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## Conference Paper

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# The use of collateral in formal and informal lending

Carmen Kislak <sup>a</sup>, Lukas Menkhoff <sup>b</sup> and Doris Neuberger <sup>c</sup>

## Abstract

The ex ante theory of collateral states that better informed lenders, such as informal lenders, rely less on collateral. We test this by contrasting the use of collateral between formal and informal lenders in the same market. Indeed, formal lenders rely more often on collateral, controlling for conventional determinants of collateral. Moreover, better information about borrowers has implications within lender groups: first, relationship lending reduces asymmetric information, but only for formal lenders who use collateral less with longer relationship; second, short distance between lender and borrower reduces asymmetric information, mainly for informal lenders who use collateral less at shorter distances.

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

Keywords: collateral, relationship lending, informal lenders

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# The use of collateral in formal and informal lending

## 1 Introduction

Collateral is a standard ingredient of loan contracts which is used to overcome information and incentive problems. Empirical studies show that collateral is indeed used in most loan contracts and that theoretically expected determinants are relevant (Steijvers and Voordeckers, 2009). However, this evidence typically refers to developed markets and cannot be simply transferred to loan markets in developing countries because these differ in some relevant aspects: in general, institutions are less developed, which implies more opaque information and more severe problems in monitoring and enforcing loan contracts. Due to this difference, specific financial institutions have emerged, in particular informal lending. Informal lenders address information and incentive problems of lending by their proximity to the borrower. Proximity, indicated by relationship and near distance, may reduce the need for collateral and thereby create a competitive advantage of informal lenders. Despite the prominence of informal lenders in developing countries, 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 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. In this sense, the variety of financial institutions in developing markets, ranging from conventional banks over semiformal credit cooperatives to informal lenders, provides a rich environment for empirical tests. Our examination is guided by the two dominating theories on the use of collateral in lending, the *ex post* and the *ex ante* theory. 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 a quite 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 in general. 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. We propose such another approach.

Our proceeding is different from most other studies on collateral (as detailed in the following Section 2) because we can observe the lending operation of financial institutions in the same market where these institutions have different information about borrowers. Essentially, regular banks use observable information about the riskiness of borrowers but informal lenders potentially use a richer set of information due to their intimate knowledge about borrowers. This difference in 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 kind of lender, we expect and find that more risky borrowers have more restrictive loan terms, including higher collateral requirements. This basically holds independently of the degree of formality of the lender. (2) According to the *ex ante* theory of collateral, regular banks require more collateral than informal lenders because they have less information about borrowers' riskiness. This holds when comparing the average of formal vs. informal lenders; in detail, however, we find interesting deviations from the general picture. (3) As a further implication of the *ex ante* theory of collateral, we find that regular banks improve their risk assessment over time so that longer relations with borrowers will reduce collateral requirements, whereas this effect does not play the same role for informal lending. (4) Another implication of the *ex ante* theory derives from distance between lender and borrower: longer distance hampers information gathering. Indeed, only proximate informal lenders can allow relying less on collateral than others.

Obviously, this research program requires appropriate data. Here we use a deep household survey, conducted among more than 2,000 households in the rural areas of Northeast Thailand. It is crucial for our purpose that 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 characteristics of the financial

markets 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, and Section 5 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,b; Coco, 2000). According to the *ex post theory of collateral*, borrowers have to provide collateral as a buffer against default risk, which arises from moral hazard (e.g. Holmstrom and Tirole, 1997; Aghion and Bolton, 1997), difficulties in enforcing contracts (e.g., Banerjee and Newman, 1993; Albuquerque and Hopenhayn, 2004; Cooley et al., 2004), or costly monitoring (e.g., Townsend, 1979; Gale and Hellwig, 1985; Williamson, 1986; Boyd and Smith, 1994). These ex post theories of collateral predict that the incidence of collateral is higher for observably riskier borrowers (Berger et al., 2011b). 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., Bester, 1985, 1987; Besanko and Thakor, 1987a,b; Chan and Thakor, 1987; 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).

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 underdeveloped economies with financial systems characterized by low transparency and weak legal enforcement (Egli et al., 2006). Especially in the case of very 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 at banks in emerging markets. Beyond being a strategy of regular banks or formal lending institutions, relationship lending may have emerged as a specific organizational form, called informal lenders. Informal lenders are per se closer to their customers and hence have a comparative advantage especially in reducing ex ante information gaps. For the case of small household loans in emerging markets, ex ante theories of collateral are especially relevant, because hard information about the credit risk of households operating mainly in the rural sector 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.

Our distinction between formal and informal lenders fits into 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).

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 the 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).<sup>1</sup> 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) did not isolate effects of private information from ex post incentive problems (Berger et al., 2011a,b). 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 by 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.

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<sup>1</sup> Studies include Berger and Udell, 1990, 1995; Harhoff and Körting, 1998; Degryse and Van Cayseele, 2000; Lehmann and Neuberger, 2001; Chakraborty and Hu, 2006; Hernández-Cánovas and Martínez-Solano, 2006; Menkhoff et al., 2006, 2012; Voordeckers and Steijvers, 2006; Brick and Palia, 2007.

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; Harhoff and Körting, 1998; Lehmann and Neuberger, 2001; Chakraborty and Hu, 2006; Brick and Palia, 2007, Menkhoff et al., 2012), while others find a positive effect (e.g., Hernández-Cánovas and Martínez-Solano, 2006; Machauer and Weber, 1998; Ono and Uesegi, 2009) and again others find mixed signs or insignificant results (e.g., Degryse and 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 (Harhoff and Körting, 1998; 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).

Empirical evidence for the lender-based theory of collateral is scarce so far. Degryse and Ongena (2005) find that the geographical distance between borrower and lender is relevant for loan pricing, but do not examine its influence on collateral. Agarwal and Hauswald (2013) 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 headquarter 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).<sup>2</sup> 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 H3.

Summarizing, there is a research gap in the empirical literature on the ex ante theories of collateral, lender-based theories of collateral and the use of collateral by informal lenders. Our paper contributes to close all three gaps. First, we try to isolate the ex ante information hypothesis from the ex post one by differentiating between formal and informal lenders, thus focusing on the organizational form of lending rather than the lending technology or institutional factors that differ across countries. Secondly, we test the lender-based theory of collateral by examining the influence of the type of lender and distance between borrower and lender on the use of collateral. Third, we examine whether variables of observed borrower risk and relationship lending that are commonly used in the literature on bank collateral also matter for the collateral decisions of informal lenders.

### **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.

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<sup>2</sup> 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.

### 3.1 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. The survey covers more than 2,000 rural households in the Northeastern part of Thailand. These 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 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, 2009). 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<sup>3</sup>. These households and their borrowing behavior are described in the following.

Table 1 provides descriptive statistics about five areas of interest, i.e. (1) household demographics, (2) occupation of the household head, (3) economic status of the household, (4) borrowing characteristics and (5) 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<sup>4</sup>. About 25% of all households are female headed and 80% of all household heads are married.

With respect to their *occupation* 64% of all households consider themselves to be farmers. To complement this self-assessed information we use a second definition of farming households, i.e. households whose share of agricultural income on total income is higher than 20%. According to this second definition just about 44% of households can be considered as farmers.

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.<sup>5</sup> This nominal increase applies to income, consumption expenditures and asset

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<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> Growth rates were 4.2% (2007), 1.8 (2008), -3.0 (2009) and 7.2% (2010), respectively.

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. 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. Furthermore we drop 55 loans for which the lender is not known. The remaining sample consists of 1,791 and 6,957 loans. 2,529 loans have been granted within the first wave, 2,497 within the second and 1,931 within the third wave.<sup>6</sup> 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 over time. The percentage of collateralized loans drops by 2% from 18% to 16% in wave 2 and increases again in wave 3 to 21%. From secondary data we know that 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 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%. 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 some *relationship variables* available. 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 and the average household is engaged with 2.27 different lenders.

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<sup>6</sup> 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.

### 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 (or in other words, lenders with a tighter relationship), 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 having less intimate knowledge about borrowers and thus relying more on collateral than informal lenders.

Table 2 presents information about the use of collateral and relationship variables 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 any 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.

## 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 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 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. We prefer the incidence of collateral to the degree of collateralization because the latter is typically very high in our sample and thus less informative than in other studies where many loans are collateralized to less than 100 percent.

Empirically analyzing the use of collateral requires considering various potential determinants as they have been found in the literature.<sup>7</sup> These determinants include four groups: (i) information about loan characteristics, i.e. in particular loan size, loan duration, annual interest rate, loan purpose, and eventual guarantees; (ii) information about borrower characteristics, i.e. income, age, education, household size, gender, total loan volume, earlier repayment behavior; (iii) information about the relationship between lender and borrower and (iv) control variables, i.e. here lender dummies, year dummies and province dummies.

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. [Table 3](#) 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 intuitive as we expect the risk for the lender to increase with increasing loan size and longer duration. Concerning the use of loans it is the marginal effect of consumption purpose which

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<sup>7</sup> 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.

is significant. The negative sign indicates that loans borrowed for consumption purposes require less collateral than loans used for other purposes. 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 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 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.

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), relationship aspects between lender and borrower are measured in new ways. That is, first, the “number of loans from same lender” and, second, the “number of lenders” the household is engaged with, respectively. The 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, ML, FRI and FAM. Obviously, formal institutions require collateral quite frequently, semiformal lenders require less often collateral and informal lenders have the lowest collateral requirements. Though, informal loans are somewhat diverse in this matter since 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. When 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).

The following two specifications are used to check the robustness of our finding above. Specification (2) again includes dummies for different lending institutions but we exclude semiformal loans. As a consequence there are no observations for CRED. Now, BPs demand collateral most often, closely followed by BAAC and CB. Overall the observed pattern for types of lending institutions remains: formal lenders demand collateral more frequently than informal lenders.

In specification (3) 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 in specification (3), this is because variance increases in the small sample whereas the marginal effect almost has the same size.

## 4.3 The impact of relationship within lending groups

In this section the possible private information influencing the use of collateral is further examined. If the different reliance on collateral by formal and informal lenders (see Section



4.2 directly above) is indeed driven by different degree of information asymmetry between lender and borrower, this asymmetry may decline during enduring relations of formal lenders (H3). 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 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 the 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.

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 relationship duration may have other effects on collateral for ML/BP and FAM/FRI since the signs are different. However, further inference is not possible because both effects prove to be insignificant.

#### **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 of 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 (2013). In fact, the role of distance

expanded into literature 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, where lenders and borrowers are located (i.e. in 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.<sup>8</sup>

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 with increasing distance they have less information 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. 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 at regular banks. A possible explanation is that the lending technology of banks in Thailand is asset-based rather than relationship-based, so that distance does not matter 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. This rough split provides an indication that proximity

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<sup>8</sup> We dropped 19 loans for which lenders are located in Europe and in Bangkok, which is still hundreds of kilometers away from our target group.

within a village may define a critical point up to which distance provides an information advantage.

## 5 Conclusions

This research is at the intersection of development and banking. Both fields are interested in the use of collateral: From a development perspective, collateral is often seen as limiting access to finance, which explains the existence and role of informal lenders who rely less on collateral in their lending decisions. 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” and “lender-based theory” of collateral. We provide novel evidence by testing both theories in a new way, i.e. by contrasting the lending behavior of formal and informal lending institutions in the same market.

Our dataset is based on a largely representative household survey in 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 who 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), and the lender-based theory, according to which the type of lender matters for information gaps and collateral (Inderst and Mueller, 2007). 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 go further 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* and lender-based theories of collateral. At the same time, we learn about the relative 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 seem indeed 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 complement each other and, in the case of Thailand, they are further complemented by other specialized financial institutions.

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**Table 1: Descriptive statistics of variables**

	<i>1st wave</i>		<i>2nd wave</i>		<i>3rd wave</i>	
	<i>Mean/fraction</i>	<i>Std. dev.</i>	<i>Mean/fraction</i>	<i>Std. dev.</i>	<i>Mean/fraction</i>	<i>Std. dev.</i>
<b>Household characteristics</b>						
<i>Demographics</i>						
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
<i>Occupation</i>						
Farmer	0.64	0.48	0.64	0.48	0.64	0.48
Informal worker	0.07	0.26	0.07	0.25	0.08	0.27
Formal worker	0.03	0.18	0.03	0.16	0.02	0.15
Government official	0.04	0.20	0.04	0.20	0.03	0.16
Business owner	0.08	0.27	0.08	0.27	0.09	0.28
Economically inactive	0.13	0.33	0.15	0.35	0.14	0.34
Farmer according to share of agric. income	0.39	0.49	0.47	0.50	0.45	0.50
<i>Economic status</i>						
Area of owned land (rai, hectare?)	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 (Income/ total loan volume)	2.78	9.67	2.52	8.81	2.32	6.29
<i>Borrowing</i>						
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)	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
<i>Relationship variables</i>						
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).

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

<b>Panel A</b>										
	<i>CB</i>	<i>BAAC</i>	<i>VF</i>	<i>CRED</i>	<i>POL</i>	<i>ML</i>	<i>BP</i>	<i>FAM</i>	<i>FRI</i>	<i>weighted average</i>
<i>Collateral</i>										
Collateralized loans (in %)	43.6%	37.4%	2.3%	19.1%	1.4%	40.5%	48.5%	6.4%	9.7%	18.0%
Rate of collateralization	2.56	4.43	1.20	4.00	0.00	2.87	1.39	3.47	6.44	2.57
Guarantee	54.4%	74.3%	96.3%	75.0%	80.9%	14.7%	42.9%	5.6%	8.3%	74.4%
Neither collateral nor guarantee	12.1%	2.6%	2.7%	11.6%	18.4%	49.6%	24.4%	87.7%	83.4%	13.6%
<i>Relationship variables</i>										
Relationship duration	3.88	10.00	5.62	7.63	5.30	2.90	2.14	3.50	3.19	6.36
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
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
<i>Sample size</i>										
Number of households	123	765	1,281	477	218	205	355	245	112	
Number of loans	149	1,605	2,860	868	293	252	443	342	145	Σ 6,957
<b>Panel B</b>										
	<i>formal</i>	<i>semiformal</i>			<i>informal</i>			<i>weighted average</i>		
<i>Collateral</i>										
Collateralized loans (in %)	37.9%	5.9%			29.9%			18.0%		
Rate of collateralization	4.24	3.14			2.15			2.57		
Guarantee	72.6%	90.5%			21.8%			74.4%		
Neither collateral nor guarantee	3.5%	5.9%			55.8%			13.6%		
<i>Relationship variables</i>										
Relationship duration	9.48	6.03			2.82			6.36		
Number of loans from same lender	3.01	3.02			2.46			2.93		
Number of different lenders per hh	2.52	2.50			2.87			2.57		
<i>Sample size</i>										
Number of households	848	1,456			745					
Number of loans	1,754	4,021			1,182			Σ 6,957		

**Table 3: Determinants of collateral**

	(1)	(2)	(3)	(4)	(5)
<i>Dependent variable</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>
<b><i>Independent variables</i></b>					
Loan size (Baht)	0.167*** (0.0153)	0.167*** (0.0153)	0.168*** (0.0153)	0.171*** (0.0160)	0.163*** (0.0158)
Loan duration (months)	0.00210*** (0.000429)	0.00208*** (0.000422)	0.00208*** (0.000423)	0.00200*** (0.000410)	0.00198*** (0.000419)
Annual interest rate	-0.000231 (0.000263)	-0.000261 (0.000265)	-0.000277 (0.000270)	-0.000362 (0.000277)	-0.000359 (0.000274)
Agricultural production loan	0.0295 (0.0276)	0.0314 (0.0273)	0.0302 (0.0273)	0.0322 (0.0272)	0.0305 (0.0271)
Non-agricultural production loan	0.0406 (0.0342)	0.0431 (0.0341)	0.0435 (0.0342)	0.0372 (0.0339)	0.0369 (0.0339)
Consumption loan	-0.0506* (0.0285)	-0.0508* (0.0285)	-0.0515* (0.0285)	-0.0606** (0.0277)	-0.0617** (0.0276)
Guaranteed loan	-0.437*** (0.0228)	-0.435*** (0.0226)	-0.435*** (0.0226)	-0.421*** (0.0219)	-0.425*** (0.0218)
Female headed household	-0.0170 (0.0243)				
Household size (adult equivalence)	-0.00864 (0.00921)				
Education of household head	-0.00657* (0.00387)	-0.00590 (0.00385)	-0.00595 (0.00387)	-0.00598 (0.00382)	-0.00603 (0.00383)
Income per adult equivalence (Baht)	0.00330 (0.00536)	0.00389 (0.00532)		0.00482 (0.00537)	0.00465 (0.00538)
Asset endowment (in Baht)			0.00229 (0.00640)		
Savings (in Baht)	0.00319 (0.00334)				
Debt capacity	-0.00732* (0.00436)	-0.00664 (0.00424)	-0.00560 (0.00402)	-0.00674 (0.00424)	-0.00723* (0.00436)
Dummy if repaid late	-0.0147 (0.0339)				
Total loan volume per hh (in Baht)	-0.0474*** (0.0161)	-0.0457*** (0.0156)	-0.0457*** (0.0159)	-0.0449*** (0.0164)	-0.0337** (0.0170)
Relationship duration	0.0306*** (0.00971)	0.0318*** (0.00965)	0.0322*** (0.00968)		
Number of loans from same lender				-7.69e-05 (0.00801)	
Number of lenders					-0.0180* (0.00984)
Dummy for wave 1	-0.0236 (0.0217)	-0.0242 (0.0216)	-0.0247 (0.0217)	-0.0313 (0.0213)	-0.0316 (0.0214)
Dummy for wave 2	-0.0192 (0.0215)	-0.0199 (0.0214)	-0.0206 (0.0214)	-0.0220 (0.0213)	-0.0229 (0.0213)
Dummy Buriram province	0.0424 (0.0353)	0.0430 (0.0349)	0.0440 (0.0350)	0.0460 (0.0353)	0.0488 (0.0359)
Dummy Ubon province	-0.00685 (0.0342)	-0.00693 (0.0338)	-0.00617 (0.0338)	0.00580 (0.0344)	0.0104 (0.0344)
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;

**Note:** 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.

Specification (1): Broad set of explanatory variables;

Specification (2) Reduced set of explanatory variables;

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**

<i>Dependent variable</i>	(1)	(2)	(3)
<i>Independent variables</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>
Loan size (Baht)	0.143*** (0.0157)	0.172*** (0.0237)	0.163*** (0.0313)
Loan duration (months)	0.00148*** (0.000395)	0.00243*** (0.000514)	0.00245*** (0.000665)
Annual interest rate	-0.000245 (0.000272)	-0.000250 (0.000336)	0.000564 (0.000605)
Agricultural production loan	-0.0180 (0.0253)	-0.0199 (0.0349)	0.0202 (0.0545)
Non-agricultural production loan	0.0172 (0.0315)	0.0473 (0.0438)	0.0175 (0.0643)
Consumption loan	-0.0452 (0.0287)	0.00675 (0.0440)	0.0123 (0.0703)
Guaranteed loan	-0.602*** (0.0267)	-0.629*** (0.0312)	-0.624*** (0.0454)
Income per adult equivalence (Baht)	-0.00395 (0.00473)	-0.00540 (0.00675)	-0.0128* (0.00724)
Debt capacity	-0.00543 (0.00350)	0.000328 (0.00367)	0.000989 (0.00823)
Total loan volume per hh (in Baht)	-0.0309* (0.0160)	-0.0148 (0.0219)	-0.00593 (0.0297)
Relationship duration	-0.0281*** (0.0106)	-0.0327** (0.0149)	-0.0248 (0.0223)
Dummy for CB	0.462*** (0.110)	0.456*** (0.109)	0.563*** (0.143)
Dummy for BAAC	0.510*** (0.0574)	0.471*** (0.0479)	0.520*** (0.0901)
Dummy for CRED	0.476*** (0.0787)		0.441** (0.176)
Dummy for ML	0.287*** (0.0929)	0.318*** (0.0943)	0.349** (0.161)
Dummy for BP	0.500*** (0.134)	0.486*** (0.122)	0.697*** (0.0896)
Dummy for FAM	-0.146*** (0.0322)	-0.192*** (0.0444)	-0.183*** (0.0621)
Dummy for wave 1	-0.0235 (0.0221)	-0.0137 (0.0294)	0.0132 (0.0453)
Dummy for wave 2	-0.0136 (0.0218)	0.000201 (0.0296)	0.0392 (0.0442)
Dummy Buriram province	0.0509 (0.0359)	0.0784* (0.0471)	0.0282 (0.0756)
Dummy Ubon province	-0.00514 (0.0338)	0.000669 (0.0448)	-0.0752 (0.0726)
Pseudo R-squared	0.414	0.412	0.443
Observations	3,145	2,344	939

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

**Note:** 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.

Specification (1): Base line regression with reduced set of explanatory variables including lender dummies;

Specification (2): Only formal and informal loans are considered;

Specification (3): Sample is reduced to households who borrowed from formal and informal institutions (irrespective of borrowing from semiformal lenders).

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

<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)
<i>Independent variables</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>	<i>collateral</i>
Loan size (Baht)	0.223*** (0.0410)	0.0841*** (0.0138)	0.105*** (0.0172)	0.194*** (0.0585)	0.0273*** (0.00840)
Loan duration (months)	0.00302*** (0.000684)	-0.000420 (0.000346)	0.00131** (0.000580)	0.00259 (0.00182)	0.000374 (0.000230)
Annual interest rate	-0.00104 (0.00130)	-0.000159 (0.000464)	0.000183 (0.000152)	-0.000251 (0.000540)	-4.62e-06 (5.67e-05)
Agricultural production loan	0.0477 (0.0564)	-0.0196 (0.0229)	-0.0557** (0.0254)	-0.155* (0.0932)	-0.0338** (0.0135)
Non-agricultural production loan	0.101 (0.0683)	-0.0402* (0.0207)	-0.0206 (0.0344)	0.0876 (0.130)	-0.0220*** (0.00852)
Consumption loan	-0.0149 (0.0754)	-0.0935*** (0.0231)	-0.00483 (0.0287)	-0.0156 (0.108)	-0.0139 (0.0119)
Guaranteed loan	-0.727*** (0.0217)	-0.524*** (0.0544)	-0.0300 (0.0306)	-0.202** (0.0904)	-0.0144 (0.0125)
Income per adult equivalence (Baht)	-0.0180* (0.00928)	-0.000257 (0.00446)	0.00608 (0.00462)	0.0264* (0.0137)	-0.00205 (0.00306)
Debt capacity	0.00403 (0.00944)	-0.00664* (0.00351)	-0.00559 (0.00404)	-0.00548 (0.0175)	-0.00182 (0.00144)
Total loan volume per household (Baht)	-0.0221 (0.0376)	-0.0406*** (0.0148)	-0.0313* (0.0173)	0.0233 (0.0529)	-0.0154** (0.00699)
Relationship duration	-0.0342* (0.0206)	-0.0114 (0.0109)	0.0164 (0.0139)	-0.0114 (0.0478)	0.00550 (0.00737)
Dummy for wave 1	-0.0272 (0.0461)	-0.0394* (0.0236)	0.0246 (0.0293)	-0.0364 (0.0925)	-0.00329 (0.0123)
Dummy for wave 2	0.0177 (0.0444)	-0.0255 (0.0224)	-0.0126 (0.0270)	-0.161* (0.0948)	0.00943 (0.0135)
Dummy Buriram province	0.131** (0.0662)	-0.0245 (0.0350)	0.0722 (0.0446)	0.0638 (0.133)	0.0123 (0.0194)
Dummy Ubon province	0.0342 (0.0630)	-0.0424 (0.0418)	-0.0138 (0.0464)	-0.161 (0.138)	0.00963 (0.0177)
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.

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)
<i>Dependent variable</i>	<i>all lenders collateral</i>	<i>formal collateral</i>	<i>semiformal collateral</i>	<i>informal collateral</i>	<i>informal collateral</i>
<b>Independent variables</b>					
Distance to lender (in minutes)	0.108*** (0.0168)	0.0565 (0.0370)	0.0253 (0.0175)	0.0332*** (0.0112)	
Lender and borrower in the same village					-0.0964*** (0.0310)
Loan size (Baht)	0.161*** (0.0206)	0.195*** (0.0462)	0.0813*** (0.0229)	0.0865*** (0.0209)	0.0834*** (0.0212)
Loan duration (months)	0.00169*** (0.000477)	0.00268*** (0.000842)	-0.000423 (0.000465)	0.00135*** (0.000454)	0.00129*** (0.000451)
Annual interest rate	-6.82e-05 (0.000359)	0.00106 (0.00117)	-0.000321 (0.000822)	0.000375** (0.000146)	0.000323** (0.000141)
Agricultural production loan	-0.0256 (0.0302)	-0.0255 (0.0612)	-0.00852 (0.0348)	-0.0755*** (0.0239)	-0.0717*** (0.0228)
Non-agricultural production loan	-0.000335 (0.0354)	0.0604 (0.0737)	-0.0509* (0.0272)	-0.0405* (0.0210)	-0.0343* (0.0208)
Consumption loan	-0.0652** (0.0322)	-0.0175 (0.0854)	-0.0820*** (0.0309)	-0.0383* (0.0224)	-0.0391* (0.0230)
Guaranteed loan	-0.511*** (0.0274)	-0.727*** (0.0252)	-0.641*** (0.0562)	-0.0397* (0.0211)	-0.0413** (0.0194)
Income per adult equivalence (Baht)	0.00487 (0.00799)	-0.0194 (0.0132)	0.00609 (0.0109)	0.00398 (0.00418)	0.00345 (0.00387)
Indebt capacity	-0.00684 (0.00595)	0.00104 (0.0143)	-0.00690 (0.00741)	-0.00642 (0.00467)	-0.00835* (0.00462)
Total loan volume per household (Baht)	-0.0402** (0.0198)	-0.00457 (0.0426)	-0.0218 (0.0253)	-0.0464*** (0.0153)	-0.0473*** (0.0152)
Relationship duration	0.0236** (0.0116)	-0.0354 (0.0238)	-0.0161 (0.0147)	0.0122 (0.0125)	0.0144 (0.0123)
Dummy for wave 2	-0.0238 (0.0230)	0.00714 (0.0453)	-0.0297 (0.0326)	-0.0172 (0.0200)	-0.00251 (0.0183)
Dummy Buriram province	0.0529 (0.0399)	0.232*** (0.0808)	0.0452 (0.0740)	-0.00717 (0.0297)	-0.00537 (0.0275)
Dummy Ubon province	0.0425 (0.0371)	0.152** (0.0733)	0.0406 (0.0594)	-0.0382 (0.0309)	-0.0277 (0.0286)
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.

Specification (1): all lenders;

Specification (2): Formal lenders (CB and BAAC) only;

Specification (3): Semiformal lenders (CRED) only;

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.

### **Appendix 1:**

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 versus possible substitutes (Menkhoff et al., 2012). This earlier paper differs from ours in some 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 very 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. ML, BP and FAM and FRI comprise all loans given by the respective institution no matter whether the interest rate is positive or zero. 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.

Appendix 1 shows that the sign and most often size of marginal effects are quite similar despite different samples used. However, there are differences regarding the statistical significance in three cases: (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.



**Appendix 1: Comparison to Menkhoff et al. (2012)**

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

Specification (1) includes loans from CB, BAAC (base category); CRED, ML, BP, FAM and FRI; 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. Only loans that have been granted within the 12 month period of the first wave are considered.