value of social capital as means of contract enforcement by requiring no collateral and charging zero interest. Intuitively, for large social capital values informal borrowers never default strategically and hence informal lenders always find it optimal to lend when asked, knowing that they would not be approached by the borrower if the risk of default (project failure) were too high.

In contrast, formal loans always require collateral and, as long as there is positive probability of default, demand a strictly positive interest rate. The relative disadvantage of formal loans in terms of monetary costs notwithstanding, the potential loss of social capital associated with informal lending makes borrowers choose formal over informal credit when the ratio of the loan size to borrower's wealth (the LTW ratio) is relatively high, which corresponds to a higher probability of default.

Our theoretical model has empirically testable implications that we take to the Thai data. First, informal loans should have 'better' terms (lower interest and collateral) than formal loans. Second, the model predicts a *negative* relationship between the riskiness of a loan (measured by the ratio of the loan size to borrower's wealth) and the likelihood of observing informal credit. The reason is as follows: if the risk of equilibrium default is negligible, then informal credit is always preferred due to its favourable terms. As the risk of default increases, however, informal credit becomes more costly because of the value of the social capital that is lost upon default, and thus borrowers can prefer formal loans, ceteris paribus.

The patterns we find in the data from the 1997 Survey of Thai households (part of the Townsend Thai Project) are consistent with the model results and assumptions. We show that "informal loans", from

relatives or neighbors, have more favorable terms (lower interest and low or zero collateral) compared to "formal loans", from commercial banks or moneylenders. In addition, riskier loans are statistically significantly *less* likely to be informal: using the ratio of loan size to borrower's wealth as the (model-suggested) measure of the likelihood of default, we find that *higher-risk loans are associated with a lower incidence of informal credit* than lower-risk loans in the Thai data. The empirical results remain robust with respect to alternative definitions of formal vs. informal credit, selection bias in borrowing, and the possible endogeneity of loan size.

Related literature

Our paper contributes to a relatively small but growing literature on the coexistence of formal and informal credit. The closest is the work of Lee and Persson (2013) who offer an alternative and complementary explanation of the downside of informal credit. Among several key differences, while we assume that informal loans are 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 some of the implications regarding reduced agency costs and lower interest in informal loans are similar, the implied cost of using informal credit in their paper is different. Specifically, Lee and Person emphasize the role of risk avoidance: informal credit amplifies the borrowers' aversion to failure, thereby undermining the entrepreneurs' willingness to take risk which potentially limits investment and firm size.

Gine (2011) assumes limited enforcement and fixed costs in accessing formal loans to model a trade-off between informal and formal credit. He estimates the model structurally using Thai data and concludes that the limited ability of banks to enforce contracts, as opposed to fixed costs, leads to the observed diversity of lenders.[8] This 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, etc.) is traded off against an informational advantage that informal lenders possess about their borrowers.[9]

More generally, we contribute and draw upon 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 a social network improve enforcement (Hoff and Stiglitz, 1994; Besley and Coate, 1995). In this respect, our paper relates to 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 other members of her social group. Second, informal lenders' better access to local information can allow them to write contracts that are more state-contingent than formal contracts (Bond and Townsend,

[8] See also Madestam (2012) who, unlike us, models formal lenders (banks) as having a monitoring disadvantage relative to informal lenders and shows that formal and informal sources can be substitutes or complements depending on banks' market power.

[9] The empirical work on the choice of formal versus informal finance generally highlights the factors mentioned in the first paragraph of this paper. For example, in a study of Peruvian farmers, Guirkinger (2008) 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 the demand for formal credit is positively associated with household wealth while informal credit is positively associated with bad credit history and the number of dependents.

1996; Bose, 1997; Kochar, 1997; Guirkinger, 2008 among others). Similar insights underlie the spread of joint-liability lending programs by exploiting information sharing or peer enforcement (see Ghatak and Guinnane, 1999 or Morduch, 1999 for discussion). Udry (1994) models informal loans between risk-averse agents as reciprocal and state-contingent and shows that low interest rates may be observed after a borrower suffers an adverse shock and higher rates otherwise. In contrast, our explanation for the more favorable terms of informal loans does not rely on risk aversion or information advantages and we additionally model the co-existence of informal and formal credit with different terms. The literature on social capital (see Woolcock and Naryan, 2000 for a survey) identifies a downside of transactions based on social ties, as the lack of such ties to outsiders can stifle the extent to which production can move beyond the kin group. Our focus differs, since we highlight how the possibility of losing social capital in a risky environment makes borrowers substitute informal with formal credit arrangements. Finally, since we model informal lending as embedded in a pre-existing social relationship, our paper also relates to the literature on interlinking (e.g., Braverman and Stiglitz, 1982).

We proceed as follows. In Section 2, we describe the data we use and highlight the key empirical regularities that a model should account for. In Section 3 we describe the model and characterize the optimal informal and formal loan contracts. The costs and benefits of informal vs. formal credit are compared and the choice of credit source is analyzed in Section 4. Section 5 presents the empirical analysis. Section 6 concludes. All proofs are in the Appendix.

2 Household Loans in Rural Thailand

We use data from a detailed survey of rural households in Thailand, conducted in 1997 by the Townsend Thai Project.[10] The sample originates from four provinces located in two distinct regions of Thailand – the more developed Central region near Bangkok, and the poorer, semi-arid Northeast region (see Figure 2). The data contain both socioeconomic and financial variables, including current and retrospective information on assets, savings, income, occupation, household demographics, entrepreneurial activities, and education. Most importantly for our purposes, the 1997 survey provides detailed information on the use of a variety of formal and informal lenders such as commercial banks, agricultural banks, village lending institutions, moneylenders, as well as neighbours and family.

Households were asked detailed questions about their borrowing and lending activities: 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 what type of lender it was borrowed. The last question has a range of possible answers including: a neighbour, a relative, the Bank for Agriculture and Agricultural Cooperatives (BAAC), a commercial bank, an agricultural cooperative, a village fund, a moneylender, etc. Table 1 breaks down the loan sources into the respective categories. We see that borrowing from neighbours and relatives comprises about 24% of all loans in the sample. Borrowing from commercial

[10]The initial survey was fielded in May, prior to the economic and financial crisis which began with the devaluation of the Thai baht in July 1997. For full details, including the sample selection and the administration of the survey see the Townsend Thai Project website http://cier.uchicago.edu/about/.

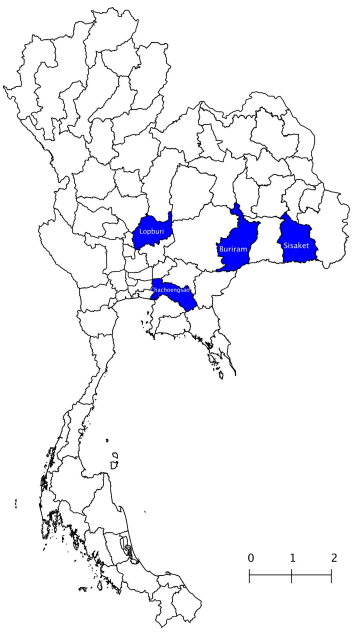


Figure 2: Surveyed Provinces in Thailand

banks, in contrast, is relatively rare (3% of all loans), reflecting the fact that a large fraction of these rural households do not have access to commercial banks. Instead, they resort more often to moneylenders or to 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 BAAC loans are extended to individuals, borrowers are often organized in joint liability groups. The interest rates on BAAC loans are typically 1–2 % lower than those of commercial banks.

Summary statistics of the data are provided in Table 8 in the Appendix. We computed household wealth from detailed self-reported information on the value of household assets which include land, agricultural assets (animals, machinery, etc.), business assets, durable consumption goods, financial assets, and savings. 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 access' equals one if the household was a customer of a commercial bank. All other variables in the table are self-explanatory. As a point of reference, the average annual income in Thailand in 1996 was 105,125 Baht, or roughly $4,200 (Paulson and Townsend, 2004).

As mentioned in the introduction, the key distinction we make between 'formal' and 'informal' credit is whether or not a loan is backed or enforced by physical collateral as opposed to social/relationship capital.

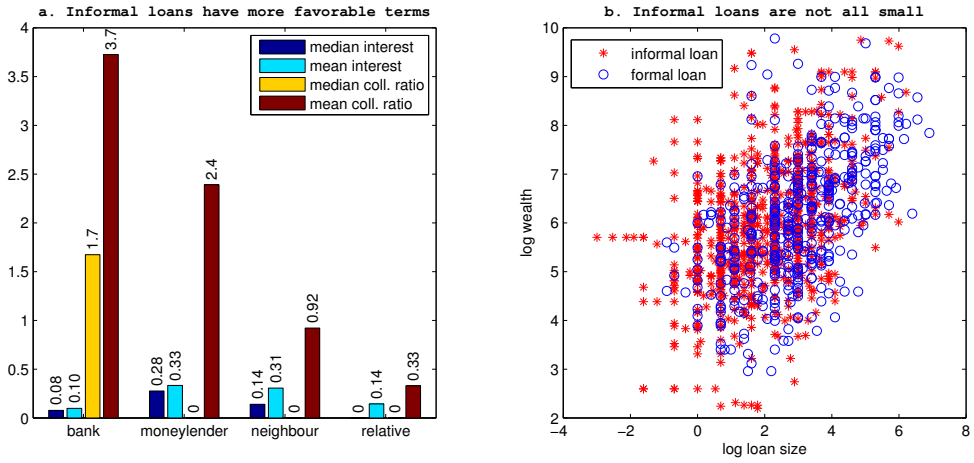
Table 1: Loan Source

Source	Frequency	Percent
neighbor	272	7.94
relative	552	16.11
BAAC	1,185	34.58
commercial bank	106	3.09
agricultural cooperative	347	10.13
village fund	32	0.93
moneylender	338	9.86
store owner	141	4.11
other	454	13.25
Total	3,427	100.00

[a] **Note:** Category "other" includes: 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.

In our baseline specification we define 'formal' credit as loans from commercial banks or moneylenders and 'informal' credit as loans from relatives or neighbors. Since the BAAC and agricultural coops are hybrid institutions in terms of our social capital based classification – they often require collateral but may also use social links (via a joint liability clause) to secure repayment – we initially exclude those loans from the analysis but we then perform robustness checks by including them in either the formal or informal category. While moneylenders are often considered 'informal' sources of credit in other papers, using an institutional-based definition, the dimension we focus on, whether or not the loan is secured by personal or social ties, leads us to group moneylenders with commercial banks. We drop the remaining loans in the baseline runs but consider several robustness checks to our definitions of formal and informal credit (see Section 5.2 below).

To motivate the theory we first look at the loan terms in our sample. Although the survey did not ask about interest rates directly, we were able to manually compute them, in most cases, using the loan period length, the total required repayment, and the initial loan size. Figure 3(a) shows the mean and median loan interest rate and the ratio of collateral to loan size ('collateral ratio') for the four loan sources we use in our baseline results: commercial banks, moneylenders, neighbours, and relatives. We see that, in most cases, informal credit (loans from relatives or neighbours) is significantly cheaper in monetary terms (interest and collateral) than formal credit (loans from commercial banks or moneylenders) – the median interest rate on loans from relatives is zero which is considerably lower than both the median commercial bank interest rate (8%) and the median moneylender rate (28%). In addition, the vast majority of neighbours and relatives (over 90%) require no collateral, arguably using in its place social capital. Some neighbors do charge high interest, which explains the large mean, but their median rate is half that of moneylenders (14% vs. 28%). Banks do charge lower interest than both neighbors and moneylendes but require much more collateral. A large fraction of moneylenders do not require collateral but charge high interest rates.



Panel (a) excludes observations with interest rate > 200% and collateral ratio > 100.

Figure 3: Variation in (a) loan terms, and (b) size of loan vs. household wealth, by type of credit

The fact that informal credit as defined, is cheaper than borrowing from a bank or a moneylender, however, does not mean that formal credit is rare in our data. Figure 3(b) plots the distribution of formal and informal loans over loan size and household wealth. The Figure illustrates that informal loans from relatives and neighbours exist all over the range of observed wealth and loan sizes, and similarly for formal credit.[11] The point is that, even though informal loans are smaller on average (see Table 7), loan size is not the sole factor affecting loan source choice. Indeed, we argue next that loan riskiness is an important determinant.

It is natural to think that the availability of different lenders, and the borrowers' choice among them, is related to the risk of default. Unfortunately, our data do not allow us to directly infer default risk. Instead, we compute the borrowers' loan-size-to-wealth (LTW) ratio as an indicator of the riskiness of a loan, with the interpretation that loans with large size relative to household wealth are riskier than loans that are small relative to household wealth.[12] A direct link between the LTW ratio and the risk of default arises endogenously in our model described in the next section. The argument from the literature that informal credit has enforcement or informational advantages suggests that riskier loans should be more likely to come from informal sources. This is not confirmed by the data. In fact, the exact opposite holds as Figure 4 shows: the relationship between loan informality and the LTW ratio as proxy for risk is negative. The riskier a loan, the *less likely* it is to come from a relative or neighbour. The left panel of Figure 4 shows the negative relationship using a lowess regression of an indicator for loan informality (from neighbor or relative) against log of the LTW ratio. The right panel plots kernel density estimates of the distributions of formal and informal loans over the LTW ratio showing that formal loans are

[11] Within formal loans, mostly relatively large loans, taken out by wealthy households, originate from commercial banks. The explanation is that access to banks is limited in our rural setting and commercial banks require more collateral than moneylenders, which is a serious constraint for poorer borrowers.

[12] Note that the LTW ratio is akin to the loan-to-value (LTV) ratio, calculated as the mortgage amount divided by the appraised property value, which is frequently used by financial institutions to assess risk before approving a mortgage loan.

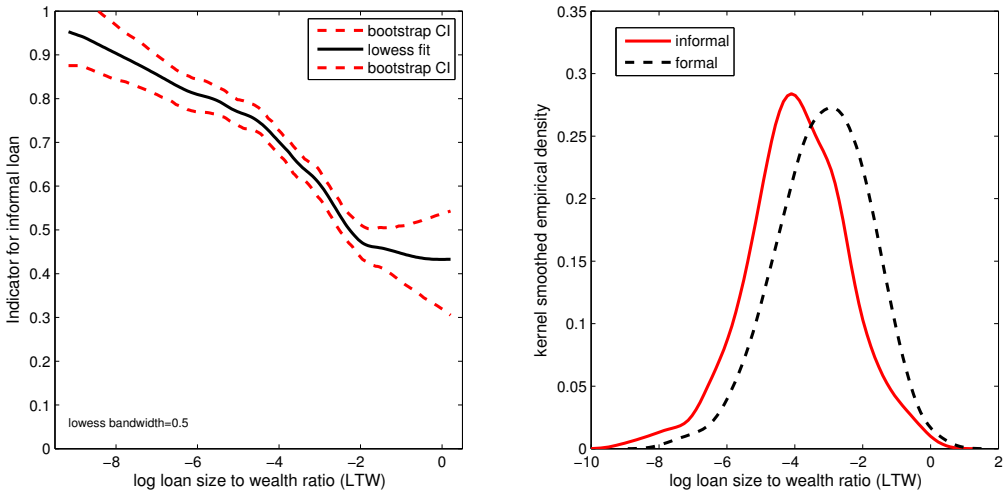


Figure 4: LTW ratio and type of credit

riskier.

3 Model

3.1 Basic Setting

The economy is populated by lenders and borrowers. Each borrower has an investment project financed by a loan at time $t = 0$. The projects can vary in size denoted by θ. A project requiring investment θ generates a stochastic return $y(\theta)$ at $t = 1$ which can take two possible values: $R\theta$ ('project success') with probability p, and 0 ('project failure') with probability $1 - p$, where $R > 1$ and $p \in (0, 1)$.

Each borrower is endowed with some amount of illiquid assets, $w > 0$ which can differ across borrowers. The assets are collateralizable but subject to risk. Specifically, at time $t = 1$ only fraction α of the agent's assets is available to compensate the lender, where α is a random variable with cdf $G(\alpha)$ and support $[\alpha_{\min}, 1]$ with $\alpha_{\min} \in (0, 1)$ and $E(\alpha) \in (\alpha_{\min}, 1)$. The cdf $G(\alpha)$ is assumed continuous on $[\alpha_{\min}, 1)$ but we allow it to have strictly positive mass at $\alpha = 1$, that is, a drop in the asset value may occur with cumulative probability less than one.[13]

The parameter α is important for what follows as it ties the risk of default to the loan-size-to-wealth (LTW) ratio, $\frac{\theta}{w}$. A possible interpretation of α is that it captures ex-ante uncertain expenses that the lender needs to incur in acquiring or storing the collateral. Alternatively, one can think of α as a shock to the $t = 1$ asset value – for example, a bad harvest, an accident lowering the resale value of a vehicle,

[13]For simplicity, we set the upper bound of α to 1 but all results easily generalize for an upper bound $\alpha_{\max} > 1$ as long as $E(\alpha) < 1$.

or a drop in house or land prices. Importantly, the value of α is unknown to both borrowers and lenders at $t = 0$ when the loan is taken but the value αw is observable by both at $t = 1$ when repayment is due.

Both lenders and borrowers are risk-neutral and, for simplicity, do not discount the future. We assume a limited enforcement setting in which the project return $y(\theta)$ is non-verifiable. This gives rise to the possibility of *strategic default* – a borrower may choose to default on a loan despite being able to pay it back. In addition, as in most of the related literature, the borrowers are assumed to have limited liability: if the project fails, $y(\theta) = 0$ and the borrower has insufficient funds to repay, then the borrower defaults involuntarily in which case the lender cannot punish her beyond seizing the posted collateral.

The main focus of our analysis is on the distinction and choice between informal and formal credit. Remember, the defining characteristic of what we call informal credit is that the lender has a personal or social relationship with the borrower, which gives rise to *social capital*. We denote the non-pecuniary (friendship or kinship) value that either party derives from the relationship by $\gamma > 0$. Both parties lose this value in case of default. To capture the idea that friends or family may have limited funds, we also allow the possibility that an informal lender has a maximum amount $\bar{\theta} > 0$ available for lending. The analysis below is done for any given γ and $\bar{\theta}$ and in practice the borrowers and lenders can differ in these values. Informal credit will be indicated with the subscript I. In contrast, in formal credit (indicated by subscript F) the lender is a stranger to the borrower, that is, no personal relationship exists between them ($\gamma \equiv 0$). A prime example is a loan from a commercial bank.

Let r_i, $i = I, F$ denote the the required gross repayment (principal plus interest) in a loan. Similarly, denote by c_i, $i = I, F$ the required physical collateral in terms of borrower's assets seized by the lender if the borrower defaults, that is, declares that she cannot pay back r_i. In line with the literature, we also assume that there is a (possibly small) transaction cost of using formal credit, $\lambda\theta$ where $\lambda > 0$.[14] This cost could be interpreted as arising from the need to show proof of title, filling out various forms, etc. A reduction in λ can be interpreted as financial sector development. We revisit this in Section 4, where we show that lowering the cost to access to formal credit decreases the use of informal credit, all else equal.

Assume that both formal and informal lenders are willing to lend any feasible amount θ as long as they recover their opportunity cost of funds, normalized to one.[15] This assumption helps us maintain the comparability of formal and informal loans, and is satisfied, for example, if the market for either credit type is perfectly competitive. In general, of course, the market structure and bargaining power of borrowers and lenders may differ between formal and informal lenders. The borrowers' outside option, if they do not invest, is normalized to zero.

The sequence of events is as follows. First, the borrower learns their investment requirement θ and decides whether to seek formal or informal credit (it will be possible that only one credit type is available to this borrower in equilibrium). Second, the loan terms (r_i, c_i) are determined, depending on the borrower's

[14] Assuming that this cost is proportional to loan size is not essential but helps with analytical simplification. If, instead, access to formal credit were subject to a fixed cost, then only loans above certain minimum size could be formal but all other results remain unchanged.

[15] In other words, borrowers receive all of the surplus – the loan terms (r_i, c_i), $i = I, F$ maximize the borrower's expected payoff subject to participation and incentive constraints.

wealth, project size, and social capital. Next, nature chooses the value of α and whether the investment project succeeds or fails. The value of α is then observed by both parties. The project outcome is observed only by the borrower. Finally, the borrower decides whether to default or repay, the contract terms are executed, and payoffs are realized.

In what follows, we assume

Assumption.

$$\textit{(i) } pR > 1 + \lambda \textit{ and (ii) } p > 1/2 \tag{A1}$$

and

$$\gamma > \frac{p(R-1)}{1-p}\bar{\theta} \tag{A2}$$

As it will become clear below, A1(i) guarantees that all investment projects are socially efficient and that borrowers are always willing to take a formal loan in equilibrium. A1(ii) helps simplify the analysis by focusing on the relevant cases. Assumption A2 guarantees that the social capital γ is sufficiently large so that people who borrow from informal lenders always have an incentive to repay and never default strategically. Alternatively, we could assume away strategic default in informal credit upfront, for example by referring to superior enforcement ability as is common in the literature. We discuss the role of Assumption A2 further in Section 3.2.1.

The repay or default decision

The key difference between formal and informal credit in our paper is the the absence or presence of social capital; otherwise they are treated symmetrically. Consequently, call

$$\gamma_i \equiv \begin{cases} \gamma > 0 \text{ if } i = I \\ 0 \text{ if } i = F \end{cases}$$

To understand the trade-off faced by borrowers between repaying r_i or defaulting, recall that the decision to default is made after observing α. Repaying costs r_i to the borrower. Defaulting costs

$$\delta(\alpha, \gamma_i) \equiv \gamma_i + \min\{c_i, \alpha w\},\ i = I, F \tag{1}$$

Since lending is socially efficient by A1 and the borrower receives the entire surplus, the loan terms will be such that repayment is always feasible when the borrower's project succeeds. When the project fails, the borrower has only αw in resources and repayment is feasible only if $r_i \leq \alpha w$.

Lemma 1 (Borrower's repayment decision)**.**

a) the borrower defaults involuntarily if $r_i > \alpha w$ and $y(\theta) = 0$ (project failure).

b) otherwise, if $r_i \leq \alpha w$ or $y(\theta) = R\theta$ (project success) or both, the borrower optimally repays r_i if $r_i \leq \delta(\alpha, \gamma_i)$ or strategically defaults if $r_i > \delta(\alpha, \gamma_i)$.

For future reference, the lender's payoff equals r_i if the borrower repays and

$$v(\alpha, \gamma_i) \equiv \min\{c_i, \alpha w\} - \gamma_i \tag{2}$$

if the borrower defaults. Note from expressions (1) and (2) that both the lender and the borrower lose the social capital γ_i upon default.

Finally, without loss of generality, we impose a 'no strategic default with probability one' incentive constraint by requiring that the loan terms (r_i, c_i) be such that the borrower does not default strategically *all the time* (for all α). Focusing on the natural scenario in which default occurs with probability less than one helps us streamline the exposition without qualitatively changing the results.[16]

$$r_i \leq \gamma_i + \min\{c_i, w\} = \delta(1, \gamma_i) \tag{IC}$$

Loan Terms

Given our assumption that the entire surplus is captured by the borrowers, we can solve for the loan terms (r_i, c_i) by maximizing the borrower's expected payoff, U_B^i subject to the following four constraints.[17]

- the lender's participation constraint,

$$U_L^i \geq \bar{u}_L^i(\theta, \gamma_i) \tag{PC$_L$}$$

  where U_L^i is the lender's expected payoff and $\bar{u}_L^i(\theta, \gamma_i)$ is the lender's opportunity cost. The opportunity cost depends on the loan size θ since lenders can put the funds to alternative uses. We also allow the lender's opportunity cost to depend on the social capital γ_i. Indeed, for informal lenders it is plausible that they may suffer a utility loss from refusing to lend to a friend or relative. Recalling that the opportunity cost of capital is unity, we therefore assume the following functional form $\bar{u}_L^i(\theta, \gamma_i) = \theta - \kappa\gamma_i$ where $\kappa \in [0, 1]$ measures the part of social capital lost when a loan is refused (e.g., think of lending to one's child). Since $\kappa > 0$ implies that surplus is being destroyed by not lending, borrowers could in principle demand excessively generous loan terms. To avoid this we impose

- non-negativity constraints on interest and collateral

$$r_i \geq \theta \text{ and } c_i \geq 0. \tag{NN}$$

- the borrower's participation constraint,

$$U_B^i \geq 0 \tag{PC$_B$}$$

- the incentive constraint (IC) ensuring that strategic default does not occur for all α

[16] This constraint is always slack for informal loans given our assumptions A1 and A2. For formal loans, we may otherwise have loans with $c_F > r_F$ in which there is default in all states of the world and the lender collects either αw or c_F. Such loan terms, however, give the same expected payoffs to the borrower and the lender as the loans we study (subject to constraint IC) and do not expand the set of parameters for which formal loans are feasible.

[17] The exact expressions for the borrower's and lender's expected payoffs are given in the Appendix.

Notice that social capital γ_i, when positive, enters the contracting problem in four distinct places. It affects the borrowers' and the lenders' payoffs upon default, it enters constraint (IC), and, if $\kappa > 0$ it also affects the informal lender's outside option, $\bar{u}_L^i$. In Section 3.2.1 and Appendix B we discuss allowing the social value γ to differ across these four places, including the special case $\kappa = 0$ which makes the opportunity cost of lending the same for formal and informal lenders, $\bar{u}_L^F = \bar{u}_L^I$.

3.2 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 repayment beyond what can be achieved by physical collateral. For simplicity and ease of exposition, we motivate the social value γ as arising from a simple coordination ('handshake') game in which the lender and borrower 'confirm' or 'reject' their friendship after the project return is realized and the contract terms (r_I, c_I) executed.

Borrower\Lender	confirm	reject
confirm	γ, γ	-1,0
reject	0,-1	0,0

A natural interpretation of the above game is as reduced form of repeated interaction under limited commitment, for example, as in Coate and Ravallion (1993), Kocherlakota (1996), Fafchamps (1999) or Boot and Thakor (1994). [18] We assume that the Nash equilibrium (confirm, confirm) is played whenever the loan is repaid and the Nash equilibrium (reject, reject) is played otherwise. An isomorphic game is played when a borrower asks an informal lender for a loan. In that game there is an equilibrium in which, if the lender refuses to give an informal loan when asked, he loses (a fraction of) the social value, $\kappa\gamma$ where $\kappa \in (0, 1]$. We discuss this issue further in Appendix B and show what changes if informal lenders suffer no loan refusal utility loss.

From Lemma 1, it is clear that, if the social capital value γ is sufficiently large so that $r_I < \delta(\alpha, \gamma)$, $\forall\alpha$, the borrower would always choose to repay r_I when feasible, that is, if $r_I \leq \alpha w$ or if $r_I > \alpha w$ and the project succeeds. Since $\delta(\alpha_{\min}, \gamma) > \gamma$, to obtain this result it is sufficient to ensure that $\gamma > r_I$ holds at the optimal r_I, which we will show is guaranteed by Assumption A2. There would be no strategic default because of the large social capital γ at stake. An informal borrower would only ever default involuntarily, if her project fails *and* $r_I > \alpha w$. In that case the borrower loses $\delta(\alpha, \gamma) = \gamma + \min\{c_I, \alpha w\}$ and the lender's payoff is $v(\alpha, \gamma) = \min\{c_I, \alpha w\} - \gamma$ from (2). In Section 3.2.1 we show that nothing changes if we instead assume that the lender does not lose γ in case of involuntary default by the borrower ("forgiveness").

We start the analysis by assuming that the parameter $\kappa \in [0, 1]$ in the r.h.s. of the lender's participation

[18] In Coate and Ravaillion (1993) and Kocherlakota (1996), agents share risk ('cooperate') on the equilibrium path by making transfers to each other depending on their incomes. Cooperation is supported by the threat of punishment with perpetual autarky if an agent reneges. Similarly, Fafchamps shows that contingent credit can arise as an equilibrium in a long-term risk-sharing arrangement, while Boot and Thakor provide conditions under which long-term credit relationships can achieve the first-best in a repeated moral hazard problem without a risk sharing motive.

constraint is sufficiently close to or equal to 1. That is, an informal lender loses a relatively large part of the social capital if he refuses to extend a loan. We discuss relaxing this assumption in Section 3.2.1. [19]

Consider a borrower with wealth w who needs loan size θ with $\theta < \bar{\theta}$ and shares social capital γ with an informal lender. The following proposition describes the resulting outcome and informal loan terms.

Proposition 1 (Informal Credit)**.**
Suppose Assumptions A1 and A2 hold and κ equals 1 or is sufficiently close to 1.[20] *There exists a threshold loan size to wealth (LTW) ratio, $\hat{\alpha}_I \in (\alpha_{\min}, 1)$ such that,* [21]

a) if $\frac{\theta}{w} \leq \hat{\alpha}_I$ (low LTW ratio / low default risk) the borrower is willing to use informal credit (PC_B is satisfied) and the informal loan has zero interest and no collateral, $r_I^* = \theta$ and $c_I^* = 0$.

b) if $\frac{\theta}{w} > \hat{\alpha}_I$ (high LTW ratio / high default risk) the borrower optimally chooses not to use informal credit.

Intuitively, when the social capital shared between the parties is sufficiently large, an informal lender would not find it optimal to refuse to lend when asked and lose the social capital knowing that, for the same reason, the borrower has an incentive to repay whenever feasible. The assumption that the lender suffers a utility loss if he refused to make a loan when asked ($\kappa > 0$) matters for this result as it relaxes the lender's participation constraint. It also ensures that the lender offers the loan at favourable terms.

The zero interest and no collateral result in part (a) hinges on the simplifying assumptions that social capital is large (assumption A2), that informal lenders lose sufficiently large utility if they refuse a loan, and that lenders only need to break even. The robust implication of the model is that, holding all else equal, the presence of social capital allows for *lower* interest and collateral in informal loans, compared to formal loans (with $\gamma = 0$). Intuitively, for large γ requiring the borrower to post collateral, $c_I > 0$, is sub-optimal since it is not needed to prevent strategic default (the value of social capital suffices by A2) and doing so is costly to the borrower whenever there is positive probability of default.[22] Note also that it is perfectly possible for an informal lender to incur a monetary loss on an informal loan – the desire to preserve the relationship makes it worthwhile to lend to a friend or relative even with risk of non-payment.[23]

Proposition 1 also shows that, given γ, whether a borrower would benefit from using an informal loan

[19] The field experiment results of Jakiela and Ozier (2015) offer indirect evidence in support of the idea that refusing to help with money when asked by a relative is costly. The authors document that a large number of women in their rural Kenyan sample were willing to forgo a significant amount of money to be able to hide their experiment payout from relatives.

[20] The exact condition is displayed in the proposition proof.

[21] The threshold $\hat{\alpha}_I$ depends on the social capital γ and borrower's assets w (see the proof of Proposition 1 and Lemma 2 for more details).

[22] Even if the social capital did not suffice to prevent strategic default (assumption A2 did not hold), it is easy to see that the additional physical collateral that would be necessary would be smaller for informal loans (with $\gamma > 0$) relative to formal loans (with $\gamma = 0$). Moreover, while borrowers with zero probability of involuntary default are technically indifferent to physical collateral requirements, even an ϵ cost of posting collateral would make $c_i = 0$ strictly preferable.

[23] 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 γ is added to the l.h.s. of (PC_L) while the r.h.s. becomes the opportunity cost θ.

critically depends on the value of the loan size to wealth (LTW) ratio, $\frac{\theta}{w}$. We discuss the role of the LTW ratio in more detail next.

3.2.1 Discussion

The role of α and the LTW ratio.

Loans that are not too large relative to the borrower's wealth, namely those with $\frac{\theta}{w} \leq \alpha_{\min}$, are feasible and mutually beneficial to both parties since there is zero risk of default, $\pi(r_I^*/w) = 0$ – the borrower always has sufficient assets to repay. For borrowers with higher LTW ratios, $\frac{\theta}{w} > \alpha_{\min}$, default occurs in equilibrium and the social capital is lost with positive probability. Importantly, the probability of default increases in the LTW ratio since it becomes more likely that an α is realized for which $\alpha < \frac{r_I^*}{w} = \frac{\theta}{w}$. In such case, the borrower weighs the risk of default and loss of social capital against the expected gain from borrowing and undertaking the project. The gain outweighs the loss for LTW ratios $\frac{\theta}{w}$ below the threshold $\hat{\alpha}_I$ from Proposition 1. For higher LTW ratios, $\frac{\theta}{w} > \hat{\alpha}_I$, informal credit is available but undesirable to the borrower since the risk of losing the social capital is too high.

The role of social capital γ.

We now discuss in detail each of the four instances of the social capital parameter γ in the contracting problem and the role of Assumption A2 about the size of γ. First, γ appears in the borrower's payoff, U_B^I (see the proof of Lemma 1 for the exact expression). Call this instance γ_1. It can be interpreted as the "shame", "loss of face", or similar cost to the borrower incurred if unable to repay the informal loan. As seen in the proof of Proposition 1, a sufficient condition for the proposition result is,

$$\gamma_1 \geq \tfrac{p(R-1)}{1-p}\bar{\theta} \quad \text{(C0)}$$

which is guaranteed by Assumption A2. If, instead we were to set the shame cost γ_1 to zero or sufficiently low, then, holding all else constant, the borrower would be willing to take and the lender would provide informal credit for any LTW ratio θ/w as long as $\theta \leq \bar{\theta}$. Hence, our result that risky informal loans, those with $\frac{\theta}{w} > \hat{\alpha}_I$, are avoided by borrowers hinges on Assumption A2 applied to γ_1. Note that nothing changes in the analysis, however, if we assumed that in case of involuntary default the borrower transfers all her assets αw to the lender but both lose an appropriately reduced amount, $\gamma - \alpha w$ of social capital.

Second, γ appears in the l.h.s. of the lender's participation constraint (PC_L) – call this instance γ_2. It can be interpreted as the lender's cost of being 'upset' for not being repaid if the borrower's project fails and the borrower has insufficient wealth. It is easy to see that nothing changes in the results if we allow lender 'forgiveness' in case of involuntary default, that is, $\gamma_2 = 0$. The reason is that setting $\gamma_2 = 0$ (or any $\gamma_2 < \gamma$) relaxes the lender's participation constraint. If lenders were willing to make loans at $\gamma_2 = \gamma$ satisfying A2, they are still willing to do so for any $\gamma_2 \in [0, \gamma)$.

Third, the social capital γ appears in constraint (IC) – call this instance γ_3. It can be interpreted as a 'shame' or similar cost to the borrower from *strategically defaulting* on an informal loan. For Proposition 1 to hold as stated, it is enough to ensure that no strategic default happens at $c_I = 0$. A sufficient

condition for this is $\gamma_3 \geq \bar{\theta}$, which is weaker than the condition in Assumption A2. If this cost did not exist ($\gamma_3 = 0$), then physical collateral ($c_I^* > 0$) would be needed to support informal loans in a way similar to the formal credit case discussed below.

Fourth, the social capital value γ appears in the r.h.s. of the lender's participation constraint (PC_L) – call this term $\gamma_4 = \kappa\gamma$. It can be interpreted as the utility cost to the lender from *refusing to give a loan* to a friend or relative. One can imagine this cost to be high between close friends, parents and children, etc. From the proof of Proposition 1, we see that for its result to hold we need (PC_L) to be satisfied at $r_I = \theta$ and $c_I = 0$ for which a sufficient condition is [24]

$$\gamma_4 \geq (\gamma_2 + \bar{\theta})(1-p) \quad \text{(C2)}$$

We see from (C2) that the condition in A2 can be too strong applied to γ_4. For example, if $\gamma_2 = 0$ (the forgiveness scenario discussed above) we only need the lender's loss of refusing a loan, γ_4 to satisfy $\gamma_4 \geq (1-p)\bar{\theta}$ which is strictly smaller and, depending on p, can be much smaller than the original social value γ (γ_1 here). Even if $\gamma_2 = \gamma_1 = \gamma$ (the lender and the borrower lose the whole friendship if default occurs), then for p large enough, we can still have $\gamma_4 < \gamma$ with all our previous results intact. A realistic scenario with large γ_4 and small or zero γ_2 could be taking a loan from one's parents – they may not be upset ($\gamma_2 = 0$) with a child who fails to repay for exogenous reasons, but on the other hand may have high utility cost (high κ) of refusing a loan when asked.

At the other extreme is the case $\kappa = 0$ which implies $\gamma_4 = 0$. That is, the informal lender has no qualms about refusing a loan when asked. In that case the lender would still charge zero interest and require no collateral for riskless loans, those with $\frac{\theta}{w} \leq \alpha_{\min}$. However, for risky loans, with $\frac{\theta}{w} > \alpha_{\min}$, the lender would require positive interest and collateral, the values of which can be solved from (PC_L) (see Appendix B for details).

The threshold $\hat{\alpha}_I$

Lemma 2. *The threshold LTW ratio $\hat{\alpha}_I$ from Proposition 1 is decreasing in the social capital γ and increasing in the project success probability p, the return R, and borrower's wealth w.*

Intuitively, for larger social capital γ, informal loans are more costly to both parties due to the risk of default. This reduces the range of LTW ratios for which informal loans are desirable to borrowers – a shift to safer informal loans. One implication is that, assuming A2 holds and all else equal, more closely related people are *less likely* to lend to each other *ceteris paribus*. However, note that borrower-lender pairs with low γ may be unable to support informal loans with zero collateral. Here this scenario is ruled out by Assumption A2 but would arise if we relax it, as discussed above. In contrast, larger wealth w, or larger p and R support a wider range of LTW ratios for which informal loans are desirable since either the risk of default is lower or borrowing is more profitable in expectation.

[24] A tighter sufficient condition but depending on the endogenous threshold $\hat{\alpha}_I$ is

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

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

3.3 Formal Credit

The defining difference between informal and formal credit is that formal credit lacks associated social capital, that is $\gamma_F = 0$. Noting that $\delta_F = \min\{c_F, \alpha w\}$ from (1), Lemma 1 implies that formal credit borrowers have a strict incentive to default unless a sufficiently large strictly positive amount of assets is pledged as collateral. Using (IC), to ensure that borrowers do not always strategically default, formal loans must satisfy

$$r_F \leq \min\{c_F, w\} \tag{3}$$

Therefore, $c_F \geq r_F$. Subject to (3), if $r_F > \alpha w$, a borrower would still find it optimal to default (strategically if the project succeeds and involuntarily otherwise) after a negative shock to the value of her assets. This is so since the inequality $c_F \geq r_F$ from (3) implies $\delta(\alpha, 0) = \alpha w < r_F$ – the most the lender can seize is αw, which is less than the both the required repayment r_F and the collateral c_F. As a result, strategic default cannot be avoided in formal loans and it can occur with positive probability depending on the realization of α. This is an important difference with informal credit, where all equilibrium default was shown to be involuntary.

In the remaining case, $r_F \leq \alpha w$, Lemma 1 implies that the borrower would always repay either from cash flow or voluntary liquidation of assets, since $r_F \leq \delta_F$ always holds using that $r_F \leq c_F$ by (3). This is the same outcome as in informal credit (Section 3.2), although here it is achieved in a different way, by the lender requiring strictly positive collateral, $c_F \geq r_F > 0$. Overall, these results imply that the lender obtains r_F if $\alpha \geq \frac{r_F}{w}$ and αw otherwise.

Consider a borrower with wealth w who needs a loan of size θ. The following proposition describes the resulting outcome and formal loan terms.

Proposition 2 (Formal Credit)**.** *Suppose Assumption A1(i) holds and denote $\hat{\alpha}_F = E(\alpha) > \alpha_{min}$.*

(a) if $\frac{\theta}{w} \leq \hat{\alpha}_F$ (low LTW ratio / low default risk), the borrower can obtain a formal loan with strictly positive collateral, $c_F^* \geq \theta$ and repayment, $r_F^* \geq \theta$. If $\frac{\theta}{w} > \alpha_{min}$ (there is risk of default), then the loan interest rate is positive, $r_F^* > \theta$ where r_F^* solves $U_L^F = 0$.[25]

(b) if $\frac{\theta}{w} > \hat{\alpha}_F$ (high LTW ratio / high default risk) a formal loan is not feasible as it violates the lender's participation constraint.

Note the differences with informal credit (Proposition 1). The lack of social capital at stake always necessitates a strictly positive collateral requirement since this is the only way to avoid default in all states. Formal loans also carry positive interest, unless there is zero default risk, in which case the interest rate equals the lender's opportunity cost of funds.

As with informal loans, Proposition 2 shows that the LTW ratio, $\frac{\theta}{w}$ plays a key role for whether a formal loan is feasible and, if yes, at what terms. Intuitively, since formal loans always require collateral, the

[25] If there is zero default risk, the loan interest rate equals the formal lender's opportunity cost of funds which could be positive (e.g., $1 + \rho > 0$), in which case we would have $r_F^* = (1 + \rho)\theta$. In contrast, in informal credit, for large enough γ and κ, riskless loans would be still made at zero nominal interest rate.

lender faces only one type of risk, namely that the ex-post value of the borrower's assets, αw falls short of the required repayment r_F. Default by itself is otherwise irrelevant to the lender, unlike in informal credit. This implies that borrowers with projects with high default risk (high LTW ratio) would be denied formal loans, since the lender cannot break even.

4 The Choice between Formal and Informal Credit

Using Propositions 1 and 2, we can compare and contrast formal vs. informal loans. The advantage of informal loans is twofold. First, provided the social capital is large, as assumed, informal lenders do not require the borrower to pay interest or post physical collateral – informal loans are therefore cheaper than formal loans. The reason is that informal lenders do not need to be compensated for the risk of strategic default – they know that the borrower has an incentive to pay them back whenever feasible in order to preserve the social capital. If the risk of losing the social collateral is too high, the borrower would not ask for an informal loan in the first place. Second, because of the pledged social capital, informal credit can be extended to borrowers with low or no assets (though such borrowers would not necessarily wish to borrow). In contrast, formal lenders such as banks always require physical collateral to ensure repayment.

Borrowing from informal sources does comes with a cost, however. First, unlike physical collateral that can be freely adjusted, the relationship value γ which acts as social collateral to secure an informal loan is *indivisible* – the entire amount γ is pledged to support repayment, even though for small θ only a fraction may suffice (see the discussion in Section 3.2.1). This has broader implications (not modelled here) regarding which person from her set of friends a borrower would turn to, depending on the needed loan size. Another potential disadvantage of informal credit is the loan size upper limit $\bar{\theta}$ – friends or relatives generally do not have unlimited loanable funds.

Comparing informal and formal loans, we furthermore see that, when using informal credit, both the lender and the borrower share a common interest to avoid default since each of them stands to lose the social capital γ. Hence, both want to avoid risky loans, those with high LTW ratios, and therefore 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 maximum loss is capped at αw. The lender, however, cannot break even for high-LTW ratio loans. This is 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 (loans with higher LTW ratio carry too much risk of losing γ).

We proceed to analyze the optimal choice between formal and informal credit for a given borrower with wealth and loan size, (w, θ) and given model parameters p, R, γ. Suppose $\theta \leq \bar{\theta}$ – that is, informal credit is *a priori* feasible. Propositions 1 and 2 imply 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.

Proposition 3 (Choice of loan source)**.**
Suppose Assumptions A1 and A2 hold and consider a borrower with LTW ratio $\frac{\theta}{w} \leq \min\{\hat{\alpha}_I, \hat{\alpha}_F\}$*, where* $\hat{\alpha}_I$ *and* $\hat{\alpha}_F$ *are defined in Propositions 1 and 2.*

(a) if $\frac{\theta}{w} \leq \alpha_{\min}$*, the borrower uses informal credit.*

(b) if $\frac{\theta}{w} \in (\alpha_{\min}, \min\{\hat{\alpha}_I, \hat{\alpha}_F\}]$*, then there exists an* $\hat{\alpha} \in (\alpha_{\min}, \hat{\alpha}_I)$ *such that the borrower uses informal credit for low LTW ratios,* $\frac{\theta}{w} \leq \min\{\hat{\alpha}, \hat{\alpha}_F\}$ *and formal credit otherwise.*

(c) a decrease in the cost of formal credit access λ *lowers the threshold* $\hat{\alpha}$*, thus (weakly) increasing the use of formal credit relative to informal credit. If the cost is negligible (*$\lambda \to 0$*), borrowers weakly prefer formal credit for all* $\frac{\theta}{w} \leq \hat{\alpha}_F$*, and strictly so for* $\frac{\theta}{w} > \alpha_{\min}$*.*

Intuitively, when the LTW ratio and hence the risk of losing the social capital γ is zero (part a), the borrower prefers informal credit since it offers more favorable loan terms and no access cost. By continuity, this preference also extends to (θ, w) for which the default risk is small (part b), namely borrowers with $\frac{\theta}{w} \leq \min\{\hat{\alpha}, \hat{\alpha}_F\}$ where $\hat{\alpha}$ is the LTW ratio, $\frac{\theta}{w}$ at which the borrower is indifferent between using informal and formal credit,

$$U_B^I(\theta, 0, \gamma) = U_B^F(r_F^*, c_F^*, 0).$$

In contrast, for higher values of the LTW ratio, above $\hat{\alpha}$, borrowers prefer formal loans despite their less favorable terms. In this case the expected cost of losing the social capital is smaller than the larger repayment required under project success or failure.

Proposition 3(c) shows that, as the transaction cost of using formal credit decreases, which could be interpreted as a process of financial development, more borrowers prefer using formal credit as long as it is feasible. This implication is consistent with the discussion in the introduction on why informal credit seems to be unpopular in developed countries despite its apparent advantages in terms of interest rate and collateral.

It is also possible that a borrower may not have a choice of credit source. Specifically, suppose $\frac{\theta}{w} \in (\min\{\hat{\alpha}_I, \hat{\alpha}_F\}, \max\{\hat{\alpha}_I, \hat{\alpha}_F\}]$. Then, if $\hat{\alpha}_I > \hat{\alpha}_F$, the borrower uses informal credit since formal credit is unavailable. If $\hat{\alpha}_I \leq \hat{\alpha}_F$, the borrower uses formal credit. Finally, if $\frac{\theta}{w} > \max\{\hat{\alpha}_I, \hat{\alpha}_F\}$ the borrower would not or cannot borrow from any source – either the risk of losing the social capital is too high or the lender cannot break even.

Numerical example

To visualize the model results, we provide a numerical example. Let $p = 2/3$, $R = 3$, $\lambda = .2$, $\bar{\theta} = 1$, $\alpha_{\min} = .2$, $\gamma = 5$ and α be uniformly distributed on $[\alpha_{\min}, 1]$. Normalize borrower's wealth to $w = 1$ so

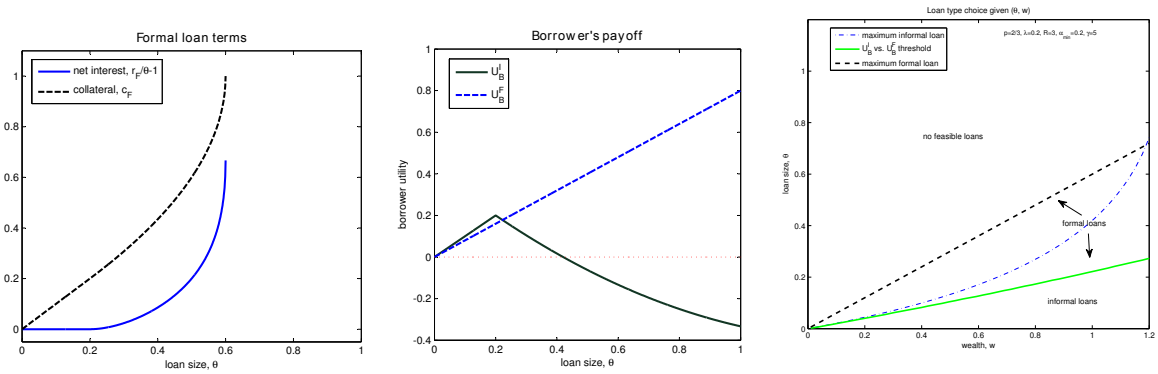


Figure 5: Loan terms, payoffs, and choice of loan source

that loan size and the LTW ratio coincide. It is easy to verify that A1-A2 are satisfied for these parameter values. The net interest rate for formal loans, $\frac{r_F^*}{\theta} - 1$ increases monotonically in the LTW ratio (loan size) up to 66.7% for $\frac{\theta}{w} = \hat{\alpha}_F = .6$, as shown in the left panel of Figure 5. The collateral requirement, $c_F = r_F$ also increases monotonically in the LTW ratio. The middle panel plots the borrower's payoffs from using formal or informal credit. For the chosen parameters, $\hat{\alpha}_I = .42$, that is, informal loans are undesirable for loan size exceeding 42 percent of the borrower's wealth. Similarly, borrowers whose LTW ratio is above 60 percent do not have access to formal loans, since $\hat{\alpha}_F = .6$. Comparing the borrower's payoffs, U_B^I and U_B^F, informal loans are optimal for borrowers with an LTW ratio $\frac{\theta}{w} \in (0, 0.22]$, while formal loans are optimal for riskier loans, with LTW ratios $\frac{\theta}{w} \in (0.22, .6]$. Loans with LTW ratios above .6 are not feasible, regardless of their source.

The right panel of Figure 5 illustrates the choice of loan source in the loan size–wealth plane (w is now allowed to vary). Thinking in terms of borrowers who differ in some unobserved dimension such as γ, we see that *for a given loan size θ, borrowers with higher LTW ratios (lower wealth, w) are less likely to borrow from an informal source* than borrowers with lower LTW ratios (larger wealth, w).

5 Empirical Analysis

In Section 2 we showed two major patterns in the Thai data. First, informal loans based on social connections have more favorable terms - lower interest rate and collateral. Second, the loan size to wealth (LTW) ratio, viewed as proxy for default risk, is an important predictor of whether a loan is formal vs. informal, beyond the simple effect of loan size. In this section, we show that the assumptions and results of our theoretical model developed in Section 3 are consistent with and able to explain those data patterns. We go beyond the simple raw associations in the data from earlier on and test the model predictions, taking advantage of the fact that our data contain many additional household characteristics that we can control for. We view households as heterogeneous in two key observables, the size of each loan they have, θ and household wealth, w. Since in practice households generally also differ

in unobservables which can be captured in the model by $\alpha_{\min}$, $G(\alpha)$, p and γ, the model predictions can be thought of as being about average differences in the loan terms between formal and informal credit, as well as about the likelihood that we observe an informal versus a formal loan as a function of the loan-to-wealth (LTW) ratio or loan size.

Specifically, Propositions 1 and 2 imply that the interest rate and collateral in informal loans based on shared social capital should be lower on average, than those required by formal lenders. In equilibrium, as implied by Proposition 3, households with lower LTW ratios would choose informal loans with low interest and collateral while households with higher LTW ratios would choose formal loans with higher interest and collateral. Importantly, the loan choice pattern is not simply due to loan size. That is, holding loan size fixed, we should still observe formal credit for borrowers with lower wealth (that is, lower LTW ratio) and informal credit for borrowers with more wealth (higher LTW ratio). In sum, Proposition 3 predicts a negative relationship between loan informality and the LTW ratio.

The same reasoning implies also that, holding borrower's wealth fixed, larger loans are less likely to be informal. We should therefore expect that loan informality, on average, decrease in the loan size θ. However, there can be other reasons why borrowers with larger credit requirements are more likely to use formal credit, ceteris paribus. One such reason may be that informal lenders are more limited in their funds than formal lenders. To accommodate this possibility, the model allows for informal loans to be capped at $\bar{\theta}$, so all loans $\theta > \bar{\theta}$ are necessarily formal.[26] Notice, however, that a purely loan-size based explanation would not be able to explain the fact that riskier loans (with higher LTW ratio) are more likely to be formal holding loan size constant (see Table 4 below).

5.1 Results

5.1.1 Loan Terms

We first explore the model implication about the loan terms – the interest rate and collateral requirement. Table 2 reports results from a tobit regression of the loan interest rate and collateral on the loan source, controlling for household characteristics including log income, age, gender, marital status, tenure, education, location fixed effects, as well as the loan intended use and the total number of loans. Table 2 shows that loan informality (a loan from relative or neighbour as opposed to a commercial bank or moneylender) is associated with statistically significantly lower interest rate and collateral. Larger wealth and loan size are associated with larger collateral. These findings are consistent with the model. Specifications (1) and (3) in Table 2 only use household controls and fixed effects, while columns (2) and (4) also include log household wealth. Finally, specifications (3) and (6) add loan size, implicitly treating it as exogenously given, as in the model. In practice, the loan terms and loan size may be jointly determined, however, we see that despite the potential simultaneity problem the negative relationship between the loan terms and loan informality is unaffected. We discuss further the potential endogeneity

[26] While one could imagine borrowers tapping multiple informal sources if their investment needs exceed $\bar{\theta}$, taking multiple loans would increase the risk of default and costly loss of social capital (such borrower may lose several friends).

of loan size in the robustness section 5.2.

Table 2: Tobit Regressions for Loan Terms

dependent variable	interest			collateral size		
	(1)	(2)	(3)	(4)	(5)	(6)
loan source (informal=1)	-0.41***	-0.42***	-0.42***	-690***	-647***	-514***
	(0.10)	(0.10)	(0.09)	(94.0)	(86.7)	(76.7)
household wealth		-0.07	-0.07		148***	92.0**
		(0.05)	(0.05)		(31.8)	(28.8)
loan size			-0.00			173***
			(0.03)			(25.7)
Observations	900	896	896	1235	1,231	1,231
pseudo R^2	0.03	0.03	0.03	0.08	0.09	0.11

[a] **Note:** All specifications include fixed effects for location (tambon) and the intended loan use (consumption, real estate, investment, other). We also control for age, gender, marital status, tenure, and education of the household head, as well as household income and total number of loans. The standard errors reported in parentheses are clustered at the household level. Superscripts ***, **, and * indicate significance at 0.1%, 1% and 5%, respectively.

5.1.2 The loan-size-to-wealth (LTW) ratio

We next explore the relationship between the observed choice of loan source (formal versus informal), loan characteristics, and household characteristics. In doing so, we initially assume that the loan size is exogenously given by the needs of the household.[27] In our baseline specification the dependent variable is the loan source, $Lsource \in \{0, 1\}$, which equals one if the loan is informal, that is, originates from a neighbour or a relative, and zero if the loan is formal, that is, originates from a commercial bank or a moneylender. For the reasons explained in Section 2, the baseline regressions exclude BAAC loans from both categories.[28] Altogether, formal credit, as defined, constitutes 35 percent of the regression sample.

The main dependent variable of interest is the LTW ratio and we control for various household characteristics. We also run specifications including loan size. The LTW ratio and loan size in the data are highly skewed and so are logged in all regressions. Specifically, we run the following two probit regressions:

$$Lsource_{kij} = \delta_j + \gamma_0 LTW_{ki} + \beta X_{ik} + u_{kij} \quad \text{(A)}$$

$$Lsource_{kij} = \delta_j + \gamma_1 Lsize_{ki} + \gamma_2 LTW_{ki} + \beta X_i + u_{kij} \quad \text{(B)}$$

where i refers to the household, j refers to the tambon (a local administrative unit at a subdistrict level)[29], and k to the loan (one household can have several loans in our sample). In specification (B), we

[27] This is obviously a strong assumption, but could be justified if most loans are taken for a specific purpose, as our data indicate. A related issue is that some households may borrow from several sources to finance a single investment project (Kaboski and Townsend, 1999). In the Thai data, we observe the calendar dates at which households took each loan as well as rough categories regarding the reported purpose of the loan. If we count loans taken for the same purpose within a year of each other as potentially being part of a larger loan that has been split up (e.g., due to cash constraints on the lenders' side), 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 loan size is endogenous in the robustness section below.

[28] See Section 5.2 on the robustness of the results with regard to the coding of the dependent variable including BAAC loans.

[29] There are 20 tambons in the data. On average, 226 households reside in a tambon.

additionally control for loan size because there may be other explanations about why smaller loans are more likely informal, that are logically distinct from the loan-size-to-wealth ratio (default risk) effect we highlight. If that were the case, then finding a negative relationship between the incidence of informal credit and the LTW ratio in specification (A) (as we do) may be purely an artifact of loan size, instead of indicating that larger LTW ratios imply higher default risk thereby disadvantaging informal credit, which is the primary channel we model and seek to identify. Controlling for loan size means that residual variations in the LTW ratio correspond to variations in household wealth and a negative coefficient γ_2 would thus suggest that, for given loan size, wealthier (less risky in the model) households are more likely to seek informal credit that poorer households. Estimation is done by probit and the results are reported in Table 3. In the Appendix we also display an alternative table using wealth instead of the LTW ratio (Table 7). The regressions with log loan size and log wealth in columns (2) and (4) of Table 7 are of course mathematically equivalent to those with log loan size and log LTW ratio in Table 3.

Table 3: Probit Regressions for Loan Source

dependent variable	loan source (informal=1)			
independent variable	(1)	(2)	(3)	(4)
LTW ratio	-0.23***	-0.10*	-0.24***	-0.11*
	(0.03)	(0.04)	(0.03)	(0.05)
loan size		-0.22***		-0.22***
		(0.04)		(0.05)
tenure			-0.42	-0.38
			(0.22)	(0.21)
bank access			-0.31**	-0.20
			(0.11)	(0.11)
BAAC member			-0.23*	-0.13
			(0.10)	(0.10)
income			-0.01	0.09
			(0.04)	(0.05)
Observations	1232	1232	1231	1231
pseudo R^2	0.13	0.15	0.15	0.16

[a] **Note:** The regressions include fixed effects that account for location (tambon) and intended loan usage. We also control for the following household characteristics: age, gender, marital status, education of the head, and total number of outstanding loans. The standard errors reported in parentheses are clustered at the household level. Superscripts ***, ** and * indicate significance at 0.1%,1% and 5%, respectively.

Columns (1) and (2) in Table 3 are the most parsimonious specifications and include as controls only basic demographic characteristics of the household head, such as gender, education, marital status, and age, as well as fixed effects for location (tambon) and intended use of the loan.[30] The estimates show that the incidence of informal loans is significantly lower the larger is the loan-size-to-wealth ratio, ceteris paribus. This holds both with and without controlling for loan size (columns 1-2). These results are

[30]We distinguish between four broad categories of loan use: investment, real estate, consumption, and other. The coefficients on age, education and the total number of outstanding loans are statically significant and have the expected signs. They are suppressed in the reported output for brevity of exposition. Full details are available from the authors.

in line with the model prediction that riskier loans, as measured by their LTW ratio, are less likely to be informal. The magnitude of the effects is relatively large; for example, in column (1) one standard deviation change around the mean log LTW ratio decreases the probability of a loan being informal by 13 percentage points. Controlling for loan size (column 2), the estimated effect of one standard deviation change in the LTW ratio lowers the likelihood of informal credit by 5 percentage points (this corresponds to a 5 percentage points increase in the likelihood of informal credit for one standard deviation increase in household wealth).

Columns (3) and (4) in Table 3 add four additional control variables, namely whether or not the household head has lived in the village longer than 6 years ('tenure'), whether (s)he has bank access, whether (s)he is a BAAC member, and household income. [31] In rural areas, access to commercial banks is often severely restricted and travel times to the nearest branch may be prohibitive while the government-funded BAAC may act as a backup credit source. Clearly, these factors may affect the choice of loan source and, since they are also likely to be correlated with the loan size and borrower wealth, omitting them could bias the estimates. We see, however, that the negative coefficients on the LTW ratio and loan size are virtually unaffected and remain statistically significant (compare columns 3 and 4 to columns 1 and 2).

Looking at the coefficients on the controls, column (3) indicates that access to a commercial bank increases the probability of a formal loan holding the LTW ratio constant, which is expected but the significance of this effect disappears when loan size is also controlled for. A similar result holds for BAAC access. Household income is not associated with the loan source choice when controlling for the LTW ratio and household characteristics.

5.2 Robustness

5.2.1 Selection

A potentially important issue neglected so far is that we may not observe loan-choice related characteristics of the households in the data who have not taken a loan. For instance, the households with outstanding loans could have larger credit needs or be more creditworthy than the households without a loan. If the propensity to borrow is correlated with unobserved characteristics that are important for the choice of loan source, then our baseline estimates in Table 3 would be biased since selection into the sample may be correlated with the error term. To address the potential selection bias we use Heckman's (1979) two-step sample selection correction method for probit models.[32] In the first stage, we estimate the probit selection equation,

$$s_{ij} = \delta_j + \alpha Z_i + e_{ij}, \;\; D_{ij} = 1 \Leftrightarrow s_{ij} \geq \bar{s}$$

[31] Having access to the BAAC or a commercial bank does not mean that the household has an outstanding loan with these institutions.

[32] We use a version of Heckman's method in which the second stage equation is also probit. The STATA command is 'heckprob'.

Table 4: Heckman Correction Probit Regressions for Loan Source

dependent variable	loan source (1=informal)			
	(1)	(1')	(2)	(2')
LTW ratio	-0.24***		-0.10*	
	(0.04)		(0.05)	
loan size			-0.22***	
			(0.05)	
tenure	-0.40	0.13	-0.35	0.13
	(0.21)	(0.15)	(0.21)	(0.15)
bank access	-0.33**	0.00	-0.22*	0.00
	(0.10)	(0.09)	(0.11)	(0.09)
BAAC member	-0.14	0.74***	-0.02	0.74***
	(0.14)	(0.09)	(0.14)	(0.09)
income	-0.00	0.09**	0.10*	0.09**
	(0.04)	(0.03)	(0.05)	(0.03)
savings		-0.15***		-0.15***
		(0.02)		(0.02)
credit constrained		0.35***		0.35***
		(0.07)		(0.08)
Observations	1228	866	1228	866
corr. of error terms		0.26		0.34
		(0.29)		(0.28)
Wald test p-value		0.39		0.26

[a] **Note:** The columns with primes are the selection equations. All specifications control for household characteristics (age, gender, marital status, tenure, and education of the head) and include tambon fixed effects. The loan source regressions also include intended loan usage and total number of outstanding loans. The standard errors reported in parentheses are clustered at the household level. Superscripts ***, ** and * indicate significance at 0.1%,1% and 5%, respectively.

where s^*_{ij} is the propensity to be included in our 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. Along with the controls from Table 3 (columns 3 and 4), we include in the selection equation household savings and the binary variable "credit constrained" that 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.[33] In the second stage, we correct for self-selection by incorporating a transformation of the predicted choice probabilities as additional explanatory variable. The estimated model is

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

where $\lambda(\cdot)$ is the inverse Mills ratio, evaluated at $\alpha Z_i + \delta_j$ and M_{ki} is either $Lsize_{ki}$ or ($Lsize_{ki}$, LTW_{ki}) corresponding to specifications (A) and (B) in Section 5.2.

The results in Table 4 suggest that sample selection bias is unlikely to drive our results. Comparing columns (1) and (2) in Table 4 with the corresponding uncorrected estimates in columns (3) and (4) in

[33] We also ran a specification using the same covariates in the selection and main equations in which identification comes from the joint normality assumption; the results are unaffected.

Table 3, we see that the coefficients on the main variables of interest (the LTW ratio and loan size) are virtually the same. Furthermore, the estimates of the correlation between the error terms in the first and second stage equations show a relatively weak relationship and the corresponding Wald test is not statistically significant.

The coefficient estimates in the selection equations (columns 1' and 2') have the expected signs. Controlling for other household characteristics, the propensity to have taken a loan increases in household income and decreases in household savings. Also, households who state that expanding investment would be profitable are more likely to borrow than those who do not.

5.2.2 Alternative definitions of formal and informal credit

We examine the sensitivity of the results to alternative definitions of formal and informal credit. As explained earlier, we have thus far excluded loans from village-based organizations: production credit groups (PCGs), rice banks, poor and elderly funds, as well as loans from agricultural lending institutions such as the BAAC or agricultural cooperatives. The latter two are very common in rural Thailand and make up for almost 45 percent of all loans in the survey.

At first thought, one may consider these institutions as formal lenders. 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 organizations the corresponding 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, loans from these institutions often rely on joint liability or community monitoring for enforcement and so they could be viewed as backed by social (rather than physical) capital and bear more resemblance to informal loans in our model. For example, about 50 percent of BAAC loans are reported as backed by multiple guarantors (group lending). We therefore check the robustness of our benchmark results by adding all loans from village institutions, BAAC and agricultural coops to either the formal or informal loan categories (see columns 2, 2' and 3, 3' in Table 5 respectively). In addition, we also consider a narrower definition of formal credit (commercial banks only, columns 4, 4') and a narrower definition of informal credit (loans from relatives only, columns 5, 5'). Columns 1 and 1' in Table 5 repeat the baseline results from Table 3 for convenience. For brevity we only report the main coefficients of interest.

The results in Table 5 show that the definition of formal vs. informal loans matters for the coefficients' magnitude but overall the results remain consistent with the model implications. In all specifications with the LTW ratio alone (columns 2,3,4,5) the corresponding coefficients are statistically significantly negative at the 0.1% level, indicating a negative relationship between loan informality and the LTW ratio regardless of the considered definition of formal vs. informal credit. However, when we include both the LTW ratio and loan size (the columns with primes), the coefficient on the LTW ratio appears sensitive to the definition of formal loans but not that of informal loans. Part of this could be due to sample size, for example in columns 4 and 4' there are only 106 formal loan observations. We also find

Table 5: Alternative classifications of formal and informal credit

	baseline		wide formal		wide informal		narrow formal		narrow informal	
loan source	(1)	(1')	(2)	(2')	(3)	(3')	(4)	(4')	(5)	(5')
LTW ratio	-0.24***	-0.11*	-0.21***	-0.02	-0.15***	-0.09*	-0.51***	0.10	-0.23***	-0.14**
	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)	(0.04)	(0.07)	(0.11)	(0.04)	(0.05)
loan size		-0.22***		-0.33***		-0.11*		-0.97***		-0.14*
		(0.05)		(0.04)		(0.04)		(0.13)		(0.06)
N	1231	1231	2818	2818	2818	2818	846	846	968	968
pseudo R-sq	0.15	0.16	0.25	0.27	0.13	0.13	0.55	0.65	0.15	0.15

[a] **Note:** The dependent variable is the loan source which equals 1 if the source is informal, and 0 otherwise (see the text for the categorization in different samples). All regressions control for location and intended loan usage, household demographics, and the co-variates specified in columns (3) and (4) in Table 3. The standard errors reported in parentheses are clustered at the household level. Superscripts ***, ** and * indicate significance at 0.1%,1% and 5%, respectively.

that loan size is always significantly negatively associated with loan informality (at the 5% confidence level or higher).

5.2.3 Loan size endogeneity

In a last robustness exercise we address the potential issue of loan size endogeneity. In the model and the empirical analysis thus far we have treated loan size as exogenously given, for instance as determined by the borrower's investment needs. In practice, however, loan size, the loan source and the loan terms can be jointly determined; for example a risky borrower could receive a smaller loan than requested. Alternatively, if informal lenders have limited funds, instead of taking a more expensive formal loan a borrower could split the needed amount into smaller loans from multiple informal sources. This possibility does not invalidate our theory *a priori* – allowing households to split up large loans in the model would not alter our conclusions qualitatively, except for increasing the range for which informal credit is feasible (the upper limit $\bar{\theta}$). However, if such issues were widespread, the causal link implied by the model from loan size and the LTW ratio to the chosen credit source could be reversed or the dependent and independent variables be co-determined, potentially biasing the estimated coefficients of interest.

The survey contains a question which allows us to tackle the loan size endogeneity concern by using an exogenous proxy for loan size. Specifically, households were asked to imagine a hypothetical situation in which they need funds for an emergency and asked from where 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 the latter case the loan source had to be specified. The same questions were posed for two hypothetical loan amounts, 2,000 Baht and 20,000 Baht. Since each household faced the same numbers, these hypothetical loan amounts are clearly exogenous to any observed and unobserved household characteristics. If we reasonably assume that households responded to the hypothetical situation in a way that would correspond to their actual behaviour, we can use an indicator variable for the two hypothetical loan sizes as a regressor and the corresponding answer about the chosen loan source

as the outcome variable. The results are reported in Table 6. For brevity we only report the estimates for the main variables of interest. The fixed effects specification in column (1) uses only *Lsize* since all other variables are at the household level. The other specifications include the same set of covariates as Table 3.

Table 6: Exogenous Loan Size Regressions

dependent variable	hypothetical loan source (informal =1)				
estimation method	fixed effects	random effects GLS		random effects logit	
	(1)	(2)	(3)	(4)	(5)
LTW ratio		-0.05***	-0.02*	-0.49***	-0.22*
		(0.01)	(0.01)	(0.07)	(0.11)
loan size	-0.01***		-0.01**		-0.05**
	(0.00)		(0.00)		(0.02)
Observations	2830	1,791	1,791	1,791	1,791
number of HHs	1,987	1,256	1,256	1,256	1,256

[a] **Note:** In specification (1), 1793 households were dropped because their answers did not vary with the size of the loan. The random effects regressions include fixed effects for location (tambon) and intended loan usage, and control for household characteristics. The LTW ratio, loan size and income are logged. Superscripts ***, ** and * indicate significance at 0.1%,1% and 5%, respectively.

The results in Table 6 remain consistent with the model predictions: in the model with household fixed effects, column (1), an exogenous increase in the hypothetical loan size has a statistically significantly negative effect on the reported choice of informal credit. Similarly, in the random effects models, columns (2)–(5), the probability that a household reports relatives or neighbours as their preferred loan source decreases in the LTW ratio, with and without controlling for loan size.

6 Conclusions

We model borrowers' choice between formal (collateral based) credit and informal (social capital based) credit in a setting with asymmetric information, risk, and strategic default. Our model delivers testable predictions that we show are consistent with data from rural Thailand. First, informal lenders charge lower interest rate and require less physical collateral than formal lenders. Second, the likelihood of observing informal loans decreases with the loan size to household wealth ratio (the LTW ratio) which proxies risk of default in the model.

We focus on informal loans between agents who are in a kinship or social relationship characterized by a sufficiently large and indivisible shared value that is lost to both parties in case of default. The presence of this 'social capital' is key for supporting repayment and the absence of strategic default in informal loans requiring no physical collateral. Our assumption (A2) that the social capital value is large makes our model better suited to more traditional social settings, such as rural or immigrant-group communities in which the value of maintaining interpersonal links is high. It is also consistent with the

observed prevalence of informal credit in such settings.

Relaxing the indivisibility of the social capital lost upon default or relaxing the reciprocity of this loss would make informal loans look more like formal (carry interest to compensate for default risk and require collateral). The informal loan terms would still be more favorable than those of formal loans and informal loans would still be chosen for less risky investments, as long as (some) social capital can be pledged. On the other hand, allowing forgiveness by the lender in case of involuntary default by the borrower does not affect our results at all.

In the model, agents choose either an informal or formal loan, depending on the desired loan size and their wealth. Nothing in the analysis, however, prevents agents from having two projects requiring different loan size and hence borrowing from both an informal and formal source, backing the informal loan with social capital and the formal loan with their wealth. The analysis would change, though, if formal lenders could observe repayment on the informal loan as a signal of project success or ability to repay.

In addition to the 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 type of investments that are likely to be financed using formal vs. informal loans. For example, if formal credit is unavailable (e.g., for lack of collateral), and the model is extended to allow project type choice, the social capital utility loss from default would imply that projects financed by informal credit would involve less risk taking compared to in a setting without financial constraints. As a result, households or regions primarily relying on informal credit could experience slower or limited business growth.

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7 Appendix

Proof of Proposition 1:

We first write down the informal credit contracting problem and show that, under our assumptions, if an informal loan is taken, it will have zero interest and no collateral. We then derive the LTW ratio threshold $\hat{\alpha}_I$ below which informal loans are desirable to the borrower.

Define the function $\pi(x) : \mathbb{R}_+ \to [0, 1]$ as

$$\pi(x) \equiv \begin{cases} 0 \text{ if } x \leq \alpha_{\min} \\ G(x) \text{ if } x \in (\alpha_{\min}, 1] \\ 1 \text{ if } x > 1 \end{cases} \tag{4}$$

and note that $\int_0^\infty d\pi(\alpha) = 1$. The value $\pi(\frac{r_i}{w})$ equals the probability of involuntary default conditional on the realization of α and project failure, $\text{Prob}(r_i > \alpha w)$, that is, the probability that a borrower with wealth w is unable to repay r_i.

As discussed in the main text, an informal borrower always repays r_I unless $y(\theta) = 0$ *and* $r_I > \alpha w$ (involuntary default). This implies that r_I is repaid with probability $1 - (1 - p)\pi(\frac{r_I}{w})$. In case of involuntary default the borrower and lender lose the social capital γ (with probability $(1 - p)\pi(\frac{r_I}{w})$) and the borrower transfers $\min\{c_I, \alpha w\}$ to the lender. Call $\eta(r_I, c_I)$ the ex-ante expected cost to the borrower associated with the collateral requirement,

$$\eta(r_I, c_I) \equiv (1 - p) \int_0^{r_I/w} \min\{c_I, \alpha w\} d\pi(\alpha). \tag{5}$$

We can write the $t = 0$ contracting problem for an informal borrower with project size $\theta \in (0, \bar{\theta}]$, wealth $w > 0$, and social capital $\gamma > 0$ as

$$\max_{r_I,\, c_I} \; U_B^I = pR\theta - [1 - (1-p)\pi(\tfrac{r_I}{w})]r_I - (1-p)\pi(\tfrac{r_I}{w})\gamma - \eta(r_I, c_I) \tag{OBJ$_B$}$$

$$\text{s.t. } U_L^I = [1 - (1-p)\pi(\tfrac{r_I}{w})]r_I - (1-p)\pi(\tfrac{r_I}{w})\gamma + \eta(r_I, c_I) \geq \theta - \kappa\gamma \tag{PC$_L$}$$

$$U_B^I \geq 0 \tag{PC$_B$}$$

$$r_I \leq \gamma + \min\{c_I, w\} \tag{IC$_I$}$$

$$r_I \geq \theta \text{ and } c_I \geq 0. \tag{NN}$$

We first show that, given assumptions A1, A2 and given (NN), (PC$_L$) is always satisfied for κ sufficiently close to or equal to 1. Call $\pi \equiv \pi(r_I/w)$ and $\eta \equiv \eta(r_I, c_I)$. Then (PC$_L$) is:

$$[1 - \pi(1-p)]r_I + \eta - \theta \geq \gamma[(1-p)\pi - \kappa] \tag{6}$$

By (NN), $r_I \geq \theta$ and $\eta \geq 0$ and so the l.h.s. of (6) is larger or equal to $\theta[1 - \pi(1-p) - 1] = -\pi(1-p)\theta$. The latter is larger or equal to $\gamma[(1-p)\pi - \kappa]$ for any $\theta \in (0, \bar{\theta}]$ as long as $\kappa\gamma \geq \pi(1-p)(\gamma + \bar{\theta})$ which is satisfied for κ close to 1 since $\pi \leq 1$ and since $p > 1/2$ and $\gamma \geq \bar{\theta}$ by Assumptions A1 and A2.

From the objective function, observe that it is optimal to set r_I and c_I as low as possible given (NN), that is $r_I = \theta$ and $c_I = 0$, as long as all constraints are satisfied.[34] We already proved that (PC$_L$) holds for any r_I and c_I satisfying (NN) and κ sufficiently close to 1. In addition, Assumptions A1 and A2 imply $\gamma \geq \bar{\theta}$, that is, (IC$_I$) is also satisfied. Therefore, whenever informal loans are beneficial to the borrower, that is (PC$_B$) holds, they would have zero interest and no collateral.

At $r_I^* = \theta$ and $c_I^* = 0$, (PC$_B$) can be written as,

$$(pR - 1)\frac{\theta}{w} + (1-p)\pi(\frac{\theta}{w})(\frac{\theta}{w} - \frac{\gamma}{w}) \geq 0. \tag{7}$$

There are three possible cases depending on the LTW ratio, $\frac{\theta}{w}$.

1. Case I1: $\frac{\theta}{w} \leq \alpha_{\min}$. Then $\pi(r_I/w) = \pi(\theta/w) = 0$ and hence (7) is satisfied for any such (θ, w) since $pR > 1$ by Assumption A1. No default occurs for such loans and the social capital is never lost.

2. Case I2: $\frac{\theta}{w} \geq 1$. Then $\pi(r_I/w) = \pi(\theta/w) = 1$ and hence (7) is violated for any such (θ, w) since $\gamma > \frac{p(R-1)\bar{\theta}}{1-p}$ by Assumption A2. Thus, no informal loans are taken for these (θ, w).

3. Case I3: $\alpha_{\min} < \frac{\theta}{w} < 1$. From cases I1 and I2 we know that, for given (θ, 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 (7) holds with equality.[35] Informal loans thus satisfy

[34] 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 $M \equiv (1 - (1-p)\pi(\frac{r_I}{w}))r_I + (1-p)\pi(\frac{r_I}{w})\gamma$. We have $\frac{\partial M}{\partial r_I} = 1 - (1-p)\pi(\frac{r_I}{w}) + (1-p)\frac{1}{w}\pi'(\frac{r_I}{w})(\gamma - r_I) \geq 0$ since $\gamma \geq r_I$ from (IC$_I$).

[35] By continuity, this value always exists since at $\frac{\theta}{w} = \alpha_{\min}$ (Case I1) the l.h.s. of (7) is strictly positive, while at $\frac{\theta}{w} = 1$ (Case I2) it is negative and since the l.h.s. is a continuous function. See Lemma A1 for a sufficient condition for the uniqueness of $\hat{\alpha}_I$.

(PC$_B$) for LTW ratios $\alpha_{\min} < \frac{\theta}{w} \leq \hat{\alpha}_I$. Note that the borrower may be unable to repay the required amount $r_I = \theta$ depending on the realization of α. Thus, such loans are risky and social capital is lost with positive probability.

Finally, we provide a sufficient condition for uniqueness of the threshold $\hat{\alpha}_I$.

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

Proof of Lemma A1: In case I3 where $\hat{\alpha}_I$ is relevant we have $\pi(\frac{\theta}{w}) = G(\frac{\theta}{w})$. Thus, the first derivative of the l.h.s. of (7) (multiplied by w) with respect to θ is,

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

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, e.g. this is satisfied by G uniform), the above expression is positive since $\gamma > \theta$ for all $\theta \in [0, \bar{\theta}]$ by Assumption A1–A2. That is, the l.h.s. of (7), call it $\Phi(\theta)$, is a strictly convex function of θ over the entire interval $(\alpha_{\min} w, w)$. This implies that $\Phi(\theta)$ can cross the horizontal axis exactly once in this interval since it is continuous and since $\Phi(\alpha_{\min} w) > 0$ and $\Phi(w) < 0$. Hence, if $G'' \leq 0$, the threshold $\hat{\alpha}_I$ defined as the value $\theta/w \in (\alpha_{\min}, 1)$ such that $\Phi(\theta) = 0$, is unique.■

Proof of Lemma 2:

Using the definition of $\hat{\alpha}_I$ and $\pi(.) = G(.)$ we have from (7),

$$(pR-1)\hat{\alpha}_I + (1-p)G(\hat{\alpha}_I)(\hat{\alpha}_I - \frac{\gamma}{w}) = 0 \tag{8}$$

By Assumption A1, $pR > 1$ and so for the above equality to hold it must be that $\hat{\alpha}_I < \frac{\gamma}{w}$, so we can write (8) as,

$$G(\hat{\alpha}_I) = \frac{(pR-1)\hat{\alpha}_I}{(1-p)(\frac{\gamma}{w} - \hat{\alpha}_I)} \tag{9}$$

The left and right hand sides of (9) can be viewed as functions of α on the interval $[\alpha_{\min}, 1]$ with equality holding when evaluated at $\alpha = \hat{\alpha}_I$. Both sides are strictly increasing in α. The l.h.s. equals 0 at $\alpha = \alpha_{\min}$ and 1 at $\alpha = 1$. The r.h.s. is positive at $\alpha = \alpha_{\min}$ and < 1 at $\alpha = 1$.[36] Hence, assuming $\hat{\alpha}_I$ is unique (see Lemma A1 above for sufficient condition), the r.h.s. of (9) as function of α crosses the l.h.s. from above at $\hat{\alpha}_I$. We thus obtain: (i) An increase in the social capital γ shifts the r.h.s. of (9) down, thus $\hat{\alpha}_I$ decreases in γ, ceteris paribus and (ii) An increase in the borrower's assets w, the project's return R, or the project's probability of success p shifts the r.h.s. of (9) up hence $\hat{\alpha}_I$ increases, ceteris paribus.□

Proof of Proposition 2:

From the discussion in the main text, the contracting problem between a formal lender and a borrower

[36] The latter follows noting that at $\alpha = 1$ we have $w = \theta$ and using Assumption A2.

with wealth w and loan size θ can be written as:

$$\max_{r_F,\, c_F} \; U_B^F = pR\theta - \int_0^\infty \min\{\alpha w, r_F\} d\pi(\alpha) - \lambda\theta \tag{OBJ$_B$}$$

$$\text{s.t.} \;\; U_L^F = \int_0^\infty \min\{\alpha w, r_F\} d\pi(\alpha) \geq \theta \tag{PC$_L$}$$

$$U_B^F \geq 0 \tag{PC$_B$}$$

$$r_F \leq \min\{c_F, w\} \tag{IC$_F$}$$

$$r_F \geq \theta \text{ and } c_F \geq 0 \tag{NN}$$

Constraints (IC) and (NN) imply that formal loans always require positive collateral since $c_F \geq r_F \geq \theta > 0$. Evaluating the expected payoff of the lender U_L^F at zero interest ($r_F = \theta$), we obtain

$$\int_0^\infty \min\{\theta, \alpha w\} d\pi(\alpha) \leq \theta,$$

with equality only if $\theta \leq \alpha w$ for *all* $\alpha \in [\alpha_{\min}, 1]$, that is when $\frac{\theta}{w} \leq \alpha_{\min}$, and with strict inequality otherwise (if $\theta > \alpha w$ for some α). Since U_L^F is increasing in r_F, this implies that, if $\frac{\theta}{w} > \alpha_{\min}$, a strictly positive interest, $r_F^* > \theta$, is needed for the lender to break even.

The optimal r_F^* is found by setting the lender's participation constraint (PC$_L$) to equality:

$$\int_0^\infty \min\{\alpha w, r_F\} d\pi(\alpha) = \theta \tag{10}$$

There are three possible cases depending on the value of the LTW ratio, $\frac{\theta}{w}$.

1. Case F1 (low LTW ratio): $\frac{\theta}{w} \leq \alpha_{\min}$. In this case $r_F^* = \theta$ solves (10) since $r_F^* \leq \alpha w$ for all α. The borrower always has sufficient funds and incentive to repay the loan and hence there is no risk for the lender and no default in equilibrium.

2. Case F2 (high LTW ratio): $\frac{\theta}{w} > E(\alpha)$. We have,

$$\theta > wE(\alpha) \geq \int_0^\infty \min\{r_F^*, \alpha w\} d\pi(\alpha) = \theta$$

The second inequality holds since $\alpha w \geq \min\{r_F^*, \alpha w\}$ for all α and hence $wE(\alpha) = \int_0^\infty \alpha w d\pi(\alpha) \geq \int_0^\infty \min\{r_F^*, \alpha w\} d\pi(\alpha)$ with equality only if $r_F^* \geq \alpha w$ for all α. Thus, for $\frac{\theta}{w} > E(\alpha)$, the lender's break-even constraint (PC$_L$) cannot be satisfied – no feasible r_F exists due to the possibility of strategic default.

3. Case F3 (intermediate LTW ratio): $\alpha_{\min} < \frac{\theta}{w} \leq E(\alpha)$.

It is easy to see that, for $\frac{\theta}{w} > \alpha_{\min}$, evaluating the l.h.s. of (10) at $r_F = \theta$ yields an amount strictly less than the r.h.s. θ. On the other hand, substituting $r_F = w$ in the l.h.s. of (10) yields $wE(\alpha)$ which is strictly larger than the r.h.s. θ for any $\frac{\theta}{w} < E(\alpha)$. This implies that, by continuity, for any $\frac{\theta}{w} \in (\alpha_{\min}, E(\alpha))$, there exists an $r_F^* \in (\theta, w)$ which solves (10) and which is strictly increasing in the loan size θ. From case F2, it is also immediate to verify that $r_F^* = w$ solves (10) for $\frac{\theta}{w} = E(\alpha)$.

The above results imply that the maximum LTW ratio value $\hat{\alpha}_F$, such that formal loans are feasible for $\frac{\theta}{w} \in (\frac{\alpha_{\min}}{\phi}, \hat{\alpha}_F]$ and not otherwise, equals $E(\alpha)$.■

Proof of Proposition 3:

(a) Since $\alpha_{\min} < \hat{\alpha}_F = E(\alpha)$, formal loans are feasible over the entire interval $\frac{\theta}{w} \in (0, \alpha_{\min}]$. If $\theta \leq \alpha_{\min} w$, Propositions 1 and 2 imply $r_F^* = r_I = \theta$ and $\pi(\frac{\theta}{w}) = 0$ since the risk of non-repayment is zero for both formal and informal lenders. The borrower's expected payoff from taking an informal loan loan is $U_B^I = (pR-1)\theta$ while her expected payoff from taking a formal loan is $U_B^F = (pR-1-\lambda)\theta$ which is strictly smaller – informal loans are strictly preferred because they avoid the cost λ.

(b) By Proposition 2 and its proof, for $\frac{\theta}{w} \in (\alpha_{\min}, \min\{\hat{\alpha}_I, \hat{\alpha}_F\}]$, the repayment r_F^* solves (10) and is strictly larger than θ while we have $r_I^* = \theta$ from Proposition 1. For such $\frac{\theta}{w}$ we have $\pi(\frac{r_I^*}{w}) = G(\frac{\theta}{w}) \in (0,1)$ and $\gamma > \theta$ by A2. The borrower's expected payoff from using informal credit is

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

which she would compare to the expected payoff from using formal credit, $U_B^F = (pR-1-\lambda)\theta$. The optimal loan source choice in this case depends on the parameter values. Recall from the above discussion that: (i) $U_B^I > U_B^F$ at $\theta/w = \alpha_{\min}$, (ii) $U_B^I < 0$ at $\theta/w > \hat{\alpha}_I$, and (iii) $U_B^F > 0$ for any θ/w. This implies the existence of $\hat{\alpha} \in (\alpha_{\min}, \hat{\alpha}_I)$ such that $U_B^I > U_B^F$ for $\theta/w < \hat{\alpha}$ and $U_B^I < U_B^F$ otherwise. Thus, informal loans are preferred for relatively small θ/w ratios, while formal loans are chosen for larger θ/w ratios in the interval $(\alpha_{\min}, \min\{\hat{\alpha}_I, \hat{\alpha}_F\}]$.

(c) Note that we showed above that $U_B^I \leq (pR-1)\theta$ with strict inequality if $\frac{\theta}{w} > \alpha_{\min}$ and $U_B^F = (pR-1-\lambda)\theta$ which increases as λ decreases. Since $\hat{\alpha}$ is defined as the LTW ratio value at which $U_B^I = U_B^F$ and since U_B^I does not depend on λ, the result follows directly.■

Appendix B. No utility cost of refusing a loan ($\kappa = 0$)

Consider the case in which an informal lender's reservation utility is $\bar{u}_L = \theta$ – the same as that of a formal lender, that is he suffers no disutility from refusing to make a loan when asked. It is then clear from the proof of Lemma 2, that if $\pi(\frac{r_I}{w}) > 0$ (positive default probability), that the lender can no longer break even at $r_I = \theta$ – a positive interest must be charged. Hence, for $\frac{\theta}{w} > \alpha_{\min}$, the optimal informal loan terms (r_I^*, c_I^*) must satisfy the lender's break-even constraint,

$$[1-(1-p)\pi(\tfrac{r_I}{w})]r_I - (1-p)\pi(\tfrac{r_I}{w})\gamma + (1-p)\int_0^{r_I/w} \min\{c_I, \alpha w\} d\pi(\alpha) = \theta$$

Substituting into U_B^I, the borrower's expected payoff is:

$$(pR-1)\theta - 2\gamma(1-p)\pi(\frac{r_I}{w})$$

which is decreasing in r_I (strictly if $\pi(\frac{r_I}{w}) \in (0,1)$). Thus, to keep the interest rate as low as possible, it is optimal to choose r_I^* and $c_I^* \geq r_I^*$ where r_I^* solves:

$$[1-(1-p)\pi(\frac{r_I}{w})]r^I - (1-p)\pi(\frac{r_I}{w})\gamma + (1-p)\int_0^{r_I/w} \alpha w d\pi(\alpha) = \theta$$

This ensures that a defaulting borrower would always hand αw to the lender and the interest r_I would cover the rest of the lender's opportunity cost θ. Evaluating the l.h.s. at $r_I = \theta$ for $\frac{\theta}{w} > \alpha_{\min}$, the third term is smaller than $(1-p)\pi(\frac{\theta}{w})\theta$ since $\alpha w \leq \theta$ under the integral with strict inequality for $\alpha \in (\alpha_{\min}, \frac{\theta}{w}]$. This implies that he left hand side is smaller than θ. Informal loans thus would charge strictly positive interest and collateral for $\frac{\theta}{w} > \alpha_{\min}$.

Notice that it is unclear apriori how the resulting interest rate r_I^* compares to r_F^* in Proposition 2 since there are two opposing effects. On the one hand, given A2, informal loans are repaid in full more often as there is no strategic default. On the other hand, the lender needs to be compensated for the utility loss γ in case of default. If we set $\gamma = 0$ in the l.h.s. of (PC_L) (the 'forgiveness' scenario discussed in Section 3), then it is easy to see that the optimal informal credit interest rate r_I^* is strictly lower than the formal credit rate r_F^* for the same (θ, w) since only the former effect operates.

Table 7: Additional Probit Regressions for Loan Source

dependent variable	loan source (informal=1)			
	(1)	(2)	(3)	(4)
wealth		0.10*		0.11*
		(0.04)		(0.05)
loan size	-0.28***	-0.32***	-0.31***	-0.33***
	(0.03)	(0.04)	(0.04)	(0.04)
tenure			-0.34	-0.38
			(0.21)	(0.21)
bank access			-0.15	-0.20
			(0.11)	(0.11)
BAAC member			-0.09	-0.13
			(0.10)	(0.10)
income			0.13**	0.09
			(0.05)	(0.05)
Observations	1236	1232	1235	1231
pseudo R^2	0.15	0.15	0.16	0.16

[a] **Note:** The regressions include fixed effects that account for location (tambon) and intended loan usage. We also control for the following household characteristics: age, gender, marital status, education of the head, and total number of outstanding loans. The standard errors reported in parentheses are clustered at the household level. Superscripts ***, ** and * indicate significance at 0.1%,1% and 5%, respectively.

Table 8: Summary Statistics

Variable	obs.	median	mean	std.	min	max	units
Household-level data							
wealth	1915	515	1145	2072	9	21342	1000s Baht
income	1910	65.3	164	519	0.4	15710	1000s Baht
number of outstanding loans	1915	1	1.78	1.03	1	6	integer
age	1892	48	49.3	12.8	23	101	years
education	1892	3	3.47	1.86	1	11	years
gender (1=female)	1892	0	0.19	0.39	0	1	binary
marital status (1=married)	1915	1	0.83	0.37	0	1	binary
tenure	1911	1	0.95	0.22	0	1	binary
bank access (1 = yes)	1914	0	0.28	0.45	0	1	binary
BAAC access (1 = yes)	1914	1	0.52	0.5	0	1	binary
Loan-level data - all loans							
loan size	3406	20	39.6	78.9	0.05	1000	1000s Baht
loan size to wealth (LTW) ratio[a]	3406	0.03	0.07	0.15	0.00	3.54	n.a.
interest rate[b]	2917	9.8	15.7	23.4	0	199	percent
collateral	3406	0	71.3	231	0	2800	1000s Baht
Loan-level data - informal only (relative or neighbor)							
loan size	822	7.5	20	43.8	0.05	500	1000s Baht
loan size to wealth (LTW) ratio	822	0.02	0.05	0.11	0.00	1.16	n.a.
interest rate	552	4.6	19.9	30.1	0	186	percent
collateral	822	0	9.3	69.8	0	1500	1000s Baht
Loan-level data - formal only (commercial bank or moneylender)							
loan size	439	20	58.2	105	0.4	1000	1000s Baht
loan size to wealth (LTW) ratio	439	0.05	0.09	0.14	0.00	1.23	n.a.
interest rate	337	15.8	27.7	32.2	0	199	percent
collateral	439	0	127.3	320	0	2400	1000s Baht

Notes: The household level data include all observations with positive and non-missing wealth and loan size. In the loan-level data: a. the LTW ratio is computed using household wealth, including when a household has multiple loans, b. the interest rate summary statistics exclude observations with missing data and 44 outliers with interest above 200%.