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The Use of Collateral in Formal and Informal Lending

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Abstract

We offer a new test of the ex ante theory of collateral. Theory states that lenders rely less on collateral if they have better information about borrowers. We test this by contrasting the use of collateral between formal and – better informed – informal lenders in a developing financial market. Indeed, formal lenders rely about 40% more often on collateral than informal lenders, controlling for conventional determinants of collateral. Moreover, having better information about borrowers has implications within lender groups: formal lenders rely less on collateral with longer borrower-relationship and informal lenders rely less on collateral with shorter distance to the borrower.

Keywords: collateral, informal lenders, private information, relationship lending, distance

JEL codes: G 21 (banks, microfinance), O 16 (financial markets), O 17 (formal and informal sectors)

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1 Introduction

Collateral is a common element of loan contracts which is used to overcome information and incentive problems. Empirical studies have shown that collateral is indeed used in most loan contracts and that theoretically expected determinants are relevant (Steijvers and Voordeckers, 2009). However, do we find the same use of collateral among diverse lenders which differ, in particular, in their degree of private information about borrowers? We examine this issue based on a sample of loans from a developing country. Developing markets are characterized by more opaque information as well as more severe problems in monitoring and enforcing of loan contracts. Due to this difference, specific financial institutions have emerged, in particular informal lending. Informal lenders address information and incentive problems in lending by their proximity to the borrower. Proximity, indicated by relationship and near distance, may contribute to generating private information, thus reducing the need for collateral. Despite the prominence of informal lenders in developing countries (e.g., Kan, 2000; Banerjee and Duflo, 2007; Barslund and Tarp, 2008), their use of collateral has rarely been examined and a comparison with formal lenders in this respect is missing. We contribute to filling this gap by making use of a novel data set.

The use of collateral is an important issue in developing countries because widespread poverty limits the availability of collateral. Lack of collateral contributes to restricted access to finance which is a major concern in developing financial markets (Beck and Demirgüc-Kunt, 2008). From this perspective, an information advantage of informal lenders may contribute to better access to finance. It may also complement formal finance by contributing to the growth of small firms (Degryse et al., 2013) and by providing capital despite difficult loan contract enforcement (Giné, 2011). Moreover, a deeper understanding of the information environment in general may generate insights into how to improve lending technologies in order to make (semi-) formal financial institutions more inclusive.

However, the differences in the informational setting between formal and informal lending are not just interesting for the analysis of developing financial markets. They also allow for more general insights into the use of collateral. Our examination is guided by the two dominating

theories on the use of collateral in lending, the ex post and the ex ante theory (Berger et al., 2011a, 2011b). According to the *ex post theory of collateral*, borrowers have to provide collateral as a buffer against default risk. The testable implication of this theory is that loans with higher observable risk will have to pledge more collateral. As this is quite a general statement, the empirical relation is expected to hold across various types of lenders, in particular at formal and informal ones. This ex post theory has often been tested and has been confirmed in most cases, although there is a gap regarding informal lenders.

By comparison, empirical evidence on the validity of the *ex ante theory of collateral* is rather rare. This theory starts with the assumption that lenders cannot (fully) observe the riskiness of borrowers. The resulting asymmetric information may be reduced by borrowers: less risky borrowers have an incentive to signal their superiority by pledging more collateral. Despite its theoretical appeal, this ex ante theory of collateral has hardly been tested because of the lack of available knowledge of borrowers' riskiness which is *not* observable to lenders. Thus the researcher needs a degree of information which lenders do not have – this is rare and motivates the search for alternative approaches.

Such approaches exploit an implication of the ex ante theory: The signaling incentive of less risky borrowers is weaker and thus their provision of collateral is lower if lenders have better information about borrowers. Therefore, if there are two cases which differ only in the information asymmetry between lender and borrower, the ex ante theory predicts that less collateral is used in case of better information. This has been analyzed in an event study approach where the information asymmetry changes due to new regulatory requirements (Berger et al., 2011a). We propose another approach which exploits the different degree of information asymmetry across lending institutions.

Essentially, regular banks mainly use observable information about the riskiness of borrowers but informal lenders are able to use a richer set of information, including more private information, due to their intimate knowledge of borrowers. This difference in the degree of information between formal and informal lenders has testable implications regarding the role of collateral in their lending operations.

Overall, by empirically examining four theoretically expected relations we get the following results: (1) As a baseline relation derived from the ex post theory, and thus independent from the degree of lender information about the borrower, we expect and find that more risky loans have

more restrictive terms to a significant degree, including higher collateral requirements. (2) According to the ex ante theory of collateral, regular banks require more collateral than informal lenders as they have less information about borrowers' riskiness. On average, formal lenders require collateral about 40% more often compared to informal lenders. (3) As a further implication of the ex ante theory of collateral, we find that regular banks – but not informal lenders – improve their risk assessment over time: at the mean, about 7.5 years longer relationship with borrowers will reduce the probability of collateral by about 8%. (4) Another implication of the ex ante theory derives from the physical distance between lender and borrower: larger distance hampers information gathering, for informal lenders only. The effect at the mean is about 10% higher collateral probability with 17 minutes longer travel time. If borrower and informal lender are located in the same village, collateral probability decreases by even a third.

This research program requires appropriate data. In this paper, we use a comprehensive household survey, conducted among more than 2,000 households in the rural areas of Northeastern Thailand. This data set is particularly useful for our purpose as these households make frequent use of the various financial institutions offering loans. Overall, about 65% of households have a loan at a certain point in time and on average these households take loans from 2.3 different institutions. Moreover, we observe the operations of a broad range of formal, semiformal and informal financial institutions which is important in identifying differing degrees of information asymmetry between lender and borrower. These financial market characteristics under review are necessary to implement our research strategy and distinguish our study from others in the literature, as we argue later in more detail (see Section 2).

The paper is structured as follows: Section 2 links our research to the literature and carves out our contribution. Section 3 describes data, Section 4 presents and discusses results of the empirical examinations, Section 5 contains robustness checks and Section 6 concludes.

2   Literature and hypotheses

2.1 Theoretical literature

Economic theory explains collateral as an instrument to reduce adverse selection and moral hazard arising from ex ante and ex post information asymmetries between borrowers and lenders. This helps to reduce credit rationing (for reviews see Berger et al., 2011a, 2011b). According to the *ex post theory of collateral*, borrowers have to provide collateral as a buffer against default

risk, which arises from moral hazard, difficulties in enforcing contracts, or costly monitoring. These ex post theories of collateral predict that the incidence of collateral is higher for observably riskier borrowers (Berger et al., 2011b) and that collateral provides incentives to monitor these borrowers (Longhofer and Santos, 2000). Observable risk depends on characteristics of the borrower and the loan contract. Ex post frictions such as moral hazard may not only be reduced by collateral, but also by shorter loan duration and lower loan volume. Therefore, the use of collateral is expected to increase with loan duration and loan size (Ortiz-Molina and Penas, 2008; Steijvers and Voordeckers, 2009).

Ex ante, collateral may be used as a sorting or signaling device by inducing observationally equivalent loan applicants to reveal their default risk. From a menu of contracts offered, applicants with projects of higher quality choose secured debt with lower loan rates, while those with projects of lower quality self-select into unsecured debt with higher loan rates (e.g. Boot et al., 1991). According to these ex ante theories of collateral, the incidence of collateral is expected to increase with the ex ante information gap between borrower and lender (Berger et al., 2011a). A special aspect of this information asymmetry has been addressed by the lender-based theory of collateral, which states that the type of lender matters for information asymmetries and collateral requirements. A model of competition between a local lender with an information advantage and distant transaction lenders predicts that the incidence of collateral increases, if the information advantage of local lenders is reduced, e.g., by technological innovations in credit scoring (Inderst and Mueller, 2007).

Theories of relationship lending predict that ex ante and ex post information asymmetries between borrower and lender depend on the strength (length, breadth or intensity) of the lending relationship, because the proximity between lender and borrower facilitates ex ante screening and ex post monitoring (for an overview see Boot, 2000). In a model of repeated lending, Boot and Thakor (1994) show that a bank initially requires high collateral from a firm, but reduces these requirements after having observed timely repayment of the loan. The strength of the bank-borrower relationship depends on the lending technology, which is categorized as relationship lending or asset-based lending (Berger and Udell, 2006; Egli et al., 2006). Relationship lending relies on soft, private information about the borrower's risk obtained through a close relationship between bank and borrower, while asset-based lending is more transactions oriented and relies on hard, public information (Brick and Palia, 2007). A possible disadvantage of relationship lending

for borrowers is that the proprietary information gained by the relationship lender increases his or her ex post bargaining power, so that the borrower is locked in (Sharpe, 1990; Rajan, 1992). This lock-in can be used by the lender to increase collateral requirements. Then, collateral is the result of hold-up, and the incidence of collateral rises with the strength of the lending relationship.

While these theories have been developed for banks in mature economies, relationship lending plays an even larger role in less developed economies with financial systems characterized by low transparency and weak legal enforcement (Egli et al., 2006). Especially in the case of small loans in not fully developed markets, the costs of evaluating and utilizing collateral may be excessive, which makes relationship lending especially attractive as a substitute for collateral. We therefore expect a negative influence of the duration of the lending relationship on collateral required by banks in emerging markets. Relationship lending can be seen as a strategy of regular banks and other formal lending institutions to improve their limited information. Beyond serving as strategy for formal lenders, relationship lending has emerged as a specific organizational form, called informal lenders. Informal lenders are closer to their customers than formal lenders and hence have a comparative advantage in reducing ex ante information gaps about their borrowers. For the case of small loans in developing markets, ex ante theories of collateral are especially relevant, because hard information about the credit risk of rural households is missing or difficult to obtain (e.g. lack of credit registers). Therefore, we expect that collateral is less often used by informal lending institutions than by formal ones that provide loans at arms' length, and that the distance to the customer matters for the use of collateral by informal lenders. The duration of the lending relationship is likely to play a larger role for collateral requirements of formal banks to reduce their larger ex ante information gaps.

Summarizing, we derive the following hypotheses:

H1: The incidence of collateral increases with observable credit risk at all types of lenders.

H2: Regular banks require more collateral than informal lenders.

H3: A longer duration of the lending relationship reduces collateral requirements of formal lenders.

H4: A shorter distance between borrower and lender reduces collateral requirements of informal lenders.

2.2 Empirical literature

One way to test the validity of ex ante and ex post theories of collateral is to examine the relationship between borrower risk and collateral. While the ex post theories of collateral predict a positive influence of observable borrower risk on collateral, the ex ante theories predict a negative influence of unobservable risk on collateral due to its signaling role. The majority of studies find that observed risk, measured by borrower and loan characteristics, positively affects collateralization, consistent with H1 (for a review see Steijvers et al., 2010).[1] Collateral and monitoring seem to be complements to reduce the risk of ex post information problems (Cerqueiro et al., 2012). Evidence in favor of the ex ante theories of collateral is less clear, because the first studies that found a negative relationship between borrower risk and collateral (Jiménez et al., 2006; Lehmann and Neuberger, 2001) do not isolate effects of private information from ex post incentive problems (Berger et al., 2011a, 2011b). To do so, Berger et al. (2011a) exploit exogenous variation in ex ante lender information related to the adoption of an information-enhancing loan underwriting technology and find a negative effect on the use of collateral, consistent with the ex ante theory of collateral. Berger et al. (2011b) isolate private from public information by using information about borrower risk from a credit registry which is not known to the lender. They find that ex post theories of collateral dominate, and that the ex ante theories seem to hold only for customers with relatively short relations to the lender. Berger et al. (2012) find that the mixed results of the risk-collateral studies may be explained by different economic characteristics of collateral in the different samples.

Another set of empirical studies examines the influence of asymmetric information, measured by the duration of the lending relationship or the number of lenders, respectively exclusivity of the lending relationship, on the incidence of collateral (for reviews see Berger et al., 2011a; Steijvers et al., 2010). The evidence is mixed. Some studies find a negative effect of relationship duration on the incidence of collateral, consistent with H1 (e.g., Berger and Udell, 1995; Lehmann and Neuberger, 2001; Chakraborty and Hu, 2006; Brick and Palia, 2007; Menkhoff et al., 2012), while others find a positive effect (e.g., Machauer and Weber, 1998; Ono and Uesegi, 2009) and again others find mixed signs or insignificant results (e.g., Degryse and

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[1] Studies include Berger and Udell, 1995; Degryse and Van Cayseele, 2000; Lehmann and Neuberger, 2001; Chakraborty and Hu, 2006; Menkhoff et al., 2006, 2012; Voordeckers and Steijvers, 2006; Brick and Palia, 2007.

Van Cayseele, 2000; Jiménez et al., 2006; Menkhoff et al., 2006; Voordeckers and Steijvers, 2006). Also the effect of the number of lenders on the use of collateral is sometimes positive (Chakraborty and Hu, 2006; Jiménez et al., 2006), sometimes negative (Menkhoff et al., 2006; Voordeckers and Steijvers, 2006) and sometimes insignificant (Menkhoff et al., 2012). These mixed results can be interpreted as being partly consistent with ex ante theories of collateral, ex post theories of collateral and the hold-up hypothesis, and reflect the problem of isolating the ex ante information hypothesis from the ex post one (Berger et al., 2011a). Ioannidou and Ongena (2010) find that switching to a new bank increases the likelihood of collateralization. This clearly supports the ex ante theories of collateral, because ex ante information asymmetries are higher for outside banks than for relationship lenders as inside banks.

With respect to the role of distance in lending, Degryse and Ongena (2005) find that the geographical distance between borrower and lender is relevant for loan pricing, but they do not examine its influence on collateral. Agarwal and Hauswald (2010) provide evidence that the proximity between bank and borrower is a source of local informational advantage and increases credit availability. Jiménez et al. (2009) show that the organizational distance, measured as the distance between the headquarters of the bank and the location of the borrower, matters for the use of collateral for business loans in Spain. In contrast to our expectations, the use of collateral is higher for loans that are granted by local lenders. This can be explained by the finding that hard data about the credit quality of the borrower (accounting variables) and organizational distance are substitutes in the collateral decision. If distant lenders can offset their informational disadvantage by the availability of hard data, they can grant loans with less collateral than local banks (Jiménez et al., 2009).

The majority of studies focuses on mature markets. As theoretically expected, collateral requirements of banks tend to be larger in less developed markets and decline with financial development (Liberti and Mian, 2010; Nguyen and Qian, 2012). For a cross-section of 31 countries, Godlewski and Weill (2011) show that consistent with the ex ante theories of collateral, the relationship between collateral and risk premiums tends to be negative only in countries with higher levels of asymmetric information, measured among others by the presence of credit registries, accounting standards, creditor rights and the level of financial development. Relatively high rates of collateral have been found for business loans in transition countries (Hainz, 2003) and in the emerging markets of Mexico (La Porta et al., 2003) and Thailand (Menkhoff et al.,

2006), while the incidence of collateral is comparatively low in business loans in Bolivia (Ioannidou and Ongena, 2010) and Peru (Guirkinger and Boucher, 2008). The evidence for China is mixed (Allen et al., 2005; Lin, 2011).[2] Collateral plays a limited role in rural household lending in Thailand (Menkhoff et al., 2012), and in lending to very small enterprises and households by microfinance institutions in developing countries (Conning and Udry, 2007; Hermes and Lensink, 2007). In these markets, collateral tends to be substituted by guarantees and relationships (e.g., Besley and Coate, 1995; Fafchamps and Lund, 2003; Menkhoff et al., 2012). Whether this depends on the formality of the lender is still an open question. In a cross-section of 43 developing countries, loans from non-bank financial institutions were less often collateralized (Nguyen and Qian, 2012), consistent with H2. In commercial microlending in Mozambique, collateral is relevant, but decreases with informational gains from successive loans (Behr et al., 2011). This supports the mechanism underlying H3.

Summarizing, there is a research gap in the empirical literature on the ex ante theories of collateral and the use of collateral by informal lenders which we address in this paper.

3   Data

This section contains data information, from general to specific: Section 3.1 is about the overall survey underlying our research, Section 3.2 describes the specific data of this survey which we use and Section 3.3 shows the reliance on collateral in our sample.

3.1 The underlying survey

The data emanates from the project "Vulnerability to poverty in Southeast Asia" which started in 2006 to compile a long-run panel data set providing household information.[3] The survey covers more than 2,000 rural households in the Northeastern part of Thailand in which most people are engaged in farming activities. Households have been selected according to a three-stage stratified sampling procedure, in which 3 provinces were chosen according to their share of rural population. In a subsequent step sub-districts in these provinces were randomly selected with probability relative to their population density. In each of these sub-districts two villages were

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[2] While Allen et al. (2005) show that collateral is important in private sector loans in China, Lin (2011) finds only a limited role of collateral in China due to weakly protected creditor rights.

[3] Part of the data has been used in an earlier study on collateral, with a different research focus, too. Appendix 1 shows comparability of both studies as far as data and issues overlap.

chosen and 10 households in each village were randomly identified. The generated sample is representative for the relatively poor rural population in Thailand's Northeast.

So far, three waves have been conducted during April and May in the years 2007, 2008, and 2010. Each wave captures the period of the last 12 months so that there is a 12 months gap for 2009. The range of questions is quite broad, capturing household dynamics, health, education, risks, shocks, economic activities, employment and financial issues. For our research purpose, we use information about borrowing and lending activities, repayment behavior and savings of a household. It is this broad informational basis, notably the detailed data about households' borrowing activities, which distinguishes our dataset from others.

Due to the setting in Thailand, many lenders operate in rural areas. Roughly, one can differentiate between three diverse types of lenders according to their degree of formality, i.e. formal, semiformal and informal lenders. *Formal lenders* consist of commercial banks (CB) which have, however, only a very limited lending business in the rural Northeast, and a large state owned bank, the "Bank for Agriculture and Agricultural Cooperatives" (BAAC), which was set up to serve the agricultural sector of the economy, i.e. rural areas.

Semiformal lenders consist of three groups: first, there are credit-granting institutions at the village level (CRED), such as village banks, credit cooperative or credit groups; these financial institutions have been analyzed in some detail by Kaboski and Townsend (2005). Second, the Thai government established in 2002/03 the so-called Thai Village Fund Program (VF), i.e. a revolving fund set up in each village (see details in Boonperm et al, 2013). With respect to formality CRED and VF can be located between formal and informal lenders since they are operating according to binding regulations but these regulations are only valid for a specific clientele or linked to membership. Third, another type of loans can also be defined to be semiformal, i.e. loans given by political entities to specific borrowers such as very poor households or students (POL).

Finally, despite Thailand's economic progress over the last decades and despite the set-up of specific (semi-)formal institutions in rural areas, *informal lenders* still play an important role. They comprise professional moneylenders and pawnshops (ML), business partners such as traders and suppliers (BP), family members (FAM) and friends (FRI).

3.2 Description of data

This study is about the role of collateral. Thus out of the overall survey sample, we are only interested in those households who were interviewed in each of the three waves and who ever took a loan in the 12 months preceding one of the three interviews: 1,791 households fulfill these conditions and thus form the sample for our empirical study[4]. These households and their borrowing behavior are described in the following.

Table 1 provides descriptive statistics about four areas of interest, i.e. (1) household demographics, (2) economic status of the household, (3) borrowing characteristics and (4) relationship variables. We comment on some of the data. Regarding *demographic information*, household heads are about 54 years old and spent slightly above five years in school, as compulsory schooling for the old cohort was 4 years. The household size is more than four persons, which translates into about three when measured as adult equivalence units according to the OECD[5]. About 25% of all households are female headed and 80% of all household heads are married.

Variables indicating the *economic situation* of households show that most households own a small area of land. Most variables become larger over time in nominal terms as the overall economy experienced average real growth rates of about 2.5% annually between 2007 and 2010.[6] This nominal increase applies to income, consumption expenditures and asset endowment. Finally, debt capacity, expressed by the ratio of income over total loan volume, slightly decreases over the years.

Regarding *borrowing* behavior, we have to ensure comparability over time, i.e. across three waves. Thus we capture only newly granted loans within our reference periods and do not consider loans that have been granted before the survey started in 2006 nor loans that have been granted in the 12 months gap in 2009. The remaining sample consists of 1,791 households and 6,957 loans. 2,529 loans have been granted within the first wave, 2,497 within the second and

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[4] 314 households (15% of all households) never borrowed. These households distinguish from borrowing households in that they are mainly retired people who have a relatively high but non-increasing income, high amounts of savings but only small land plots, low asset endowments and low consumption levels.

[5] The OECD assigns different weights to household members. The first adult member attributes to the measure with 1.0, all other adult attributes with a weight of 0.7 and each child is assigned a weight of 0.5.

[6] Growth rates were 4.2% (2007), 1.8 (2008), -3.0 (2009) and 7.2% (2010), respectively.

1,931 within the third wave.[7] On average, households agree on about 1.6 new loans per year which is, of course, partially driven by the short duration of below 17 months. The percentage of loans with either (tangible) collateral or guarantees is increasing over time though collateral and guarantees exhibit a different development. The share of collateralized loans drops by 2%-points from 18% to 16% in wave 2 and increases again in wave 3 to 21%. Wave 2 can be considered as a crisis year since the financial crisis of 2007/2008 hit the country in these months what may explain the results. Consequentially the pattern for guaranteed loans is reverse: personal guarantees increase in wave 2 and decrease again in wave 3 suggesting a substitution of collateral and personal guarantees. Also the purpose of loans slightly changes over time. The share of loans used for agricultural production, which is the most important use of loans, increases from 38% (wave 1) to 42% (wave 2) and decreases again to 39% in wave 3. The share of loans used for non-agricultural production decreases from 18% to 13% and increases again to 18%, reflecting the economic crisis during wave 2. Consumption loans decrease from the first to the second wave and remain at the new level of 28%. Loans to pay back other loans or to relend to other households increase from 12% (wave 1) to 15% (wave 2) and also remain at that level in wave 3.

Finally, there are three potential *relationship variables*: Relation duration between lender and borrowing household is on average more than six years and increasing. On average households have borrowed 2.6 loans from the same lender across waves, indicating close relations, and the average household is engaged with 2.27 different lenders, where less lenders indicate a closer relation.

3.3 The reliance on collateral

The sample includes a variety of lending institutions and the different institutions may have different collateral requirements. In particular, lenders with more information on borrowers, should have less need of collateral as the ex ante theory predicts (Berger et al., 2011a). Lenders with less information regarding the borrower should therefore have higher collateral requirements. According to theoretic reasoning (see Section 2 above), we expect formal lending institutions

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[7] These loans are mostly cash loans but there are also 433 installment loans and 116 in kind loans which are included in the descriptive statistics. However, we do not include them in the regressions due to the following reasons: 1) we want to avoid measurement errors for loan size and therefore do not consider in kind loans and 2) we do not want to mix purchasing decisions and their payment modalities with real loan decisions and hence exclude installment loans.

having less intimate knowledge about borrowers and thus relying more on collateral than informal lenders.

Table 2 presents information about the use of collateral, relationship variables and loan characteristics for the nine different lending institutions operating in the rural Northeast of Thailand (Panel A) and for the three major groups of lending institutions (Panel B). Panel A shows that on average about 18% of all loans are collateralized. This share is rather low compared to collateralization in other developing countries. In Peru, Guirkinger and Boucher (2008) find collateralization of 24% of all loans. Berger et al. (2012) observe the same share for loans from formal institutions in Bolivia. As expected, in our sample formal institutions, i.e. CB and BAAC, have a high share of collateralized loans, i.e. roughly 40% (Panel B). Semiformal institutions are very diverse. The VF does not rely on collateral at all but on guarantees. Policy loans (POL) also do not use the instrument of collateral. Therefore it does not seem relevant to consider these two lending institutions when examining the role of collateral. Only credit institutions (CRED) use collateral to some extent, i.e. in 19% of cases and thus indeed less than formal lending institutions.

Within the informal institutions we can distinguish between ML/BP and FAM/FRI. Former demand collateral similar to formal lenders and drive the results for the whole group. The motivation for ML and BP to give loans to households is economic reasoning. Furthermore it is likely that loan transactions, in particular from BP, are interlinked with other business transactions between the lender and the borrower which might influence loan terms. FAM and FRI in contrast do not follow economic reasoning in the first place. But it is possible that they want to gain advantages in case of own potential problems in the future by helping their kin. Overall, FAM/FRI use collateral to less than 10% and thus indeed seem to act in accordance with the theoretical expectations, whereas ML/BP use collateral to an unexpectedly high degree. We come back to this fact (in Sections 4.2 and 4.3).

Turning to the descriptive statistics about relationship variables and loan characteristics, we see some marked differences between lending institutions. As expected, for example, CB lend large loan amounts and ML charge high interest rates. However, we would also emphasize that many variables – such as average loan size and loan duration – are not very different between formal and informal lenders, indicating some degree of homogeneity in loans across these

institutions. As a consequence, differences in collateral requirements do not obviously emanate from differing loan characteristics but reflect different lending practices.

4   Results

This section documents results in four steps. In Section 4.1 we confirm standard results of the ex post-theory of collateral for our sample. On this basis we show in various forms that better information of lenders about borrowers reduces the use of collateral: this holds across different lenders (Section 4.2), it is corroborated by the influence of relationship across lenders (Section 4.3) and it is further supported by the role of distance across and within groups of lenders (Section 4.4).

4.1 The empirical approach in examining the use of collateral

Our empirical approach in examining the use of collateral follows standards in the literature (see Section 2). We analyze the determinants of collateral at the loan level. As households typically have several loans at the same time and over time, we take care of this fact by using standard errors being clustered at the household level.

Moreover, we examine the use of collateral by applying a logistic regression in which the use of collateral is approximated by its incidence. If not indicated otherwise we present the marginal effects at the means of explanatory variables. As a measure of collateral we prefer the "incidence of collateral" over the "degree of collateralization" because the latter is unusually high in our sample with about 200 to 400 percent on average, mainly due to indivisibility of land. Unfortunately, there is little information in rates of collateralization above 100%, so that the measure of degree of collateralization is much less informative than in other studies where loans are typically collateralized to less than 100 percent.

We employ a logistic regression model to explain the incidence of collateral of the following form:

$$P(Inc._{ijt}) = f\ (Loan\ characteristics_{ijt},\ Borrower\ characteristics_{ijt},\ Information\ proxy_{ijt},\ \gamma_t,\ \delta_j)$$

where P(·) indicates probability, *Inc.$_{ijt}$* is a dummy variable which equals one if collateral has been pledged and zero otherwise and γ_t and δ_j represent time and provincial fixed effects, respectively.[8] The subindices *i,j* and *t* correspond to loans, provinces and waves.

Empirically analyzing the use of collateral requires considering various potential determinants as they have been found in the literature.[9] These determinants include four groups: (i) information about *Loan characteristics*, i.e. in particular loan size, loan duration, annual interest rate, loan purpose, and eventually guarantees; (ii) information about *Borrower characteristics*, i.e. income, age, education, household size, gender, total loan volume, earlier repayment behavior, and (iii) *Information proxies* which capture information asymmetry between lender and borrower (we will mainly use relationship in years and distance between lender and borrower in minutes travel time).

When pooling over all lenders and over three waves we get a standard outcome, because we find several determinants to be statistically significant in our sample and the sign of the marginal effects is in line with theory.[10] <u>Table 3</u> shows the regression results: specification (1) is the broadest one, where we consider a large set of potential determinants. We find that a larger loan size and longer duration increase the probability that collateral has to be pledged. This is consistent with H1 as we expect the risk for the lender to increase with increasing loan size and longer loan duration. Concerning the use of loans it is the marginal effect of consumption purpose which is significant. The negative sign indicates that loans borrowed for consumption purposes require less collateral than loans used for other purposes; this probably reflects short-term agreements on consumption loans (and possibly also effects from short duration and low volume beyond the average). If a loan is guaranteed for by other persons collateral requirements are less likely. Higher education of the household head lowers collateral requirements since higher

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[8] We prefer the logit model over the probit model since most variables are not normally distributed according to the Shapiro-Wilk and Shapiro-Francia test. However, comparing the values of the Akaike and Bayesian information criterion (AIC and BIC) the models do not differ much. Accordingly marginal effects are almost unchanged when using a probit model.

[9] We use a standard set of variables to describe household characteristics (see, e.g., Behr et al. 2011) and we derive loan terms from other papers such as Degryse and van Cayseele (2000), Ioannidou and Ongena (2010) and Berger et al. (2011a,b). Following Berger and Udell (1995) and more recently e.g. Jiménez et al. (2006) or Brick and Palia (2007), we proxy relationship by calculating the duration a household is engaged with the same lender in years.

[10] The pooling over lenders and waves results from the analysis of loans. An analysis of households might use a panel approach but this would be a different research question than ours.

education may indicate lower risk. Higher debt capacity of a household is also associated with lower use of collateral. Next, a higher loan volume per household lowers collateral requirements, basically because this represents richer and wealthier households. Finally, longer relationship duration is associated with a higher incidence of collateral: this is consistent with the hold-up hypothesis, however, it may also result from unconsidered heterogeneity among lenders because we know from Table 2 that lenders with more use of collateral, as BAAC, have longer relationship duration than others (we will see in Section 4.2, when we implement lender dummies, that the second interpretation is correct).

Specification (2) reduces the number of determinants in order to continue our future examinations with more parsimonious specifications. More precisely we drop determinants which remain insignificant in all specifications. This applies to the following variables: female headed household, household size, savings and whether a household ever repaid late on a loan. Again, in specification (2) we find that the riskiness of loans is positively related to the incidence of collateral. This confirms the prediction made by the ex post theory of collateral (H1).

Specification (3) just exchanges income by asset endowment to see whether this makes a difference, which is, however, not the case. Both marginal effects are positive, as theoretically expected, but far from turning significant. Nevertheless, we stick to the income variable because it seems to be crucial in general when explaining riskiness of borrowers and thus the use of collateral.

In specifications (4) and (5), the relationship aspect between lender and borrower is measured in new ways. First, the "number of loans from same lender" indicates a stronger relation, whereas, second, the "number of lenders" the household is engaged with rather indicates a weaker relation between borrowers and each specific lender. These new relationship variables are insignificant in specification (4), but significant with a negative sign in specification (5) which implies that more lenders increase competition and thus reduce collateral requirements. In both specifications the other variables keep signs and significance so that results remain robust and there is no need to exchange the "relationship duration" variable in standard specifications.

4.2 The use of collateral: formal vs. informal lenders

In this section we test whether formal lending institutions use collateral to a higher degree than informal ones: in line with the ex ante hypothesis of collateral we expect that informal

lenders rely less on the use of collateral because they have better information about the riskiness and behavior of their borrowers (H2).

Consequently we would expect that CB and BAAC demand more collateral than other lending institutions. To test this hypothesis we rely on the parsimonious specification (2) from Table 3 and add dummies for the seven lenders which we still consider. The resulting specification (1) in Table 4 shows that indeed BAAC loans are collateralized most often followed by BP, CRED, CB, followed with some distance by ML, FRI (the reference category) and FAM. On average, formal institutions require collateral quite frequently, semiformal lenders require less often collateral and informal lenders have the lowest collateral requirement. Within the group of informal lenders, however, there are obvious differences which require attention.

BP loans are collateralized more often than we would have expected from an informal lender. The reason is that BPs often finance the purchase of a product (such as a motorcycle) and simultaneously take this product as collateral. In this sense they follow a somewhat specific business model when granting loans. At the other extreme, FAM and also FRI do not often require collateral. This seems to be in line with earlier literature (Barslund and Tarp, 2008) because in these cases the reason to grant a loan may be influenced by altruistic motivation. This tends to lower collateral standards. In between the extremes of BP and FAM/FRI are ML, a traditional form of informal lenders. Specification (2) shows that formal lenders require collateral 30% more likely than ML, which is the reference category here. Overall, informal lenders use collateral much less than formal lenders, with the specific exception of BP.

Another interesting result occurs while controlling for the type of lender: the influence of relationship duration changes from positive (Table 3) to negative (Table 4). This can be explained by the correlation between relationship duration and type of lender. Formal lenders do not use longer relationships for hold-up, but for reducing their larger information gaps. This will be further examined below (Section 4.3).

Specifications (3) to (5) are used to check the robustness of our finding above. In specification (3) we consider the fact that borrowers of formal and informal loans might be different in unobserved characteristics (we cannot control for in our regressions). Therefore we reduce the sample quite radically to those 939 households who have loans from formal and informal institutions at the same time. Again, results are qualitatively unchanged. Even though the

relationship variable turns insignificant, this is because variance increases in the small sample whereas the marginal effect almost has the same size.

This pattern is confirmed in the final two specifications which give the regressions for a reduced sample (specification 4) and for the whole sample (specification 5). Dummy variables for formal and informal lenders show that controlled for characteristics of loans and borrowers, indeed formal lenders require about 40% more often collateral than informal lenders (ranging from families to business partners).

4.3 The impact of relationship in lending groups

In this section the possible private information influencing the use of collateral is further examined. If different reliance on collateral by formal and informal lenders (see Section 4.2 above) is indeed driven by the different degree of information asymmetry between lender and borrower, this asymmetry may decline during enduring relations. The argument runs that longer lending relations provide private information about the economic situation and the behavior of the borrower which cannot be obtained by inspecting files. This is why we expect that formal lenders profit much more from longer relations (H3), whereas informal lenders have better access to this kind of private information. This hypothesis gets empirical support, as shown in the following.

As a first step we simply split the total sample into three groups with potentially different degree of private information about borrowers, i.e. formal, semiformal and informal lenders. In Table 5, specifications (1) to (3) give the respective results for the three groups of lenders. Indeed, the marginal effect of the variable "relationship duration" varies across the three groups. For formal lenders we get the theoretically expected result consistent with a reduction of information gaps by longer relationship duration, i.e. the use of collateral (here as probability of collateral) declines with longer durations. The marginal effects of the relation variable for semiformal and informal lenders are insignificant; if at all, the size of the marginal effect for semiformal lenders is smaller than for formal lenders and for informal lenders it even turns positive. Overall, this supports our hypothesis H3.

Reassuringly, the marginal effects on other possible determinants of collateral still fit into the literature. Collateral requirement is robustly associated with larger loan size. Regarding further determinants, longer loan duration and the lack of guarantees are also related to collateral,

although the significance of these variables may be borderline or partially missing which may be caused by smaller sample size.

Motivated by the somewhat lower R-squared of the regression regarding informal lenders, we split this sample into two groups which may be more homogeneous than the total, i.e. ML and BP vs. FAM and FRI. Specifications (4) and (5) show that explanatory power is partially improved despite smaller samples but the structure of determinants is somewhat different, illustrating the heterogeneity of informal lenders. In particular, guarantees have a significant negative effect on collateral for ML/BP, but not for FAM/FRI, indicating that lending from family members or friends is the most informal form of finance with better ex ante information than ML/BP.

4.4 The role of distance between lenders and borrowing households

So far, we have seen that formal lenders require more collateral than informal lenders. An information-based explanation is supported by the fact that only formal lenders profit from increased relationship duration which allows them to operate with less collateral. We now test the significance of another proxy for good information of lenders about borrowers, i.e. their geographical distance to each other. Informal lenders are usually geographically closer to their borrowers, which is an important reason why they may have better information and increase credit availability, as shown by Agarwal and Hauswald (2010). In fact, the role of distance for lending was examined years ago (Petersen and Rajan, 2002; Degryse and Ongena, 2005) but has been linked with the issue of collateral by only one study (Jiménez et al., 2009) so far.

In this section we include a variable that captures the distance between lenders and borrowing households. The survey includes two kinds of information about distance: first, the traveling time in minutes the household takes to reach its lender, and, second, information about where lenders and borrowers are located (i.e. in the same village, same commune, same district or province, urban or rural area). This information provides a useful proxy for lender's information on borrowers and allows to test whether the effect on collateral requirements varies with distance. Since this information is only available for waves 2 and 3 it reduces the sample which is used in this section to 1,659 households and 4,409 loans.[11]

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[11] We drop 19 loans for which lenders are located in Europe and in Bangkok, which is still hundreds of kilometers away from our target group.

Table 6 shows regressions for different types of lenders, including the variable "distance to lender". If informal lenders indeed gain their information through their closeness to the borrowers it is reasonable to assume that they have less information with increasing distance and therefore demand more collateral (H4). As first step we just add the distance variable to the other determinants and find that its marginal effect is positive and significant. This is a first indication that distance – as proxy for more information asymmetry – is related to more collateral.

For formal and semiformal institutions (specifications (2) and (3)) distance has no significant effect on collateral requirements. Or, in other words: whether the borrower is located far away from the lender or not, information regarding borrower's risk does not change consistently.[12] This is completely different for informal lenders as presented in specification (4): their lending is significantly more often collateralized if the distance increases, consistent with H4. This contrasts the finding of Jiménez et al. (2009) that distance has a negative influence on the use of collateral for regular banks. A possible explanation is that the lending technology of banks in Thailand is stronger asset-based than relationship-based, so that distance does not matter consistently for them. In contrast to the Spanish banks examined by Jiménez et al. (2009), the Thai banks in our sample do not seem to be able to offset their informational disadvantage by the availability of hard data, and therefore use more often collateral than informal lenders. In order to check this finding, we run the same regression but only exchange the indicator for distance, i.e. we replace the travel time indicator by the simple information whether the lender is located in the same village as the borrower (specification 5). This rough split provides an indication that proximity within a village may define a critical point up to which distance provides an information advantage. Again, distance has a significant positive influence on collateral only in the case of informal loans.

This can also be seen in Figure 1 in which predicted probabilities of pledging collateral are plotted against the distance between *informal* lenders and borrowers. The figure shows that at distances being larger than about 5 to 10 minutes, the distance effect is clearly at work: the probability of a collateral requirement jumps upwards and increases slightly with distance thereafter.

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[12] We note that coefficient signs on the distance variable are positive for formal and informal lenders and that coefficient size is largely comparable to informal lenders; however, standard errors are high.

5   Robustness checks

This section contains robustness checks going beyond those already presented in the main text above. In detail, we examine six issues: results separated for the three waves (Section 5.1), results for the rate of collateralization instead of the incidence of collateral (Section 5.2), the role of marketability of collateral (Section 5.3), the contribution of social collateral (Section 5.4), results for other definitions of income (Section 5.5) and further insights into a possible influence of competition between financial institutions on the use of collateral (Section 5.6).

5.1 Results across the three waves

The household survey underlying our analysis has been conducted in the years 2007, 2008 and 2010, so that it may be interesting to see whether results are roughly comparable across these three waves. As a major change over waves, however, we have to consider that the macroeconomic environment worsened before wave 2 and improved again before wave 3.

Detailed results are available in the Appendix in <u>Table A.2</u>. The three panels A, B and C document results for the three waves each with 1,065, 1,098 and 982 loan cases, respectively. Columns (1) in the three panels show the outcome for all financial institutions at the respective wave and thus follows column (1) in table 4, however, without presenting marginal effects for dummy variables. Columns (2) to (6) give results for groups of financial institutions and thus follow the five columns in table 5. Overall, the structure of results is quite stable across all waves, although the number of significant coefficients becomes smaller, if the number of observations is reduced. Consistently significant variables with the theoretically expected signs are loan amount, loan duration and the use of guarantees.

Comparing the three main groups of formal, semi-formal and informal lenders over time we find that the same three variables as for the total sample (loan amount, loan duration and the use of guarantees) keep their sign and are mostly significant. Further findings are specific to the three sub-groups: (1) Examining lending behavior of the formal financial institutions, they appear to be tentatively more risk-averse during wave 2, because they require more often collateral for consumption loans and honor higher income with less collateral requirement. (2) In contrast, collateral requirements of semi-formal lenders are basically unchanged across waves and thus do not seem to react to the macroeconomic environment. (3) Finally, regarding informal lenders there are no significant coefficients for loans from family and friends, so that the structure stems from

moneylenders and business partners only. These lenders also seem to react more risk averse during the bad times of wave 2 as some risk proxies become more important: the coefficient on "loan amount" doubles and the one on "guarantees" turns significant. However, the role of this group is at the same time also unique: first, they slightly relax collateral requirements during wave 2 (wave dummies not explicitly shown in Table 5, column 3) and they tentatively do so on the three loan purposes given in Table A.2, i.e. they rather require more collateral for loans to repay other loans. Indeed, we find that this loan purpose becomes slightly more important during wave 2 in which 15.5% of all loans are borrowed to repay other loans compared to 12.5% and 15% in wave 1 and wave 3, respectively. This may indicate that these informal lenders help their borrowers to serve existing loans. Different from moneylenders' and business partners' declining importance over time, the group of family and friends does extend a larger number of loans in difficult times, i.e. during wave 2.

Overall, the separate examination of the three waves mainly confirms the earlier analysis. In addition, we learn from observing behavior during wave 2 when a severe negative macroeconomic shock hit the economy: first, formal lenders require rather more collateral, second, semi-formal lenders do not react at all, and, third, only informal lenders offer slight tendencies towards supporting their borrowers.

5.2 Results for explaining the rate of collateralization

In the following section we test whether main results still hold if we explain the rate of collateralization, i.e. the value of collateral over loan size, rather than the incidence of collateral. In the literature both empirical measures are common and most results do not depend on the preferred definition (Menkhoff et al., 2006; Behr et al., 2011). The reason that we do not prefer the rate of collateralization is its unusually large range, including not only the "normal" rates from 0 to slightly above 1 but extending far beyond the rate of 1. Our data includes more than 200 loans with a collateralization rate of more than 5 and the largest rates range above 10. Due to these extreme rates, we document results for the original rate and for an upper limit of the rate of collateralizations.

Table A.3 in the Appendix reproduces Table 4 column (1) in various specifications. Specification (1) uses institution dummies with "friends" as reference category, specification (2) excludes the semi-formal institutions and specifications (3) to (5) use groups of formal,

semiformal and informal lenders. In specification (6) the rate of collateralization is limited to 1.5 and in specification (7) all collateralization rates higher than 1.5 are set to 1.5. All specifications show that formal lenders demand higher collateral in relation to loan size than informal lenders while important risk determinants (loan size, guarantees and debt capacity) remain stable.

5.3 Results depending on marketability of collateral

Collateral, in particular land, is not marketable easily in Thailand (Menkhoff et al., 2012). Land cannot be sold, if specific land titles are missing and in other cases the weak legal system hinders effective recovery of collateral. As a consequence we test whether main results still hold if we consider only collateral which can be claimed more easily and which should be therefore of particular importance to the lender. We implement this by excluding those collateralized loans where land would be difficult to sell due to a missing respective land title.

Table A.4 shows our standard set of regressions. Formal lenders still require more often collateral. Also the other variables of interest mainly keep their sign and significance. In particular, relationship duration still has a negative effect on collateral requirements for formal lenders which is even significant to a higher degree than in our standard regression. This indicates that the consideration of land that is hardly marketable may somewhat blur the economic relations we uncover.

5.4 Results depending on consideration of social collateral

The proximity between lender and borrower in informal lending reduces the degree of asymmetric information. However, as both sides know each other better they are also tentatively closer to each other regarding social relations. These social relations may work as a kind of social enforcement to properly pay for the loan which can be termed "social collateral" (Karlan et al., 2009; Karaivanov and Kessler, 2013). As we know that the use of collateral depends on the use of alternatives, such as guarantees and loan terms (e.g. Menkhoff et al., 2012), a missing consideration of social collateral may contribute to overestimating the effect of better information on reduced collateral requirements.

However, there are also reasons limiting this potential effect: First, the better information of lenders about borrowers aims for predicting their repayment behavior. In this sense good information about a borrower includes information about this borrower's social relations which

create social collateral; thus proximity creates good information and social collateral at the same time, although not necessarily to the same degree. Second, the institutional environment in rural Thailand is different from much more closed poor communities that often serve as reference case when studying informal lending (e.g. Behr et al., 2011): Households in Thailand potentially have several lenders competing with each other, households are mobile due to public transport, private motorcycles etc., they are potentially informed as most of them use mobile phones and many of them have family networks including migrants. Thus social collateral is expected to play a more limited role.

In the end it may be an empirical question whether social collateral is very important. In order to test this, we include two rough proxies for stronger social relations in our standard regressions for informal lenders in general and for ML/BP and FAM/FRI in particular. We assume that social collateral is strengthened within small and remote villages and that therefore tangible collateral may be used less often in these cases. Thus the first proxy for more social collateral is that borrowers live in a smaller village, the second proxy is the larger distance of the borrower's village from the next district town. We expect that with increasing village size, and hence lower social collateral, tangible collateral increases. Larger distance to the next district town, however, indicating higher social collateral decreases tangible collateral. Table A.5 shows the marginal effects for the social collateral proxies which are insignificant in all specifications. We conclude that the effect of social collateral may be of limited importance in our sample or that at least our proxies for social collateral do not indicate great importance.[13] The negative marginal effect of village size may indicate a lock-in of borrowers in small villages.

5.5 Results depending on other transformations of income

In our earlier regressions we use a logarithmic transformation of income which is standard in the literature (e.g. Agarwal and Hauswald, 2010; Behr et al., 2011). However, some households have negative incomes at certain points in time, which occurs mainly due to negative shocks from

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[13] This is not a contradiction to Karaivanov and Kessler (2013) due to the studies different set-up. They assume the existence of social collateral in the group of FAM/FRI which is not distinguished from better information. They also do not focus on collateral in the regressions, possibly because it is assumed to be ideally zero in FAM/FRI-lending. Finally, their theoretically derived implication that formal loans should have larger loan size is also consistent with our data (if we exclude ML/BP from informal lenders as they do).

farming business. These negative incomes values are set to one in order to be able to apply a logarithmic transformation.

Alternative approaches also seem to be plausible. First, one may exclude extreme income values from further consideration, such as incomes beyond four standard deviations from the mean. Second, one may simply exclude all observations with negative household income. Third, one may choose a different transformation of the small incomes, such as dividing all incomes by 1,000, setting negative ones to the value of one and those which are exactly one to 1.1. Afterwards the logarithm is taken. However, all of these alternative transformations of income do not have major effects on our variables of interest. Table A.6 refers to our standard regressions when using the respective alternative income measures, but just gives two coefficients of interest: "relationship duration" has a negative sign at formal lenders, and "distance" has a positive sign for informal lenders – this is what we find in our standard regressions too, indicating that our findings are robust to modified income definitions.

5.6 A possible influence from competition among financial institutions

It can plausibly be assumed that the use of collateral also depends on the degree of competition among financial institutions: less competition reduces negotiation power of the borrower and allows the lender to require more collateral (see Hainz, 2003; Hainz et al., 2013). As the competition between lender groups may be weak in rural Thailand, we test whether there are effects within lender groups.

Basically, we complement the standard regressions from Table 6 by adding available travel times to some major financial institutions, i.e. the BAAC (public agricultural bank), the CRED (semiformal credit institutions), the GSB (public savings bank, usually considered as commercial bank), and the CB (commercial bank). Results in Table A.7 show, that there is indeed evidence being consistent with the expected competition effect among formal financial institutions: they use more often collateral if the distance to the next commercial bank is larger. Moreover, the sign of the marginal effect for the travel time to the next BAAC points into the same direction. As the BAAC has far more offices in the rural areas than all commercial banks taken together, the maginal effect of travel time to the next CB may also be interpreted as a noisy indicator of local centrality. That means collateral has less often to be pledged at more centrally located places which are characterized by more lender competition.

The further evidence is less clear: the marginal effect on credit institutions in specification (3) has the expected sign (which is reasonable since CRED is the granting institution in this specification). At the same time travel time to the next CB would lead to lower collateral required by CRED. Possibly, semiformal lenders behave special in that they require less collateral at more remote locations (i.e. where travel time to the next CB is longer). Finally, there is no significant effect for informal lenders in specifications (4) and (5) which makes sense as we do not have information about the distance to the next competing informal lender.

Overall, the evidence about the role of competition for the use of collateral is limited but points into the theoretically expected direction.

6   Conclusions

This research is at the intersection of banking and development. Both fields are interested in the use of collateral: From a banking perspective, collateral is a regular characteristic of loan contracts whose use is still not fully understood; in particular there is little evidence on the so-called "ex ante theory" of collateral. We provide novel evidence by testing this theory in a new way, i.e. by contrasting the lending behavior of two financial institutions in the same market which differ in their private information about borrowers: formal lenders know tentatively less than informal lenders. From a development perspective, the need of pledging collateral is often seen as limiting access to finance, which contributes to explaining the existence and role of informal lenders who rely less on collateral in their lending decisions.

Our dataset is based on a largely representative household survey in rural Northeast Thailand, covering more than 2,000 households over three waves during the years 2007 to 2010. This data includes all loans that households have taken from the variety of up to nine different kinds of lenders, ranging from conventional commercial banks over specialized lending institutions to informal lenders. Due to some specialized institutions which secure their loans exclusively via guarantees and not via (tangible) collateral, the average incidence of collateral is just 18%. For the whole sample as well as for groups of lenders we find that collateralization is related to indicators of risk. This confirms – as did many other studies before – that the ex post-theory of collateral is valid, i.e. collateral serves as buffer against repayment risk.

Based on these relations we examine the ex ante theory, claiming that "a reduction in the ex ante information gaps between borrowers and lenders is associated with a lower incidence of

collateral" (Berger et al., 2011a, p.56). In the cross-section, informal lenders should have a smaller information gap than formal lenders, which implies that they rely less on collateral and this is indeed what we find.

We proceed by testing two implications of the ex ante theory: if asymmetric information drives (controlled for other determinants) the reliance on collateral, we hypothesize that a reduction of information asymmetry via relationship duration should be related with less collateral. Finally, the information advantage of informal lenders should work best if their geographical distance to borrowers is short. Again, we find empirical support for both conjectures.

Overall, we provide new kind of evidence supporting the rarely tested ex ante theory of collateral. At the same time, we learn about the operation of formal and informal lenders with respect to collateral. The variety of institutions seems to perform different roles: whereas formal lenders operate to a large extent as they do in more advanced market settings, informal lenders indeed seem to rely on their assumed information advantage. Interestingly, the group of informal lenders in itself is quite heterogeneous and differentiation is necessary to understand their rationale when using collateral. In this sense formal and informal institutions seem to complement each other.

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Table 1: Descriptive statistics of variables

	1st wave		2nd wave		3rd wave	
	Mean/fraction	Std. dev.	Mean/fraction	Std. dev.	Mean/fraction	Std. dev.
Household characteristics						
Demographics						
Age of household head (years)	53.49	12.87	54.48	12.74	55.54	12.20
Years of education of household head	5.15	2.68	5.25	2.79	5.27	2.72
Household size	4.11	1.69	4.13	1.73	4.15	1.74
Number of adult equivalence	2.93	1.03	2.95	1.05	2.98	1.06
Female headed household	0.25	0.43	0.25	0.44	0.25	0.44
Married household head	0.80	0.40	0.81	0.39	0.81	0.39
Economic status						
Area of owned land (rai[a])	2.46	3.21	2.51	3.33	2.73	3.08
Household annual income (in 1,000 Baht)	116	167	135	269	165	239
Annual income per equiv. scale (in 1,000 Baht)	43	66	49	104	58	88
Consumption expenditures (in 1,000 Baht)	90	56	115	92	175	115
Food	39	22	46	30	94	65
Total assets of last 5 years (in 1,000 Baht)	149	270	174	490	209	501
Savings (in 1,000 Baht)	15	61	14	42	19	63
Livestock and stored crops (in 1,000 Baht)	19	181	20	46	19	32
Debt capacity (Annual inc./ total loan vol.)	2.78	9.67	2.52	8.81	2.32	6.29
Borrowing						
Number of loans per household	1.72	1.12	1.68	0.97	1.49	0.77
Volume of loans per household (in 1,000 Baht)	67	134	72	212	77	186
Loan size (in 1,000 Baht)	37.76	89.95	40.67	150.85	49.28	140.53
Duration of loans (in months)	17.87	22.50	17.14	23.51	18.45	23.56
Average interest rate per household (%)	12.97	30.30	11.35	29.3	10.45	23.70
Percentage of late repayment (of total loans per hh)[b]	0.11	0.32	0.08	0.27	0.03	0.18
Percentage of collateralized loans	0.18	0.38	0.16	0.38	0.21	0.41
Percentage of guaranteed loans	0.73	0.44	0.76	0.43	0.74	0.44
Agricultural production purpose (in %)	0.38	0.49	0.42	0.49	0.39	0.49
Non-agricultural production purpose (in %)	0.16	0.37	0.13	0.34	0.18	0.38
Consumption purpose (in %)	0.33	0.47	0.28	0.45	0.28	0.45
Payback or relend to others (in %)	0.12	0.33	0.15	0.36	0.15	0.36
Relationship variables						
Relationship duration	5.40	5.30	6.16	5.28	7.77	6.48
Number of loans from same lender	2.59	1.18	2.58	1.18	2.64	1.21
Number of lenders	2.27	1.01	2.26	1.00	2.30	1.01
Number of households (loans)	1,407	(2,529)	1,410	(2,497)	1,239	(1,931)

Note: Sample contains 1,791 households and 6,957 loans. Only households who have been interviewed in all 3 waves have been considered. Sample contains cash loans (6,408), installment loans (433) and loans in kind (116).

[a] One rai corresponds to 0.16 hectare.

[b] This figure gives the yearly number of loans that have been repaid late in percentage of all loans received in the respective year.

Table 2: Incidence of collateral and relationship variables by lending institution

Panel A	CB	BAAC	VF	CRED	POL	ML	BP	FAM	FRI	*total weighted average*	*sample weighted average*[c]
Collateral											
Collateralized loans (in %)	43.6	37.4	2.3	19.1	1.4	40.5	48.5	6.4	9.7	18.0	31.1
Rate of collateralization[a]	2.56	4.43	1.20	4.00	0.00	2.87	1.39	3.47	6.44	2.57	3.79
Guaranteed loans (in %)	54.4	74.3	96.3	75.0	80.9	14.7	42.9	5.6	8.3	74.4	57.4
Neither collat. nor guarantee (in %)	12.1	2.6	2.7	11.6	18.4	49.6	24.4	87.7	83.4	13.6	21.4
Relationship variables											
Relationship duration	3.88	10.00	5.62	7.63	5.30	2.90	2.14	3.50	3.19	6.36	6.99
Number of loans from same lender	2.38	3.07	3.01	3.19	2.65	2.29	2.42	2.66	2.45	2.93	2.88
Number of different lenders per hh	2.99	2.48	2.40	2.71	2.94	2.72	2.91	2.90	2.98	2.57	2.68
Loan characteristics											
Loan size (in 1,000 Baht)	184.10	55.59	17.03	51.84	13.59	49.16	143.38	30.62	20.18	43.65	65.97
Duration (in months)	33.40	24.44	12.40	17.14	21.51	15.05	28.44	12.28	11.18	17.69	21.37
Annual interest rate (in %)	13.8	9.2	7.3	12.0	2.6	49.9	25.3	11.8	42.7	11.9	16.1
Sample size											
Number of households	123	765	1,281	477	218	205	355	245	112		3,804
Number of loans	149	1,605	2,860	868	293	252	443	342	145	∑ 6,957	3,804

Panel B	formal	semiformal[b]	informal	*total weighted average*	*sample weighted average*[c]
Collateral					
Collateralized loans (in %)	37.9	5.9	29.9	18.0	31.1
Rate of collateralization[a]	4.24	3.14	2.15	2.57	3.79
Guaranteed loans (in %)	72.6	90.5	21.8	74.4	57.4
Neither collat. nor guarantee (in %)	3.5	5.9	55.8	13.6	21.4
Relationship variables					
Relationship duration	9.48	6.03	2.82	6.36	6.99
Number of loans from same lender	3.01	3.02	2.46	2.93	2.88
Number of different lenders per hh	2.52	2.50	2.87	2.57	2.68
Loan characteristics					
Loan size (in 1,000 Baht)	66.50	24.30	65.86	43.65	65.97
Duration (in months)	25.20	14.09	19.28	17.69	21.37
Annual interest rate (in %)	9.6	8.0	27.3	11.9	16.1
Sample size					
Number of households	848	1,456	745		3,804
Number of loans	1,754	4,021	1,182	∑ 6,957	3,804

[a] gives the average rate of collateralization (value of collateral/ loan size) for collateralized loans only

[b] information is for semiformal loans (weighted average of VF, CRED and POL), sample used in regressions comprises CRED only

[c] VF and POL loans are excluded since they seldom operate with collateral

Table 3: Determinants of collateral

Incidence of collateral	(1) all variables	(2) reduced set	(3) wealth indicator	(4) relationship measure II	(5) relationship measure III
Independent variables					
Loan size (Baht)	0.167***	0.167***	0.168***	0.171***	0.163***
	(0.0153)	(0.0153)	(0.0153)	(0.0160)	(0.0158)
Loan duration (months)	0.00210***	0.00208***	0.00208***	0.00200***	0.00198***
	(0.000429)	(0.000422)	(0.000423)	(0.000410)	(0.000419)
Annual interest rate	-0.000231	-0.000261	-0.000277	-0.000362	-0.000359
	(0.000263)	(0.000265)	(0.000270)	(0.000277)	(0.000274)
Agricultural production loan	0.0295	0.0314	0.0302	0.0322	0.0305
	(0.0276)	(0.0273)	(0.0273)	(0.0272)	(0.0271)
Non-agricultural production loan	0.0406	0.0431	0.0435	0.0372	0.0369
	(0.0342)	(0.0341)	(0.0342)	(0.0339)	(0.0339)
Consumption loan	-0.0506*	-0.0508*	-0.0515*	-0.0606**	-0.0617**
	(0.0285)	(0.0285)	(0.0285)	(0.0277)	(0.0276)
Guaranteed loan	-0.437***	-0.435***	-0.435***	-0.421***	-0.425***
	(0.0228)	(0.0226)	(0.0226)	(0.0219)	(0.0218)
Female headed household	-0.0170				
	(0.0243)				
Household size (adult equivalence)	-0.00864				
	(0.00921)				
Education of household head	-0.00657*	-0.00590	-0.00595	-0.00598	-0.00603
	(0.00387)	(0.00385)	(0.00387)	(0.00382)	(0.00383)
Income per adult equivalence (Baht)	0.00330	0.00389		0.00482	0.00465
	(0.00536)	(0.00532)		(0.00537)	(0.00538)
Asset endowment (in Baht)			0.00229		
			(0.00640)		
Savings (in Baht)	0.00319				
	(0.00334)				
Debt capacity	-0.00732*	-0.00664	-0.00560	-0.00674	-0.00723*
	(0.00436)	(0.00424)	(0.00402)	(0.00424)	(0.00436)
Dummy if repaid late	-0.0147				
	(0.0339)				
Total loan volume per hh (in Baht)	-0.0474***	-0.0457***	-0.0457***	-0.0449***	-0.0337**
	(0.0161)	(0.0156)	(0.0159)	(0.0164)	(0.0170)
Relationship duration	0.0306***	0.0318***	0.0322***		
	(0.00971)	(0.00965)	(0.00968)		
Number of loans from same lender				-7.69e-05	
				(0.00801)	
Number of lenders					-0.0180*
					(0.00984)
Pseudo R-squared	0.314	0.313	0.313	0.314	0.316
Observations	2,963	2,992	2,991	3,051	3,051

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;

<u>Note</u>: All lending institutions included except VF and POL. For relationship duration, loan size, income, savings, asset endowment and total loan volume logarithmic values are taken.

All specifications control for time and province effects via dummies.

Specification (1): Broad set of explanatory variables, relationship measured via relationship duration;

Specification (2) Reduced set of explanatory variables according to established literatur;

Specification (3): Household's wealth is proxied by asset endowment instead of income;

Specification (4): Relationship is proxied by the number of loans a household borrowed from the same lender;

Specification (5): Relationship is proxied by the number of lenders a household is engaged with.

Table 4: Use of collateral across lending institutions

Incidence of collateral	(1) all loans	(2) formal banks and ML	(3) formal/inf. institutions	(4) formal/inf. dummies	(5) formal/semif./inf. dummies
Independent variables					
Loan size (Baht)	0.143***	0.238***	0.163***	0.191***	0.155***
	(0.0157)	(0.0344)	(0.0313)	(0.0241)	(0.0159)
Loan duration (months)	0.00148***	0.00274***	0.00245***	0.00269***	0.00165***
	(0.000395)	(0.000678)	(0.000665)	(0.000574)	(0.000432)
Annual interest rate	-0.000245	-0.000377	0.000564	0.000347	0.000217
	(0.000272)	(0.000537)	(0.000605)	(0.000312)	(0.000247)
Agricultural production loan	-0.0180	0.0260	0.0202	-0.00576	-0.00814
	(0.0253)	(0.0495)	(0.0545)	(0.0357)	(0.0261)
Non-agricultural prod. loan	0.0172	0.0877	0.0175	0.0422	0.0146
	(0.0315)	(0.0596)	(0.0643)	(0.0451)	(0.0325)
Consumption loan	-0.0452	-0.00338	0.0123	0.0115	-0.0402
	(0.0287)	(0.0627)	(0.0703)	(0.0429)	(0.0289)
Guaranteed loan	-0.602***	-0.719***	-0.624***	-0.619***	-0.600***
	(0.0267)	(0.0263)	(0.0454)	(0.0306)	(0.0267)
Income per adult equiv. (Baht)	-0.00395	-0.00842	-0.0128*	-0.00465	-0.00325
	(0.00473)	(0.00921)	(0.00724)	(0.00649)	(0.00469)
Debt capacity	-0.00543	0.000272	0.000989	-0.00157	-0.00669*
	(0.00350)	(0.00954)	(0.00823)	(0.00436)	(0.00367)
Total loan vol. per hh (in Baht)	-0.0309*	-0.0187	-0.00593	-0.0319	-0.0420**
	(0.0160)	(0.0326)	(0.0297)	(0.0230)	(0.0166)
Relationship duration	-0.0281***	-0.0319*	-0.0248	-0.0169	-0.0191*
	(0.0106)	(0.0190)	(0.0223)	(0.0142)	(0.0103)
Dummy for CB	0.462***		0.563***		
	(0.110)		(0.143)		
Dummy for BAAC	0.510***		0.520***		
	(0.0574)		(0.0901)		
Dummy for CRED	0.476***		0.441**		
	(0.0787)		(0.176)		
Dummy for ML	0.287***		0.349**		
	(0.0929)		(0.161)		
Dummy for BP	0.500***		0.697***		
	(0.134)		(0.0896)		
Dummy for FAM	-0.146***		-0.183***		
	(0.0322)		(0.0621)		
Dummy for formal		0.301***		0.399***	0.430***
		(0.0391)		(0.0300)	(0.0339)
Dummy for semiformal					0.400***
					(0.0497)
Pseudo R-squared	0.414	0.401	0.443	0.367	0.379
Observations	3,145	1,851	939	2,344	3,145

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;

<u>Note</u>: All lending institutions included except VF and POL, with respect to lender dummies reference category is
FRI. For relationship duration, loan size, income and total loan volume logarithmic values are taken.
All specifications control for time and province effects via dummies.
Specification (1): Base line regression with reduced set of variables, reference category for lender dummies is FRI;
Specification (2): Tests collateral requirment of formal lenders against the reference category (ML);
Specification (3): Sample is reduced to households who borrowed from formal and informal institutions
(irrespective of borrowing from semiformal lenders).
Specification (4): Baseline regression with formal and informal loans only, inclusive dummies for informal and formal
to show differences in collateral requirements.
Specification (5): Baseline regression with formal, semiformal and informal loans and respective dummies
to show differences in collateral requirements.

Table 5: Use of collateral for formal, semiformal and informal lenders

Incidence of collateral	(1) formal	(2) semiformal	(3) informal	(4) ML/ BP	(5) FAM/ FRI
Independent variables					
Loan size (Baht)	0.223***	0.0841***	0.105***	0.194***	0.0273***
	(0.0410)	(0.0138)	(0.0172)	(0.0585)	(0.00840)
Loan duration (months)	0.00302***	-0.000420	0.00131**	0.00259	0.000374
	(0.000684)	(0.000346)	(0.000580)	(0.00182)	(0.000230)
Annual interest rate	-0.00104	-0.000159	0.000183	-0.000251	-4.62e-06
	(0.00130)	(0.000464)	(0.000152)	(0.000540)	(5.67e-05)
Agricultural production loan	0.0477	-0.0196	-0.0557**	-0.155*	-0.0338**
	(0.0564)	(0.0229)	(0.0254)	(0.0932)	(0.0135)
Non-agricultural production loan	0.101	-0.0402*	-0.0206	0.0876	-0.0220***
	(0.0683)	(0.0207)	(0.0344)	(0.130)	(0.00852)
Consumption loan	-0.0149	-0.0935***	-0.00483	-0.0156	-0.0139
	(0.0754)	(0.0231)	(0.0287)	(0.108)	(0.0119)
Guaranteed loan	-0.727***	-0.524***	-0.0300	-0.202**	-0.0144
	(0.0217)	(0.0544)	(0.0306)	(0.0904)	(0.0125)
Income per adult equivalence (Baht)	-0.0180*	-0.000257	0.00608	0.0264*	-0.00205
	(0.00928)	(0.00446)	(0.00462)	(0.0137)	(0.00306)
Debt capacity	0.00403	-0.00664*	-0.00559	-0.00548	-0.00182
	(0.00944)	(0.00351)	(0.00404)	(0.0175)	(0.00144)
Total loan volume per household (Baht)	-0.0221	-0.0406***	-0.0313*	0.0233	-0.0154**
	(0.0376)	(0.0148)	(0.0173)	(0.0529)	(0.00699)
Relationship duration	-0.0342*	-0.0114	0.0164	-0.0114	0.00550
	(0.0206)	(0.0109)	(0.0139)	(0.0478)	(0.00737)
Pseudo R-squared	0.426	0.444	0.224	0.258	0.188
Observations	1,640	801	704	261	443

Cluster-robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$;

Note: All lending institutions included except VF and POL.

For relationship duration, loan size, income and total loan volume logarithmic values are taken.

All specifications control for time and province effects.

Specification (1): Formal loans only; Specification (2): Semiformal loans only; Specification (3): Informal loans only;

Specification (4): ML and BP only; Specification (5): FAM and FRI only.

Table 6: The role of distance across lending institutions

	(1)	(2)	(3)	(4)	(5)
Incidence of collateral	*all loans*	*formal*	*semiformal*	*informal*	*informal*
Independent variables					
Distance to lender (in minutes)	0.108***	0.0565	0.0253	0.0332***	
	(0.0168)	(0.0370)	(0.0175)	(0.0112)	
Lender and borrower in the same village					-0.0964***
					(0.0310)
Loan size (Baht)	0.161***	0.195***	0.0813***	0.0865***	0.0834***
	(0.0206)	(0.0462)	(0.0229)	(0.0209)	(0.0212)
Loan duration (months)	0.00169***	0.00268***	-0.000423	0.00135***	0.00129***
	(0.000477)	(0.000842)	(0.000465)	(0.000454)	(0.000451)
Annual interest rate	-6.82e-05	0.00106	-0.000321	0.000375**	0.000323**
	(0.000359)	(0.00117)	(0.000822)	(0.000146)	(0.000141)
Agricultural production loan	-0.0256	-0.0255	-0.00852	-0.0755***	-0.0717***
	(0.0302)	(0.0612)	(0.0348)	(0.0239)	(0.0228)
Non-agricultural production loan	-0.000335	0.0604	-0.0509*	-0.0405*	-0.0343*
	(0.0354)	(0.0737)	(0.0272)	(0.0210)	(0.0208)
Consumption loan	-0.0652**	-0.0175	-0.0820***	-0.0383*	-0.0391*
	(0.0322)	(0.0854)	(0.0309)	(0.0224)	(0.0230)
Guaranteed loan	-0.511***	-0.727***	-0.641***	-0.0397*	-0.0413**
	(0.0274)	(0.0252)	(0.0562)	(0.0211)	(0.0194)
Income per adult equivalence (Baht)	0.00487	-0.0194	0.00609	0.00398	0.00345
	(0.00799)	(0.0132)	(0.0109)	(0.00418)	(0.00387)
Indebt capacity	-0.00684	0.00104	-0.00690	-0.00642	-0.00835*
	(0.00595)	(0.0143)	(0.00741)	(0.00467)	(0.00462)
Total loan volume per household (Baht)	-0.0402**	-0.00457	-0.0218	-0.0464***	-0.0473***
	(0.0198)	(0.0426)	(0.0253)	(0.0153)	(0.0152)
Relationship duration	0.0236**	-0.0354	-0.0161	0.0122	0.0144
	(0.0116)	(0.0238)	(0.0147)	(0.0125)	(0.0123)
Pseudo R-squared	0.352	0.419	0.493	0.351	0.354
Observations	2,038	1,129	502	407	418

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;

Note: VF and POL are excluded from semiformal institutions.

For loan size, income, relationship duration and distance to lender logarithmic values are taken.

All specifications ccontrol for time and province effects.

Specification (1): All lenders; Specification (2): Formal lenders (CB and BAAC) only; Specification (3): Semiformal lenders (CRED); Specification (4): Informal lenders (ML, BP, FAM and FRI); Specification (5): Formal lenders and dummies whether borrower and lender are located in the same village or not.

Figure 1: The probability that informal loans require collateral and distance between lender and borrower
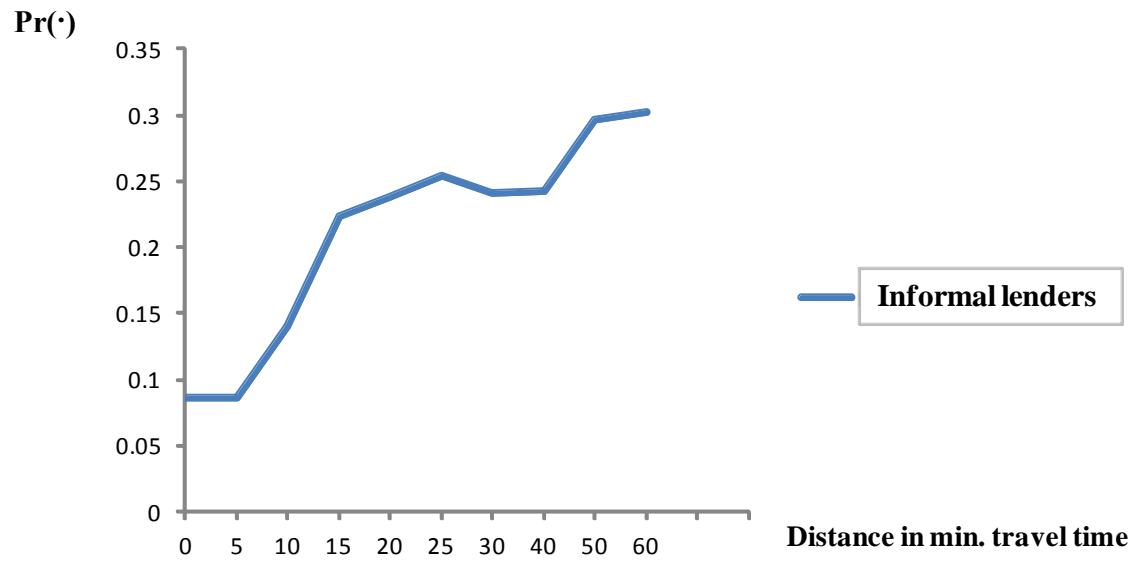
Appendix

This research is based on a household survey which has been used for other purposes before. In this respect there is a paper which also analyzes the role of collateral, focusing on possible substitutes (Menkhoff et al., 2012). This earlier paper differs from ours in some limited respect: the main difference is that we use three waves of the survey, whereas the other research is based on the first wave only. However, the other paper examines all loans that a household held in 2007, whereas we only consider all new loans at each point in time.

In few cases we also use slightly different definitions of variables. This applies to asset endowment, where we consider only assets bought within the last 5 years due to depreciation calculations. In addition the area of owned land is denominated in rai (the common surface measure in Thailand) in our paper. We undertake some changes in the lender definitions. Menkhoff et al. (2012) distinguish between CB, BAAC, CRED, ML and RELA. "ML" comprises loans from professional moneylenders, business partners and family and friends if the interest rate is positive. RELA comprises all loans from professional moneylenders, business partners and family and friends if the interest rate is zero. We use a more precise definition which is based more on the institutions than on the interest rate. To show that our estimations are still comparable to the other paper we use data of our first wave and rerun the regressions shown in Menkhoff et al. (2012) as far as our own sample allows generating the same variables. The sample still differs from the one used in the other paper in that we use newly granted loans only.

Table A.1 shows that the sign and most often size of marginal effects are quite similar despite different samples and definitions used. However, there are three differences regarding the statistical significance in that the other paper has more significant coefficients, which may be supported by more observations: (1) Whether or not a loan is used for agricultural production is significant only in one of our specifications. In the other paper it is always significant except for one small subsample. (2) Education is not significant in our regressions but it is in the paper of Menkhoff et al. (2012). (3) The other paper finds a significant impact for "number of lenders a household is engaged with" for a small subsample. In our subsample the marginal effect has the same sign but is not significant.

Table A.1: Comparison to Menkhoff et al. (2012)

Specification (sample)	(1)	(2)	(3)	(4)
Incidence of collateral	*all loans*	*excl. CB*	*cl. CB/FAM/FI*	*CB/ML/BP*
Independent variables				
Loan size (Baht)	0.101***	0.101***	0.133***	0.181***
	(0.0153)	(0.0153)	(0.0222)	(0.0487)
Loan duration (months)	0.00163***	0.00160***	0.00210**	0.00337**
	(0.000593)	(0.000618)	(0.000823)	(0.00150)
Annual interest rate	-0.000869*	-0.000801*	-0.000978*	-0.00196
	(0.000492)	(0.000450)	(0.000572)	(0.00163)
Agricultural prod. loan	0.0527	0.0518	0.0981**	-0.168
	(0.0379)	(0.0382)	(0.0498)	(0.142)
Non-agricultural prod. loan	0.130**	0.143**	0.237***	0.176
	(0.0633)	(0.0659)	(0.0867)	(0.178)
Guaranteed loan	-0.584***	-0.591***	-0.706***	-0.380***
	(0.0588)	(0.0603)	(0.0555)	(0.105)
Female headed household	0.0254	0.0427	0.0330	0.0902
	(0.0431)	(0.0446)	(0.0554)	(0.148)
Age of household head	-0.00132	-0.00115	-0.00213	-0.00552
	(0.00140)	(0.00141)	(0.00184)	(0.00466)
Household size (adult equiv.)	-0.00724	-0.00868	-0.0106	-0.0170
	(0.0154)	(0.0158)	(0.0210)	(0.0701)
Education of household head (years)	-0.00290	-0.00107	-0.00325	-0.0220
	(0.00556)	(0.00568)	(0.00764)	(0.0171)
Income per adult equ.	0.000636	0.000969	0.000319	0.0265
	(0.00609)	(0.00620)	(0.00822)	(0.0200)
Amount of savings	-0.00437	-0.00389	-0.00184	0.0186
	(0.00470)	(0.00474)	(0.00617)	(0.0198)
Dummy if ever defaulted	0.126	0.126	0.137	0.0308
	(0.113)	(0.113)	(0.134)	(0.302)
Dummy if repaid late	0.0829	0.0904	0.0506	0.188
	(0.102)	(0.104)	(0.114)	(0.208)
Number of lenders hh is engaged	0.00595	0.000405	0.00299	0.0700
	(0.0133)	(0.0138)	(0.0177)	(0.0431)
Dummy for CB	-0.146***			-0.363*
	(0.0254)			(0.199)
Dummy for CRED	-0.144***	-0.149***	-0.192***	
	(0.0315)	(0.0330)	(0.0439)	
Dummy for ML	-0.139***	-0.141***	-0.182***	-0.187
	(0.0289)	(0.0295)	(0.0398)	(0.276)
Dummy for BP	-0.0546	-0.0604	-0.0648	
	(0.114)	(0.107)	(0.158)	
Dummy for FAM	-0.242***	-0.247***		
	(0.0256)	(0.0264)		
Dummy for FRI	-0.154***	-0.155***		
	(0.0249)	(0.0256)		
(Pseudo) R-squared	0.465	0.459	0.463	0.407
Observations	886	847	723	128

Cluster- robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Regressions include only loans that have been granted within the 12 month period of the first wave.

VF and POL are always excluded since they seldom require collateral for loans.

Specification (1) includes loans from CB, BAAC (omitted base category); CRED, ML, BP, FAM and F

Specification (2) includes BAAC, CRED, ML, BP FAM and FRI; Specification (3) includes BAAC,

CRED, ML and BP; Specification (4) includes CB, ML and BP. Province dummies are considered.

Table A.2: Incidence of collateral across waves

Panel A: 1st wave

	(1)	(2)	(3)	(4)	(5)	(6)
Incidence of collateral	*all loans*	*formal*	*semiformal*	*informal*	*ML/BP*	*FAM/FRI*
Loan size (Baht)	0.128***	0.316***	0.0529***	0.0815***	0.173**	0.000115
	(0.0195)	(0.0695)	(0.0189)	(0.0286)	(0.0731)	(0.000226)
Loan duration (months)	0.00231***	0.00311***	-0.000806	0.000901	0.00323	1.35e-06
	(0.000603)	(0.00113)	(0.000576)	(0.00187)	(0.00328)	(3.60e-06)
Annual interest rate	-0.000475	-0.00456**	0.000314	5.77e-05	-0.00171	-2.04e-09
	(0.000305)	(0.00201)	(0.000446)	(0.000210)	(0.00131)	(6.96e-07)
Agricultural production	0.116**	0.307***	-0.0355	0.0309	-0.0952	
	(0.0467)	(0.114)	(0.0263)	(0.0746)	(0.168)	
Non-agricultural production	0.120*	0.308**	-0.0147	0.0752	0.216	-7.73e-05
	(0.0662)	(0.152)	(0.0256)	(0.111)	(0.229)	(0.000207)
Consumption loan	-0.0222	0.1000	-0.0656**	0.0618	-0.0442	0.000311
	(0.0474)	(0.158)	(0.0300)	(0.0776)	(0.187)	(0.000696)
Guaranteed loan	-0.384***	-0.767***	-0.477***	-0.0179	-0.190	
	(0.0344)	(0.0384)	(0.0902)	(0.0817)	(0.183)	
Income per adult equivalence (Baht)	0.00178	-0.0163	-0.00333	0.0131	0.0296*	0.000244
	(0.00578)	(0.0131)	(0.00273)	(0.00889)	(0.0176)	(0.000537)
Debt capacity	-0.00700	0.0108	-0.00665**	-0.00153	0.00740	-6.66e-05
	(0.00470)	(0.00700)	(0.00282)	(0.00380)	(0.0221)	(0.000116)
Total loan volume/household (Baht)	-0.0407**	-0.0556	-0.0404***	0.00498	0.0345	-0.000105
	(0.0196)	(0.0568)	(0.0150)	(0.0298)	(0.0690)	(0.000202)
Relationship duration	0.0182	-0.0432	-0.00277	0.0223	0.00154	-5.67e-05
	(0.0142)	(0.0363)	(0.0126)	(0.0262)	(0.0783)	(0.000162)
Pseudo R-squared	0.310	0.484	0.434	0.183	0.247	0.227
Observations	1,065	507	284	274	117	120

Panel B: 2nd wave

	(1)	(2)	(3)	(4)	(5)	(6)
Incidence of collateral	*all lenders*	*formal*	*semiformal*	*informal*	*ML/BP*	*FAM/FRI*
Loan size (Baht)	0.152***	0.188***	0.0565***	0.0794***	0.301***	0.0171
	(0.0194)	(0.0679)	(0.0167)	(0.0266)	(0.0885)	(0.0169)
Loan duration (months)	0.00114**	0.00279***	-0.000486	0.000582	0.00321	-0.000126
	(0.000527)	(0.00107)	(0.000362)	(0.000416)	(0.00284)	(0.000221)
Annual interest rate	-0.000899	-0.00207	-0.000448	0.000122	0.000345	-2.17e-05
	(0.000701)	(0.00199)	(0.000501)	(0.000108)	(0.000514)	(5.72e-05)
Agricultural production	-0.0138	0.0627	-0.0288	-0.0464**	-0.312***	-0.00922
	(0.0330)	(0.0817)	(0.0211)	(0.0193)	(0.104)	(0.0118)
Non-agricultural production	0.0337	0.174	-0.0251	-0.0160	-0.0484	-0.00471
	(0.0447)	(0.113)	(0.0178)	(0.0153)	(0.0880)	(0.00510)
Consumption loan	-0.0301	0.285**	-0.0600***	-0.0284	-0.0924	-0.0139
	(0.0391)	(0.126)	(0.0222)	(0.0202)	(0.106)	(0.0168)
Guaranteed loan	-0.422***	-0.752***	-0.524***	-0.0322**	-0.232**	
	(0.0365)	(0.0389)	(0.0979)	(0.0159)	(0.105)	
Income per adult equivalence (Baht)	-0.00650	-0.0411**	0.00292	-0.00178	-0.0319*	-0.000949
	(0.00739)	(0.0182)	(0.00540)	(0.00304)	(0.0175)	(0.00152)
Debt capacity	0.000575	0.0160	-0.00673	0.000458*	0.0299	3.58e-05
	(0.00152)	(0.0148)	(0.00717)	(0.000264)	(0.0285)	(7.88e-05)
Total loan volume per household (Ba	-0.0299	0.0329	-0.0305**	-0.0385**	-0.0132	-0.0126
	(0.0195)	(0.0587)	(0.0127)	(0.0169)	(0.0826)	(0.0111)
Relationship duration	0.0441***	-0.0375	0.00322	0.000990	-0.0963	0.00217
	(0.0142)	(0.0378)	(0.0118)	(0.00938)	(0.0595)	(0.00514)
Pseudo R-squared	0.337	0.440	0.512	0.438	0.538	0.445
Observations	1,098	551	305	242	79	153

Table A.2: Incidence of collateral across waves, continued

Panel C: 3rd wave

Incidence of collateral	(1) all loans	(2) formal	(3) semiformal	(4) informal	(5) ML/BP	(6) FAM/FRI
Loan size (Baht)	0.228***	0.229***	0.135*	0.0817***	0.154	0.00189
	(0.0379)	(0.0658)	(0.0694)	(0.0300)	(0.151)	(0.00264)
Loan duration (months)	0.00198**	0.00285**	2.82e-05	0.00182*	0.00370	9.23e-05
	(0.000785)	(0.00115)	(0.000949)	(0.000965)	(0.00412)	(0.000142)
Annual interest rate	0.000610	0.00559**	7.07e-05	0.000618**	0.00107	1.81e-07
	(0.000531)	(0.00268)	(0.00165)	(0.000305)	(0.00112)	(2.91e-05)
Agricultural production	0.00754	-0.0646	0.0994	-0.0552	0.0472	-0.00800
	(0.0536)	(0.0878)	(0.101)	(0.0452)	(0.229)	(0.0152)
Non-agricultural production	-0.0268	-0.00521	-0.103	-0.0484	0.153	
	(0.0579)	(0.0995)	(0.0662)	(0.0500)	(0.304)	
Consumption loan	-0.119**	-0.223**	-0.152*	-0.00779	0.159	-0.00378
	(0.0532)	(0.101)	(0.0803)	(0.0481)	(0.240)	(0.0102)
Guaranteed loan	-0.525***	-0.737***	-0.738***	-0.0119	-0.189	0.00519
	(0.0351)	(0.0311)	(0.0678)	(0.0461)	(0.207)	(0.0134)
Income per adult equivalence (Baht)	0.0258**	0.00680	0.0229	0.00777	0.0444	-0.000316
	(0.0115)	(0.0153)	(0.0324)	(0.00639)	(0.0364)	(0.00123)
Debt capacity	-0.0234**	-0.0305	-0.00939	-0.0235**	-0.101*	-0.00359
	(0.0111)	(0.0221)	(0.0201)	(0.00925)	(0.0608)	(0.00342)
Total loan volume/household (Baht)	-0.0867**	-0.0688	-0.0172	-0.0472	-0.0162	-0.00146
	(0.0389)	(0.0640)	(0.0806)	(0.0292)	(0.152)	(0.00334)
Relationship duration	0.0265	-0.0447	-0.0255	0.0204	0.00915	0.00254
	(0.0175)	(0.0306)	(0.0326)	(0.0224)	(0.100)	(0.00353)
Pseudo R-squared	0.315	0.434	0.464	0.248	0.240	0.296
Observations	982	582	212	188	65	102

Cluster- robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; all specifications control for provincial effects.

Table A.3: Determinants of collateralization rate

Rate of collateralization	(1) all loans	(2) formal/informal dummy	(3) formal	(4) semiformal	(5) informal	(6) trunc at 1.5	(7) high values set to 1.5
Independent variables							
Loan size (Baht)	2.513***	2.756***	0.862	3.554***	3.643***	0.374***	0.564***
	(0.480)	(0.479)	(0.662)	(0.841)	(1.133)	(0.0824)	(0.0653)
Loan duration (months)	0.00992	0.0118	0.0171**	-0.0318	0.0506**	0.00408***	0.00382***
	(0.00783)	(0.00827)	(0.00836)	(0.0280)	(0.0228)	(0.00149)	(0.00128)
Annual interest rate	-0.00290	0.00623	-0.0143	0.0236	0.00904	-0.000459	0.00101
	(0.00725)	(0.00669)	(0.0198)	(0.0295)	(0.00658)	(0.00210)	(0.00112)
Agricultural production loan	-0.0469	0.273	1.872**	-2.918	-2.387	0.0818	0.0230
	(0.751)	(0.747)	(0.888)	(1.958)	(1.555)	(0.152)	(0.107)
Non-agric. production loan	0.149	0.139	1.885*	-4.299*	0.797	0.365**	0.0661
	(0.846)	(0.848)	(1.038)	(2.435)	(1.834)	(0.163)	(0.122)
Consumption loan	-1.131	-0.935	0.772	-8.934***	0.205	0.261	-0.105
	(0.838)	(0.825)	(1.038)	(3.318)	(1.390)	(0.179)	(0.123)
Guaranteed loan	-11.60***	-11.23***	-11.57***	-14.50***	-2.135	-1.769***	-1.812***
	(1.203)	(1.187)	(1.348)	(3.566)	(1.579)	(0.103)	(0.0833)
Income per adult equiv. (Baht)	-0.0140	0.000810	-0.141	0.234	0.229	-0.0136	-0.00807
	(0.129)	(0.124)	(0.171)	(0.265)	(0.202)	(0.0255)	(0.0194)
Debt capacity	-0.184*	-0.224**	0.00740	-0.235	-0.531	0.0376**	-0.0229
	(0.103)	(0.106)	(0.154)	(0.153)	(0.343)	(0.0186)	(0.0149)
Total loan vol./hh (in Baht)	-0.765	-0.992*	-0.460	-0.792	-0.981	0.0528	-0.129*
	(0.531)	(0.535)	(0.676)	(1.154)	(1.071)	(0.0923)	(0.0682)
Relationship duration	-0.374	-0.153	-0.260	0.000242	0.564	-0.0345	-0.0538
	(0.298)	(0.282)	(0.323)	(0.682)	(0.996)	(0.0551)	(0.0389)
Dummy for CB	4.948**						
	(2.508)						
Dummy for BAAC	10.71***						
	(2.381)						
Dummy for CRED	7.359***						
	(2.273)						
Dummy for ML	4.698**						
	(2.199)						
Dummy for BP	7.541***						
	(2.607)						
Dummy for FAM	-5.072**						
	(2.494)						
Dummy for formal		2.878***				0.379***	0.420***
		(0.732)				(0.145)	(0.103)
Dummy for informal		-5.878***				0.410*	-0.926***
		(1.106)				(0.216)	(0.143)
Constant	-25.07***	-19.13***	-0.913	-25.64**	-38.20***	-4.631***	-4.218***
	(4.526)	(3.995)	(5.778)	(12.91)	(7.371)	(0.952)	(0.579)
Pseudo R-squared	0.116	0.105	0.091	0.177	0.094	0.310	0.218
Observations	3,142	3,142	1,639	801	702	1,942	3,145

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; all specifications control for time and provincial effects.

Specification (1): All loans; Specification (2): Includes all loans plus dummes for formal and informal lenders; Specification (3): Formal loans only, Specification (4): Semiformal loans only; Specification (5): Informal loans only; Specification (6): Rate of collateralization is truncated at the value 1.5; Specification (7): Values for the rate of collateralization of higher than 1.5 are set to 1.5.

Table A.4: Use of collateral excluding non-marketable land

Incidence of collateral	(1) all loans	(2) formal	(3) semiformal	(4) informal	(5) ML/BP	(6) FAM/FRI
Independent variables						
Loan size (Baht)	0.139***	0.214***	0.0756***	0.0934***	0.187***	0.0178**
	(0.0141)	(0.0404)	(0.0133)	(0.0160)	(0.0578)	(0.00702)
Loan duration (months)	0.00121***	0.00228***	-0.000286	0.00110*	0.00169	0.000297*
	(0.000336)	(0.000599)	(0.000324)	(0.000578)	(0.00227)	(0.000176)
Annual interest rate	0.000227	-0.000678	-8.14e-05	0.000175	-0.000275	4.95e-06
	(0.000226)	(0.00125)	(0.000431)	(0.000137)	(0.000546)	(3.84e-05)
Agric. production loan	0.00335	0.0668	-0.0147	-0.0442*	-0.128	-0.0228**
	(0.0236)	(0.0533)	(0.0218)	(0.0236)	(0.0945)	(0.0112)
Non-agric. production loan	0.0205	0.102	-0.0343*	-0.00759	0.124	-0.0151**
	(0.0305)	(0.0685)	(0.0197)	(0.0337)	(0.131)	(0.00673)
Consumption loan	-0.0346	0.00526	-0.0835***	-0.0105	0.00182	-0.0162
	(0.0262)	(0.0731)	(0.0221)	(0.0262)	(0.112)	(0.00983)
Guaranteed loan	-0.579***	-0.737***	-0.519***	-0.0295	-0.206**	-0.00609
	(0.0282)	(0.0241)	(0.0557)	(0.0269)	(0.0883)	(0.0102)
Inc.per adult equiv. (Baht)	-0.000766	-0.0103	-0.000986	0.00609	0.0271*	-0.00117
	(0.00438)	(0.00825)	(0.00416)	(0.00435)	(0.0142)	(0.00234)
Debt capacity	-0.00670*	0.00328	-0.00780**	-0.00470	-0.00314	-0.00153
	(0.00363)	(0.00938)	(0.00385)	(0.00367)	(0.0175)	(0.00116)
Tot. loan vol./ hh (in Baht)	-0.0381**	-0.0240	-0.0366**	-0.0279*	0.0308	-0.0117**
	(0.0150)	(0.0367)	(0.0142)	(0.0162)	(0.0537)	(0.00524)
Relationship duration	-0.0230**	-0.0412**	-0.0124	0.0112	-0.0347	0.00699
	(0.00939)	(0.0195)	(0.0104)	(0.0131)	(0.0495)	(0.00551)
Dummy for formal	0.0918***					
	(0.0249)					
Dummy for informal	-0.214***					
	(0.0197)					
Pseudo R-squared	0.381	0.426	0.457	0.231	0.265	0.216
Observations	3,021	1,542	791	688	253	435

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; all specifications contain dummies for waves and provinces. <u>Note</u>: In specifications (1) - (4) land as collateral is excluded if households do not have proper title deeds for the land.

Table A.5: Marginal effects of proxies for social collateral on collateral requirements

	Proxy for social collateral	1st, 2nd and 3rd wave			2nd and 3rd wave (distance)		
		informal	ML/BP	FAM/FRI	informal	ML/BP	FAM/FRI
I	village size (log)	-0.0285	-0.0162	-0.0109	-0.0213	-0.0254	-0.0065
		(0.0227)	(0.0675)	(0.0130)	(0.0179)	(0.0088)	(0.0065)
II	small village (< 157 households)	0.0288	0.0076	0.0102	0.0177	-0.0173	0.0092
		(0.0245)	(0.0853)	(0.0104)	(0.0206)	(0.1226)	(0.0067)
	large village (> 157 households)			omitted category			
III	distance to district town (log)	-0.0294	0.0016	-0.0084	-0.0237	-0.0036	-0.0026
		(0.0193)	(0.0627)	(0.0079)	(0.0153)	(0.0807)	(0.0046)
IV	far town (> 20 min. travel time)	-0.0269	-0.0109	-0.0071	-0.0193	0.0607	-0.0037
		(0.0231)	(0.0850)	(0.0104)	(0.0201)	(0.1108)	(0.0074)
	near town (<= 20 min. travel time)			omitted category			

<u>Note</u>: Small villages and far towns are defined according to the mean values of village size (157 households) and travel time from households to lender (20 min.)

Table A.6: Marginal effects of relationship and distance for different definitions of income

	relationship duration			distance		
	formal	semiformal	informal	formal	semiformal	informal
4 times standard deviation[a]	-0.0379*	-0.0118	0.0169	0.0445	0.0247	0.0331***
	(0.0205)	(0.0110)	(0.0140)	(0.0365)	(0.0178)	(0.0112)
exclude incomes <0[b]	-0.0342	-0.0125	0.0102	0.0658*	0.0230	0.0335***
	(0.0209)	(0.0106)	(0.0149)	(0.0372)	(0.0177)	(0.0110)
transformation[c]	-0.0349*	-0.0111	0.0155	0.0555	0.0256	0.0329***
	(0.0206)	(0.0108)	(0.0140)	(0.0372)	(0.0179)	(0.0108)

[a] Incomes of more or less than 4 times the standard deviation from the mean are excluded.

[b] Negative incomes are exluded.

[c] Incomes are divided by 1,000 to adjust the large range. Negative incomes are set to 1 and finally logarithmic values of all incomes are taken.

Table A.7: The role of distance across lending institutions (including competition among lenders)

Incidence of collateral	(1) all loans	(2) formal	(3) semiformal	(4) informal	(5) informal
Independent variables					
Distance to lender (in minutes)	0.130***	0.0204	0.0282	0.0300***	
	(0.0204)	(0.0481)	(0.0207)	(0.0113)	
Lender and borrower in the same village					-0.0870***
					(0.0317)
Loan size (Baht)	0.157***	0.199***	0.0893***	0.0813***	0.0803***
	(0.0219)	(0.0500)	(0.0270)	(0.0225)	(0.0221)
Loan duration (months)	0.00165***	0.00270***	-0.000643	0.00115***	0.00116***
	(0.000487)	(0.000857)	(0.000568)	(0.000429)	(0.000430)
Annual interest rate	-0.000116	0.00102	-0.000449	0.000322**	0.000306**
	(0.000362)	(0.00114)	(0.00105)	(0.000134)	(0.000133)
Agricultural production loan	-0.0257	-0.0336	-0.00764	-0.0671***	-0.0675***
	(0.0319)	(0.0658)	(0.0376)	(0.0238)	(0.0232)
Non-agricultural production loan	0.00249	0.0558	-0.0499	-0.0366*	-0.0313
	(0.0375)	(0.0770)	(0.0305)	(0.0203)	(0.0206)
Consumption loan	-0.0560	0.00518	-0.0782**	-0.0300	-0.0342
	(0.0349)	(0.0914)	(0.0347)	(0.0214)	(0.0226)
Guaranteed loan	-0.518***	-0.732***	-0.656***	-0.0349*	-0.0361*
	(0.0284)	(0.0257)	(0.0566)	(0.0208)	(0.0200)
Income per adult equivalence (Baht)	0.00551	-0.0177	0.00381	0.00546	0.00519
	(0.00838)	(0.0129)	(0.00918)	(0.00391)	(0.00392)
Indebt capacity	-0.00793	0.00266	-0.00651	-0.00802*	-0.00932**
	(0.00655)	(0.0143)	(0.00764)	(0.00479)	(0.00471)
Total loan volume per household (Baht)	-0.0416**	-0.00803	-0.0282	-0.0467***	-0.0473***
	(0.0203)	(0.0448)	(0.0267)	(0.0149)	(0.0152)
Relationship duration	0.0253**	-0.0327	-0.0131	0.0118	0.0135
	(0.0121)	(0.0259)	(0.0157)	(0.0117)	(0.0120)
Travel time to next BAAC	-0.00166	0.00513	-0.00183	-0.000811	-0.000441
	(0.00240)	(0.00480)	(0.00189)	(0.00160)	(0.00144)
Travel time to next CRED	-0.00122	-0.00386	0.00401**	0.000464	0.000631
	(0.00242)	(0.00459)	(0.00179)	(0.00167)	(0.00157)
Travel time to next GSB	-0.00156*	-0.00300	0.000737	-0.000299	-1.69e-05
	(0.000942)	(0.00210)	(0.000784)	(0.000706)	(0.000756)
Travel time to next CB	0.00198*	0.00480*	-0.00349***	-0.000284	-0.000394
	(0.00117)	(0.00246)	(0.00125)	(0.00106)	(0.00101)
	(0.0437)	(0.0791)	(0.0762)	(0.0330)	(0.0330)
Pseudo R-squared	0.348	0.420	0.500	0.344	0.354
Observations	1,940	1,068	476	396	406

Cluster- robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Note: VF and POL are excluded from semiformal institutions. For loan size, income, relationship duration and distance to lender logarithmic values are taken. All specifications control for time and province effects. Specification (1): All lenders; Specification (2): Formal lenders (CB and BAAC) only; Specification (3): Semiformal lenders (CRED); Specification (4): Informal lenders (ML, BP, FAM and FRI); Specification (5): Informal lenders and dummy whether borrower and lender are located in the same village or not.