Collateral-Based Lending in Emerging Markets: Evidence from Thailand*

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Abstract:

This paper examines the role and determinants of collateral in emerging markets compared to mature ones. Analyzing a data set of 560 credit files of Thai commercial banks, we find that both the incidence and degree of collateralization are higher there than in developed markets. Thai banks use collateral primarily to reduce the higher credit risks of small and relatively young firms. Long credit relationships do not reduce collateral requirements by lowering information asymmetry. Market imperfections result from housebanks demanding higher collateral than non-housebanks, suggesting a lock-in effect for their borrowers, and from larger banks realizing higher collateral claims.

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1. Introduction

In developed markets, it is an established fact that collateral plays an important role in loan contracts. In emerging markets, however, information on its role is scarce. The present paper seeks to find out whether there are systematic differences in collateral-based lending between mature and emerging markets. Investigating the collateral decisions of Thai banks, we show that this is, indeed, the case. Collateral-based lending assumes greater prevalence in Thailand, which seems to reflect the imperfections of this emerging market.

Microeconomic theories of banking and financial contracting[1] have explained the widespread use of collateral by its function to reduce credit rationing under asymmetric information. The literature on relationship lending shows that collateralization often depends on the strength of the bank-customer relationship.[2] The resulting hypotheses about loan contracting, borrower risk and relationship lending have been tested in many empirical studies. Almost all of them focus on mature markets of industrialized countries.[3] An analysis for emerging markets is even more interesting, however: On the one hand, their less developed institutions make information asymmetry more pronounced. Collateral thus assumes higher importance as an instrument of dealing with these asymmetries. On the other

[1] For reviews, see Greenbaum and Thakor (1995), Freixat and Rochet (1997).

[2] For surveys, see Boot (2000), Ongena and Smith (2000), Elyasiani and Goldberg (2004).

[3] For the U.S., see Berger and Udell (1990, 1995), Boot, Thakor and Udell (1991), Leeth and Scott (1989); for the U.K., see Cowling (1999), Cowling and Sudgen (1995), Cressy and Toivanen (2001); for Germany, see Elsas and Krahnen (1998, 2000), Harhoff and Körting (1998), Lehmann and Neuberger (2001), Lehmann, Neuberger and Räthke (2004), Machauer and Weber (1998); for Belgium, see Degryse and Van Cayseele (2000); for Spain, see Jiménez and Saurina (2004); for Argentina, see Berger, Klapper and Udell (2001); and for Mexico, see La Porta, Lopez-de-Silanes and Zamarripa (2003).

hand, it may be a less suitable tool if contracts cannot be fully enforced.[4] According to our knowledge, the influence of the lending relationship on the collateralization of bank loans in an emerging economy has been examined so far for Mexico only (La Porta, Lopez-de-Silanes and Zamarripa, 2003).

The present paper presents empirical evidence on collateral-based lending in Thailand.[5] Data on 560 credit files of nine Thai commercial banks during the years 1992-96 were collected in 2000/01. We find, first, that collateral seems to assume a higher importance in an emerging market than in a developed one: Thai banks demand higher collateral and more often so than their counterparts in mature markets. Second, regarding competing theories on the function of collateral, the Thai evidence suggests that collateral is used in order to reduce risks rather than information asymmetry. Banks use collateral primarily to reduce the higher credit risks of relatively small and young firms. Third, borrowers are likely to be locked-in in housebank relationships as housebanks demand extra collateral. Our data show that the "housebank variable" seems to capture to greater detail relationship lending for relatively small firms, whereas "number of lending banks" may be more appropriate for larger ones. Market imperfections also may be revealed, fourthly, by the higher collateral requirements of larger banks. Finally, reliance on collateral does not seem to increase significantly the bank's willingness to take risks. Collateral-based lending thus has a two-fold implication: It

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[4] We are grateful to an anonymous referee for this point.

[5] The financial landscape of the emerging markets of Asia can be characterized as an "intermediate financial market structure" that lies somewhere between a bank-dominated and a full-fledged market-based financial structure (Shirai, 2001). It has been claimed that the heavy dependence of firms' investment on highly collateralized bank loans facilitated the Asian crisis of 1997 (Yoshitomi and Shirai, 2001). The lending relationship seems to have translated into "cronyism" in Asia, owing in particular to government intervention and heavy reliance by banks on collateral without the appropriate monitoring of their borrowers.

improves credit availability in the opaque information environment of an emerging market. However, it also seems to go along with lock-in situations.

The paper is organized as follows: Section 2 shortly reviews the theoretical and empirical literature on the collateralization of bank loans in developed and emerging economies. Section 3 provides a description of the data and descriptive statistics. Section 4 presents the empirical results of our analyses in comparison with previous studies, followed by a conclusion in Section 5.

2. Review of the Theoretical and Empirical Literature

Models of bank behavior under asymmetric information show that collateralization reduces adverse selection and moral hazard. First, it induces a borrower to reveal his or her default risk, acting as a signaling device (Bester, 1985; Besanko and Thakor, 1987). Second, it provides the borrower with an incentive to exert effort and reveal truthfully the state of his project after having obtained the loan (Bester, 1987, 1994).

However, collateralization may be costly for both contract partners. Lenders must evaluate and monitor collateral and bear the cost of liquidation and collateral utilization. Borrowers must prepare additional reports and tolerate restrictive asset usage (Leeth and Scott, 1989, p. 380). The higher the specificity of the collateral asset or the less liquid it is, the higher are the costs imposed on the lender. The costs of evaluating, processing and liquidating collateral strongly depend on the legal and institutional environment. As has been shown by the recent literature on law and finance (see La Porta et al., 1997, 1998), legal variables and the efficiency of the judicial system are important determinants of loan supply, affecting the protection of creditor rights.

The effect of the underdeveloped legal and institutional environment in an emerging market on collateral-based lending has not been analyzed in great detail. A recent study on

transition economies indicates that collateral plays an especially large role there, although it is accompanied by high costs of evaluation, utilization and liquidation (Hainz, 2003, pp. 224). The fact that the incidence and degree of collateral is high in transition economies despite larger costs may be explained as follows: (1) Higher information asymmetries result in higher collateral benefits and these outweigh the higher costs; (2) with a lower liquidation payoff due to the higher costs of liquidation, the size of collateral must increase to increase bank lending profitability or to satisfy the zero profit constraint in a perfectly competitive banking sector; (3) competition in the banking sector is lower than in mature markets, enabling monopolistic or oligopolistic banks to extract rents by increasing collateral requirements.

Thailand is a suitable case to test whether higher collateralization of loans also holds for emerging markets. This country clearly has an underdeveloped legal infrastructure that protects creditor rights. During the 1990s, the creditors of Thai firms faced large uncertainty in bankruptcy proceedings and prohibitively high costs of litigation (Walker, 2000).[6]

We seek to find out whether the role that collateral plays in reducing credit risks differs between emerging and mature markets. The relationship between collateral and credit risk is theoretically ambiguous. According to both conventional wisdom in banking (see e.g., Berger and Udell, 1990) and the banks' ex post monitoring function (Bester, 1994; Rajan and Winton, 1995), banks should demand higher collateral from borrowers who are expected to

[6] In the measurement of the legal protection of investor rights provided by La Porta et al., the average efficiency of the judicial system in Thailand in the years 1980-1983 scored 3.25 within a scale from 0 to 10 (with lower scores representing lower efficiency levels; see La Porta et al., 1998, pp. 1124 and 1142). However, the index of the protection of creditor rights reached the same level as in Germany (3, with the maximum being 4; see La Porta et al., 1997, Table II).

have higher default risks.[7] The signaling models of collateral, however, predict a negative relation between collateral and default risk (Besanko and Thakor, 1987; Bester, 1985). Since they apply to the pre-contractual stage of lending, while our data refer to longer lasting lending relationships, we expect that collateralization is positively related to borrowers' default risks.

In the empirical studies on developed markets, collateral has been regressed on various proxies for credit risk, the banks' internal credit ratings, the characteristics of the borrowing firm and the kind of loans.[8] While the evidence is ambiguous, most studies find that clearly perceived risk proxies of the borrowing firm significantly affect collateralization, with the incidence and degree of collateral tending to be highest for young and small firms. This finding is in line with both the risk reduction and monitoring role of collateral, since these firms tend to be both more risky and more informationally opaque than are older and larger firms. In emerging markets we expect the directly observable characteristics of firms to play a similar or even larger role because higher information asymmetries should render credit risk measurement more difficult. La Porta, Lopez-de-Silanes and Zamarripa (2003) have tentatively confirmed this role for larger firms in Mexico.

The theories and empirical studies of relationship lending are also inconclusive about the influence bank-customer-relationships exert on collateralization. Theoretically, the collateral decision may be affected by the different benefits of a strong bank-customer

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[7] This holds irrespective of whether the collateralized asset is outside (as in Bester, 1994) or inside the firm (as in Rajan and Winton, 1995). For a brief survey, see Elsas and Krahnen (2000, p.6).

[8] See e.g., Berger and Udell (1995), Degryse and Van Cayseele (2000), Elsas and Krahnen (2000), Harhoff and Körting (1998), Lehmann and Neuberger (2001).

relationship.[9] Predictions on its influence on collateralization depend on whether the collateralized asset is assumed to be inside or outside the borrowing firm. Longhofer and Santos (2000) show that the provision of inside collateral is an incentive to monitor the borrower through a relationship. They predict a positive relationship between collateral and the intensity of the bank-borrower relationship. In an infinitely repeated moral hazard game with outside collateral, Boot and Thakor (1994) show that a bank initially requires high collateral from a firm, but reduces these requirements after having seen successful completion of the project. However, the proprietary information gained by the relationship lender increases its ex post bargaining power. This may be exploited to the detriment of the borrower (Greenbaum, Kanatas and Venezia, 1989; Sharpe, 1990; Rajan, 1992). Because the borrower is locked-in, collateral requirements may be positively related to the intensity of the lending relationship. Thus, collateral is the result of holdup. At the same time, it causes hold-up: since an asset can be pledged only once, and its evaluation is likely to be costly, switching to other banks would involve high costs.[10]

The empirical evidence for developed markets is ambiguous and depends on the measures of relationship strength used.[11] Some studies have found a significant negative influence of the relationship duration, consistent with information on stronger relationships (Berger and Udell, 1995; Harhoff and Körting, 1998). Others have found a significant positive effect of the housebank status in line with the lock-in hypothesis (Elsas and Krahnen,

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[9] It reduces information asymmetry, improves contracting flexibility, enables reputation building and ensures confidentiality (Ongena and Smith, 2000).

[10] We are grateful to an anonymous referee for this point.

[11] These are the duration of the lending relationship, the presence of a housebank status, the number of lenders and social aspects such as mutual trust. For surveys, see Ongena and Smith (2000), Lehmann, Neuberger and Räthke (2004).

2000; Lehmann and Neuberger, 2001; Machauer and Weber, 1998; Degryse and Van Cayseele, 2000).

These relationships should be even more relevant in the context of emerging economies, which have higher information asymmetries and a higher scope for extracting rent by collateralization. An earlier study revealed that relationship lending plays a comparatively larger role in explaining the behavior of Thai banks, with housebanks improving above all credit availability (Menkhoff and Suwanaporn, 2003). The above mentioned study on Mexico (La Porta, Lopez-de-Silanes and Zamarripa, 2003) uses other measures of relationship strength, defining "related lending" as bank lending to related parties.[12] They find that related lending improves the contract terms of loans, with the incidence and degree of collateral being significantly lower for borrowers with a strong bank relationship. This finding is consistent with the "information view" which holds that stronger relationships entail informational gains, but also with the "looting view", which sees close ties between banks and borrowers to allow insiders to divert resources from depositors or minority shareholders to themselves, thereby reducing the holdup problem for the borrower. The empirical evidence for Mexico supports the looting view, but not the information view. Since banks that are controlled by persons or entities with substantial non-financial interests are also prominent in Thailand (La Porta, Lopez-de-Silanes and Zamarripa, 2003, p. 233), the looting hypothesis may be also relevant for our Thai banking sample.

Collateralization may also change the willingness of banks to take risks. By reducing a bank's risk exposure, it may provide an incentive to be less careful, or even to engage in more risky lending.[13] In this case, the incidence and degree of collateralization should be positively

[12] including shareholders of the bank, their associates and family, and the firms they control.

[13] See also the "lazy bank" argument by Manove, Padilla and Pagano (2001).

related with ex post default of the loan. This hypothesis has received only little attention in the literature to date. Three empirical studies that test it in the context of developed economies yield contrasting results. For a U.K. sample of bank loans to small and medium-sized enterprises, Cressy and Toivanen (2001) did not find a significant relationship between the default and the incidence of collateral. For U.S. business loans, Berger and Udell (1990) found that collateral was associated with a higher number of borrowers with non-performing loans and higher charge-off rates (for Spain, see Jiménez and Saurina, 2004).

3. Data Set and Descriptive Statistics

3.1 Data Compilation

The data for our study were collected from nine Thai commercial banks in 2000/01. All relevant banks were contacted and most of them provided between 35 and 85 of their credit files, making participation largely representative of the market. The primary selection criterion for these credit files was to cover credit granting decisions in the years preceding the 1997 crisis, i.e. in the period 1992-1996. The secondary criterion was to consider all industries.

Helpful factors in obtaining these highly confidential data were strict confidentiality, the purely academic nature of research, a change in the responsible bank management following the crisis and a supporting letter from the Thai Ministry of Finance, which is involved in banking supervision. We received a total of 560 suitable files most of which are complete as to the required variables. This data set was then analyzed in detail, first regarding their inherent structure and, second, regarding a crosscheck with data on the Thai economy: Both ways of examination yielded favorable results, indicating that the sample is suitable for the purpose of our study (see Menkhoff and Suwanaporn, 2003). Nevertheless, the data has three minor distortions: First, the share of non-performing loans is 45.9% in the sample

compared to more than 50% for the whole of Thailand. Second, the manufacturing and the real estate sector are overrepresented whereas trade and consumption loans are underrepresented in our sample. Third, company size and the corresponding loan size are clearly above average when compared to the whole economy as credit files were collected from the banks' headquarters and thus do not reflect smaller loans in rural areas.

3.2 Variable Description and Descriptive Statistics

The variables of this study resemble standard variables from the literature on bank lending behavior (for details, see Table 1). Collateral is defined here as the collateralized percentage of the line of credit granted, by using the internal evaluation of the collateral liquidation value on which banks base their lending decisions. Since the credit decision refers to the whole credit line, it would not be logical to restrict the analysis to the credit line for the current account. Therefore, as in the study by Machauer and Weber (1998), the line of credit includes all forms of credit that a bank grants to its customers. The collateralized percentage of the credit line takes on values in the closed interval from 0 (no collateral) to 100 (full collateralization). Thus, we do not only analyze the incidence of collateral as a binary variable[14], but also its degree.[15] The kind of collateral used in Thailand is mostly in the form of physical assets, such as land and property.

Besides the common company variables, we consider the liability-to-assets ratio, the current ratio and the interest coverage ratio as three direct risk measures. These were in use in Thailand at that time, while formalized internal credit rating methods were not. The strength

[14] Like Berger and Udell (1995), Boot, Thakor and Udell (1991), Cressy and Toivanen (2001), Harhoff and Körting (1998), Leeth and Scott (1989).

[15] Like Elsas and Krahnen (2000), Lehmann and Neuberger (2001), Lehmann, Neuberger and Räthke (2004), Machauer and Weber (1998), La Porta, Lopez-de-Silanes and Zamarripa (2003).

of the lending relationship is measured by the three common variables "housebank status"[16], "relationship duration" and "number of lending banks". Moreover, the data set includes ex post default as a dummy variable in case the loan became non-performing between loan granting and data compilation, as well as dummies for nine banks, 11 industries and five years.

Some of these data have been treated in accordance with earlier studies (see in particular Petersen and Rajan, 1994). The variables "credit volume", "assets" and "number of lending banks" are taken in logarithmic form due to their right-skewed distribution. To limit the influence of outliers, the most extreme 5% cases of the direct risk variables are excluded from further examination. Finally, the negative values of the interest coverage ratio are set to zero. Due to missing values in particular for the interest coverage ratio and the modifications just described, the number of cases for which we have full information is 416. The descriptive statistics are presented in Table 1.

[Table 1 about here]

4. Empirical Results

4.1 Descriptive Analysis

In our sample, 72% of loans are made on a secured basis, and the mean collateral value is 53% of the total loan volume. Table 2 provides a comparison with the results of empirical studies on other countries. In mature markets, the percentage of collateralized loans varies between 13 and 88, and the mean collateral value ranges from 32 to above 100% of the loan

[16] As in the studies on Germany, the banks were requested to provide a self-assessment of their housebank status. A housebank is usually perceived as the largest lender of a firm (see Elsas 2004), and this concept seems to be the same in Thailand.

volume. These large variations hinge on differences in the underlying samples with respect to the size and age of the borrowing firm, the type and size of the loan and the strength of the lending relationship. It is an established fact that collateralization tends to decrease with the size and age of the firm and with the loan size. In the studies on mature markets reported in Table 2, collateralization probabilities above 70% have been observed only for small and medium-sized firms, young firms and small loans.[17] Since our sample covers a wide range of company size, we analyze the different size groups separately.[18] Figure 1 shows that there is indeed an inverse relationship between firm size (here measured by assets) and the incidence (and degree) of collateral in our sample, falling from nearly 95% for the 10 percentile of the smallest firms to 47% for the 10 percentile of the biggest firms. Among the six size groups distinguished, the three smaller ones represent small and medium enterprises in Thailand.[19] For this group, the incidence of collateral is in the range of more than 80% to 95% and thus at the highest level of all available studies. Even for large firms in Thailand, the incidence of collateral is remarkable (see also La Porta, Lopez-de-Silanes and Zamarripa, 2003, for Mexico).

Also, a comparison with recent data on the collateralization of U.S. bank loans shows that the incidence of collateral is higher in our Thai banks for all loan size classes. According

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[17] The highest value of 88 in the sample of Lehmann and Neuberger (2001) cannot only be explained by the high percentage of young firms with short lending durations, but also by the loan type of the borrowing firms: In this sample, 71% of the loans are investment loans which are usually higher collateralized than credit lines. The lowest collateral incidence of 13% in the sample of Jiménez and Saurina (2004) is partly due to the exclusion of personal guarantees.

[18] In our sample, the minimum firm asset size is 1 million Baht (~ 40,000 $ at the historical exchange rate), the maximum is about 90 billion Baht (~ 3.6 billion $), and the median value equates to around 10 million $.

to a recent survey on lending terms at commercial banks in the U.S., the percentage of loans secured by collateral was nearly 48 for all commercial and industrial loans, but ranged from 86 for the smallest to 37 for the largest loans (Federal Reserve Bulletin 2004, p.60). To compare these data with ours, figure 1 reports the average credit volume for each of our asset size percentiles in parentheses. It shows that the U.S. loans have a lower collateral incidence for each of our size classes than the loans in our sample. Thus, despite the fact that there is no statistical test on the significance of these differences, we can conclude that the incidence of collateral in the emerging market of Thailand – tentatively supported by Mexican data – is higher than what we would observe for companies of comparable size in developed countries.

As to the degree of collateral, available findings are relatively scarce and not directly comparable because of different measurements.[20] The average collateral values reported in Table 2 for mature markets refer to SMEs and also tend to decrease with firm size. As with small borrowers taking loans from U.K. banks, large borrowers with Mexican banks have to provide collateral volumes far exceeding their loan volumes. In our sample, the mean collateral value is lower, influenced by our decision not to compile collateral of more than 100%. However, a closer investigation of this variable reveals a bimodal frequency distribution, which differs from the one observed for German bank loans (Elsas and Krahnen, 2000; Machauer and Weber, 1998). We also observe two significant peaks at the values of 0 and 100, but our sample has a much higher proportion of fully secured loans. While in two German samples, the percentage of fully collateralized loans is 8.8% (Machauer and Weber,

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[19] The standard maximum asset size for SMEs in Thailand is 200 million Baht and the median asset size in our sample is 246 million Baht.

[20] Note that there may be a bias when comparing the reported collateral values because the two German samples contain bank-internal data, while the U.K. sample is based on a survey of firms. For a bank, the valuation of assets is likely to be less than for a firm (Cowling and Sugden, 1995, p. 89).

1998, p. 1368) and 5.8% respectively (Lehmann and Neuberger, 2001), in our Thai sample it is 30.9%. Note that the two former also include personal guarantees, while our sample does not, so that the differences in collateral values should be even higher if we compared the same types of collateral.

[Table 2 about here]

[Figure 1 about here]

Thus, Thai banks tend to demand higher collateral and more often so than their counterparts in developed markets. To extend our understanding on the use of collateral, Table 3 presents ANOVA results. The mean difference of collateral across different firms classified by their asset size is statistically significant below the 1% level. This relation principally also holds for the volume of credit lines (which is highly positively correlated with firm size) and collateral. In line with some studies on developed countries, we find that housebanks require significantly higher collateral than do other banks. The mean collateral value for firms with a housebank relationship is 65 compared to only 41 for firms without a housebank relationship. This difference is statistically significant below the 1% level (see Table 3). Significant differences in collateralization are also found for banks of different size. Small banks take lower collateral from borrowers than large banks. This finding contrasts with the reverse evidence for the U.S..[21] Our result may be explained by a higher bargaining power of large banks and a greater number of services provided by these banks to their corporate customers. It fits into this line of reasoning that larger banks impose significantly higher interest rates (see Menkhoff and Suwanaporn, 2003). Differences of collateral values

[21] For instance, in February 2004, the incidence of collateralization of all commercial and industrial loans was 62% at large domestic banks, but 87% at small domestic banks (Federal Reserve Bulletin, 2004, p. 62).

can also be observed for different industries, although they are not significant.[22]

The descriptive statistics on the default variable did not show significant differences of collateral between ex post defaulting and non-defaulting firms. Collateralized loans tended to default more often than uncollateralized ones, but this difference was not significant.

[Table 3 about here]

4.2 Regression Analysis

To investigate the collateralization of Thai banks, we use the Probit model to explain its incidence and the Tobit model to explain its degree. Since the dependent variable degree of collateral contains a cluster of zeros, OLS results would give biased and inconsistent coefficients. Therefore, the Tobit model as an extension of a censored regression model is appropriate (see Greene, 2002).[23]

Table 4 presents the results for the whole sample ("all") and for four sub-samples. The first two sub-samples ("small firms" versus "large firms") result from a sample split according to firm assets into two sub-samples of the same size each. The second two sub-samples ("housebanks" versus "non-housebanks") result from a split according to the incidence of a housebank relationship. First, we expect that in the sub-sample of the smaller firms, where informational asymmetries tend to be higher, the risk proxies and relationship lending variables have higher explanatory power than in the sub-sample of the larger firms. Secondly, we aim to establish whether collateral plays a different role in housebank

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[22] We find that the mean collateral value is lowest in the banking and finance sector (30), high in the real estate sector (65) and highest in the personal consumption industry (71). This may reflect differences in insolvency rates, opportunities for pledging assets as collateral or the liquidity of collateral assets.

[23] The same approach has been used by Elsas and Krahnen (2000), Lehmann and Neuberger (2001), Lehmann, Neuberger and Räthke (2004) and La Porta, Lopez-de-Silanes and Zamarripa (2003).

relationships than in other ones, as suggested by the literature.

For the whole sample, the company variables “firm age” and “asset size” show a significant negative influence on the degree and incidence of collateralization. This is consistent with both the risk reduction and monitoring role of collateral, but may also be explained by the fact that older and larger firms have higher bargaining power to obtain loans with lower collateral. Since the coefficients of the Probit and Tobit models cannot be interpreted directly, the marginal effect of each variable is additionally calculated and indicated in parentheses. The marginal coefficient of the age variable indicates that, ceteris paribus, a one-year increase in firm age is likely to reduce the amount of collateral by nearly 1%. Likewise, an increase by 1% in the asset variable is likely to reduce the collateral requirement by nearly 8%. The results correspond to those obtained for the emerging market of Mexico (La Porta, Lopez-de-Silanes and Zamarripa, 2003) and for developed markets (Degryse and Van Cayseele, 2000; Harhoff and Körting,1998; Lehmann and Neuberger, 2001).

[Table 4 about here]

The direct risk variables are of no importance in explaining collateralization, except a negative effect (at the 10% significance level) of the current ratio on the volume of collateral. This corresponds to the evidence on developed countries that collateralization does not depend on expected default risk as expressed by bank internal credit ratings (Elsas and Krahnen, 2000; Machauer and Weber, 1998), leverage (Harhoff and Körting, 1998) or predicted success probability (Cressy and Toivanen, 2001). Only Harhoff and Körting (1998) found a significant positive effect of expected default risk (proxied by financial distress in the

past) on the incidence of collateral.[24]

The finding for developed markets that collateralization depends on relationship variables is also confirmed for our Thai banking sample. In both regressions for the whole sample, the coefficient of the housebanking variable is positive and highly significant. The corresponding marginal coefficient in the Tobit model indicates that, ceteris paribus, firms with a housebank relationship are likely to pledge an additional 16.6 percentage points of their credit line as collateral, compared to firms without a housebank relationship. In comparison, the marginal coefficient of the housebank variable is 15.6 in the study by Elsas and Krahnen (2000) and 10.5 in that by Lehmann and Neuberger (2001).[25] We can conclude that while the housebank status has a positive effect on the collateralization of both Thai and German loans, its quantitative impact on the volume of collateral is higher in Thailand. Our result contrasts to that for Mexico in that strong ties between banks and borrowers tend to reduce collateral requirements (La Porta, Lopez-de-Silanes and Zamarripa, 2003). Hence, housebank relationships of Thai banks are more likely to be affected by a hold-up problem than by a reverse looting problem in Mexico.

The number of banks a firm borrows from shows a negative impact on the incidence and degree of collateral, which is significant at the 5% level only for the former. This may indicate that as the number of lending banks increases, firms gain higher bargaining power to obtain loans with lower or no collateral (see also Machauer and Weber, 1998, for German bank loans).

Contrary to Berger and Udell (1995) and Harhoff and Körting (1998), we could not find

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[24] The opposite finding for Mexican banks, where lower collateral was required for more leveraged firms, seems to be caused by "looting" behavior, not by prudent banking (La Porta, Lopez-de-Silanes and Zamarripa, 2003).

[25] These have been calculated by multiplying the presented regression coefficients with the scale factors for marginal effects of 0.87 (Elsas and Krahnen 2000; see footnote 29) and 0.88 (Lehmann and Neuberger 2001).

a statistically significant influence of the relationship duration on collateralization for our whole sample. Hence, Thai banks do not seem to gain more information in longer lending relationships as a substitute for collateral in addressing asymmetric information problems. However, we cannot conclude that this is a finding characteristic for an emerging market, since it corresponds to the results for developed markets by Elsas and Krahnen (2000), Machauer and Weber (1998), Degryse and VanCayseele (2000) and Lehmann and Neuberger (2001). The contrasting results may hinge on differences in the lending relationships included in the different samples. The duration of the relationship seems to us of minor importance in those samples that contain (or explicitly ask for) housebank or main bank relationships.[26]

Among the control variables, the coefficients of three bank dummies and two industry dummies are statistically significant. Compared to the manufacturing sector, the banking and finance sector and the export sector have a lower incidence and degree of collateral. The year dummies show no significance (as in Machauer and Weber, 1998).

For the two sub-samples of small versus large firms, Table 4 presents indeed some different results. Now, two direct risk variables show significant effects on collateralization for small firms: A higher current ratio, which indicates a lower risk, decreases the volume of collateral. A higher interest coverage ratio, indicating also a lower risk, increases the incidence of collateral. The indirect risk proxy "firm age" keeps its significant negative impact only for the collateralization of small firms. Also, the positive impact of the housebank status remains significant only for small firms, with a higher magnitude than for the whole sample. The number of lending banks, however, keeps its significant negative influence on the incidence of collateral only for the larger firms. This size-specific

[26] As shown in Table 2 above, this applies to the samples of Elsas and Krahnen (2000), Machauer and Weber (1998), Degryse and VanCayseele (2000), Lehmann and Neuberger (2001) and the present paper, but not to the

significance of relationship variables indicates the different appropriateness of relationship indicators: The variable "housebank" may be particularly suitable to capture close relations with small firms. The increasing number of bank relations of large firms depreciates the value of the housebank variable and thus makes the variable "number of lending banks" the superior indicator.

In line with our expectations, these findings show that (1) the risk-reduction or monitoring role of collateral is higher in smaller firms and (2) relationship lending with high collateral requirements of housebanks plays a larger role for the financing of small firms. Larger firms are more likely to obtain uncollateralized loans, because they have higher bargaining power by lending from several banks. Hence, in the emerging market of Thailand, collateral primarily serves to reduce the observable credit risks of relatively young and small borrowers in housebank relationships. Whether Thai banks provide similar housebank services as German banks do is an open question. Since we do not have evidence that Thai housebanks offer additional services for which they may need more collateral (such as workout activities found for German banks, see Elsas and Krahnen, 2000), it is a valid explanation that housebanks obtain more collateral because they lock-in their borrowers.

After we split the total sample according to the incidence of a housebank relationship, we found the following differences between both sub-samples: Only for housebanking relationships did the firm size variable keep its highly significant negative effect on the incidence and degree of collateral. Collateralization by housebanks was significantly positively affected by the duration of the relationship. However, the number of lending banks significantly reduced collateral requirements only in non-housebanking relationships. These results are in line with the above findings that the smaller firms which are more likely to

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samples of Berger and Udell (1995) and Harhoff and Körting (1998).

borrow money from a housebank provide higher collateral, and the more so the longer their housebank relationship lasts. Larger firms with less intense lending relationships are less collateralized. This is consistent with the hypothesis that small firms are locked in by their housebanks and inconsistent with the information view of collateral.

After running the same regressions with the ex post default variable as additional explanatory variable, we find that the inclusion of this variable does not change the signs and significance levels of the other explanatory variables (not presented). The default variable exerts a positive influence on the degree and incidence of collateral, but it is statistically insignificant. Thus, collateral does not seem to change the banks' willingness to take risks.

4.3 Robustness of Results

We examined the robustness of our results with respect to different specifications and assumptions. Since our estimation is not based on a formal model, it relies on the ad hoc assumption that the regressors in the collateral equation are exogenous and do not include the loan rate. Our single-equation study does not take into account the simultaneous determination of collateral and loan rates.[27] As shown by Brick, Kane and Palia (2004), the variation in the results of single-equation studies may be explained by a simultaneous-equation bias. The first attempt to establish the relationships between the collateral, the loan rate and the loan volume from a microeconomic banking model showed that the collateral equation depended on exogenous variables only, while the loan rate depended on the endogenous collateral variable (Cressy and Toivanen, 2001). Therefore, we dropped the credit

[27] Single-equation estimations of collateral usually do not include the loan rate in the set of independent variables, while some of them include the loan volume. See the overview in Lehmann, Neuberger and Räthke (2004, Table 2). Among nine studies, only one includes the loan rate (Machauer and Weber, 1998), while five include the loan size.

volume variable from the regression and re-estimated the whole equation. Most of the variables remained unchanged compared to the results of the baseline regressions in Table 4, but the adjusted R^2 decreased slightly.

To test whether we have a problem of multicollinearity among the three relationship variables, we performed the same regressions step by step without the housebank variable, the duration variable and the number of banks variable. The non-inclusion of the duration variable showed no effect on the signs and significance levels of the remaining variables. When we dropped the housebank variable, only the negative influence of the number of banks variable increased and assumed significance. Vice versa, the non-inclusion of the latter increased the influence of the housebank variable without changing the other results. As we dropped simultaneously the housebank variable and the number of banks variable, the coefficient of the duration variable remained insignificant. We conclude that in our Thai sample, relationship lending is best proxied by the housebank status and the number of lending banks.

To control for the effect of the bank dummy variables, we dropped them step by step, and then all together and replaced them by bank size dummies (three smallest banks, medium-sized banks, three largest banks). Moreover, we replaced bank dummies by a variable catching the size of banks, either taking asset size or the rank of size. Except for some minor changes in absolute magnitude, all the signs and significance levels of the variables we are interested in remained unchanged. Consistent with the ANOVA results, the coefficients of the bank asset size variables took a positive and highly significant (0.01) value. This indicates that large banks probably use their market power to obtain more collateral from their borrowers compared to small banks. We interpret this finding as another indication of imperfection in an emerging market, consistent with the lock-in in housebank relations reported above. Also, after dropping the year dummies and after re-grouping the 12 industries

into four industries, our results remained stable.

5. Conclusions

The increasing integration of emerging markets into world financial markets and the many crises have intensified research on the structure and functioning of emerging markets. This paper focused on the role of collateral. Many loans in mature markets are collateralized and the degree of collateralization roughly varies between 30 and 100 per cent for large and small companies. Thus, collateral is a crucial element in bank lending in developed markets. It is expected to be of even higher importance in less developed credit markets.

However, the role of collateral in emerging markets has not been studied intensively. Our data set of credit files from Thailand allowed us to analyze the lending behavior in some detail. We have found the following: First, the incidence and degree of collateral are clearly higher in emerging markets than in mature markets. Second, this holds especially for relatively young and small firms that are more risky and informationally opaque than older and larger firms. Collateral is used to reduce the observed higher risk of these borrowers. Third, the incidence and degree of collateralization are positively related to the incidence of a housebank relationship, particularly for smaller firms. The strength of this relation is higher than in industrialized countries. Instead of reducing information asymmetry, housebanks seem to exploit the lock-in of their borrowers by demanding higher collateral. Fifth, the existence of relevant market imperfections is also suggested by the fact that larger banks demand more collateral, controlling for other determinants. Finally, information about ex post default is not significantly related to the degree of collateralization, indicating that collateral-based lending does not lead to a more aggressive lending policy.

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TABLE 1: Variable Definitions and Descriptive Statistics

Variable	Description	Mean	Median	Maximum	Minimum	Std.Dev.	Skewness	Kurtosis	Observations
Loan contract variables:									
Collateral	Collateral value as percentage of the line of credit granted	52.95	55.00	100.00	0.00	42.04	-0.14	1.32	(560)
Credit volume	Volume of the line of credit (L/C) granted	240.58	56.00	6,539.00	0.30	582.08	5.77	47.63	(560)
Ln (Credit volume)	Logarithm of the volume of the line of credit (L/C) granted	4.08	4.03	8.79	-1.20	1.75	-0.12	3.11	(560)
Company variables:									
Assets	Latest book value of assets of the firm prior to the credit decision	2,165.40	246.09	90,582.00	1.45	8,425.59	7.46	66.49	(560)
Ln (assets)	Logarithm of the latest book value of assets of the firm prior to the credit decision	5.55	5.51	11.41	0.37	2.03	0.10	3.11	(560)
Age	Number of years the borrower has been in operation prior to the credit decision	14.65	11.00	66.00	0.00	10.82	1.07	4.09	(559)
Direct risk variables:									
Liability-to-assets ratio[(1)]	Liabilities divided by the assets of the borrowing firm	0.68	0.72	1.17	0.00	0.26	-0.76	2.95	(532)
Current ratio[(1)]	Current assets divided by current liabilities in the same year	1.22	1.01	7.36	0.00	1.06	2.41	10.80	(523)
Interest coverage ratio [(2)]	Earnings before interest expense, tax, depreciation and amortization divided by interest expense	2.23	1.35	15.98	0.00	2.63	2.33	9.17	(464)
Relationship variables:									
Housebank status	Dummy variable (= 1 if bank views itself as the primary bank of the borrower; =0 if otherwise)	0.49	0.00	1.00	0.00	0.50	0.03	1.00	(555)
Relationship duration	The number of years of bank-borrower relationship prior to the credit decision	7.96	6.00	36.00	0.00	6.51	1.46	5.40	(555)
Number of lending banks	Number of banks that the borrower has relationships with	4.36	3.00	44.00	1.00	4.76	3.61	22.05	(557)
Ln (number of lending banks)	Logarithm of the number of banks that the borrower has relationships with	1.11	1.10	3.78	0.00	0.82	0.42	2.78	(557)

[(1)] The variables "liabilities-to-assets ratio" and "current ratio" are screened and the most extreme 5% cases are excluded.
[(2)] The variable "interest coverage ratio" is screened and the most extreme 5% cases are excluded. Negative values are set to zero.

TABLE 2: Collateral Studies for Different Countries

Paper	Coun-try	Firm size and age	Type and size of loans	Relationship strength	Incidence of collateral[a)]	Degree of collateral[b)]
Leeth/Scott (1989)	U.S.	Small firms: mean number of employees: 12, mean age: 18 years	Mean loan size ~ 61,000 $		62	-
Berger/Udell (1995)	U.S.	Small firms: number of employees mostly < 50, mean asset size:2.3 m.$ mean age: 14 years	Lines of credit	Mean duration: 11 years	53	-
Boot/Thakor/Udell (1991)	U.S.	All firm sizes	All commercial loans		50-69	-
Harhoff/Körting (1998)	Germany	Small firms: median number of employees: 10, median age: 11 years	lines of credit	Mean duration: 13 years, mean number of lenders: 1.8	62	-
Lehmann/Neuberger (2001)	Germany	SMEs: turnover > 500.000 €, 54% younger than 10 years	Different loan types, loan size 50,000-5m. €	59% housebank relationships, duration: 60% less than 6 years	88	55
Machauer/Weber (1998), Elsas/Krahnen (2000)	Germany	Medium-sized firms: turnover 25-250 m. €	Large loans (size > 1.5 m. €)	35% housebank relationships (1996), mean duration > 20 years	66 (1992-96) 69 (1996)	69 (1992-96) 32 (1996)
Cowling (1999), Cowling/Sugden (1995)	U.K.	Small firms: median number of employees: 16, median age: 15	Different types, small loans (mean: 193,000 £)		79	> 100 (mostly 200-300)
Cressy/Toivanen (2001)	U.K.	SMEs	Small loans (mean: 19,000 £)		62	-
Degryse/Van Cayseele (2000)	Belgium	Small firms: employees < 10, turnover < ~7 m. €, mean age: 16 years	Mostly credits to consumers and to prepay taxes, small	58% main bank relationships, mean duration: 8 years	26	-
Jiménez/Saurina (2004)	Spain	All firm sizes	Different loan types, loan sizes mostly 24,000-150,000 €	Number of lenders: 1 (50%), 2 (20%), 3 (10%)	13	mostly 100
La Porta/Lopez-de-Silanes/Zamarripa (2003)	Mexico	Large firms	Largest loans of each bank	20% related loans	53 (related) 84 (unrelated)	119 (related) 290 (unrelated)
Present paper	Thailand	SMEs and large firms: Median asset size ~ 10 m.$, mean age: 15 years	Loan size in extreme 10 % percentiles: 570,000-36 m.$, mean: 9.6 m.$	49% housebank loans, mean duration: 8 years, mean number of lenders: 4.4	72	53

a): percentage of collateralized loans, b): mean collateral value as percentage of loan volume

TABLE 3: Mean Differences of Collateral (ANOVA)

Variable	Classification	Mean value	Significance of difference
Assets in percentiles	0-10	78.74	
	10-25	63.65	
	25-50	63.17	
	50-75	44.54	
	75-90	33.58	
	90-100	35.60	0.00
Housebank status	Housebank	65.26	
	Non-housebank	40.51	0.00
Bank size	Small	46.02	
	Medium	50.09	
	Large	59.20	0.00
Total mean		52.95	

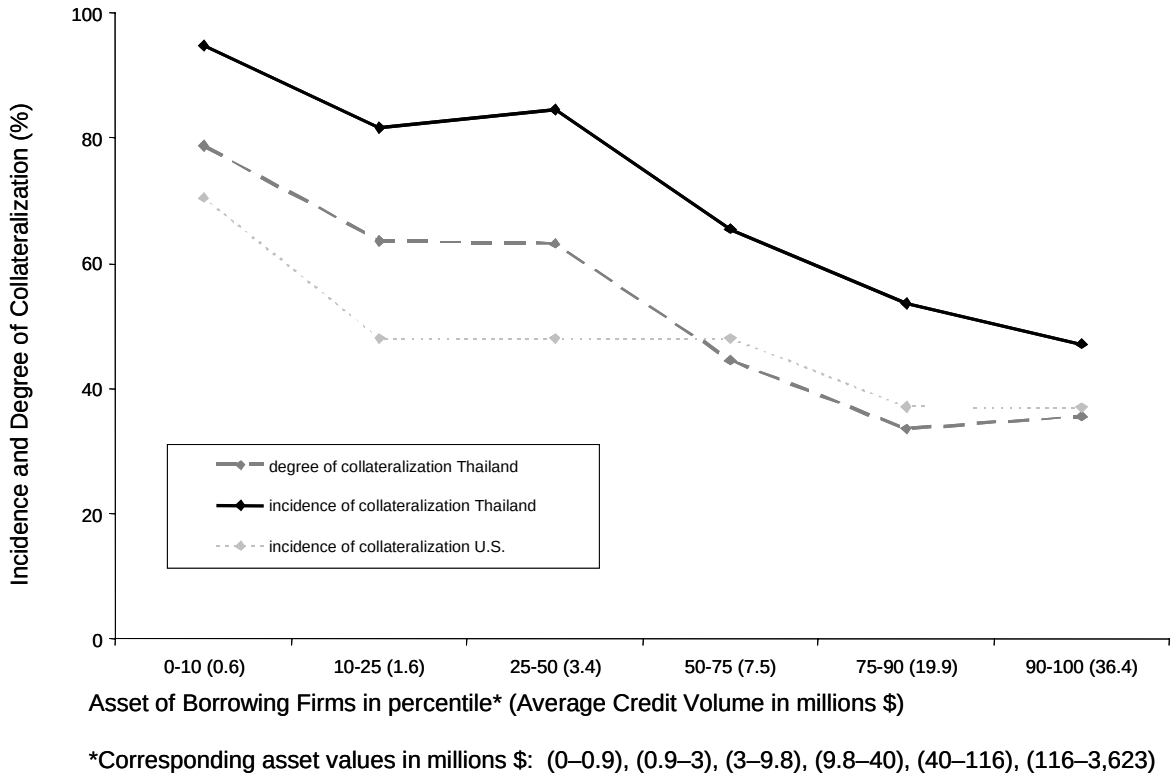
TABLE 4 : Determinants of Collateral (Probit and Tobit Results) [(a)]

	Incidence of Collateral (Probit)					Degree of Collateral (Tobit)				
Independent variables	**All**	**Small Firms**	**Large Firms**	**House-banks**	**Non-Houseb.**	**All**	**Small Firms**	**Large Firms**	**House-banks**	**Non-Houseb.**
Constant	2.67***	1.46	1.90*	6.49***	1.77**	181.33***	149.73***	90.46	209.59***	148.25***
	(2.04)	(1.46)	(1.12)	(6.49)	(1.12)	(138.67)	(141.21)	(47.23)	(192.03)	(86.01)
Ln (credit volume)	0.11	0.29	0.16	-0.21	0.16*	0.71	-4.90	10.47	-6.12	0.90
	(0.09)	(0.29)	(0.09)	(-0.21)	(0.10)	(0.54)	(-4.62)	(5.47)	(-5.60)	(0.52)
Company variables										
Age	-0.02 **	-0.06**	-0.01	-0.06**	-0.03**	-1.22**	-0.91	-0.81	-1.15**	-1.50*
	(-0.02)	(-0.06)	(-0.01)	(-0.06)	(-0.02)	(-0.94)	(-0.86)	(-0.42)	(-1.05)	(-0.87)
Ln(assets)	-0.25***	-0.70***	-0.16	-0.68***	-0.13*	-10.22***	2.37	-8.22	-9.40**	-6.87
	(-0.19)	(-0.70)	(-0.09)	(-0.68)	(-0-08)	(-7.82)	(2.24)	(-4.29)	(-8.61)	(-3.98)
Direct risk variables										
Liabilities-to-assets ratio	0.06	0.76	-0.17	1.16	-0.26	-24.60	-23.71	-20.97	-5.67	-50.56
	(0.05)	(0.75)	(-0.10)	(1.16)	(-0.17)	(-18.81)	(-22.36)	(-10.95)	(-5.20)	(-29.33)
Current ratio	-0.12	-0.25	-0.05	-0.29	-0.13	-7.70*	-10.43***	1.16	-2.53	-15.87
	(-0.09)	(-0.25)	(-0.03)	(-0.29)	(-0.08)	(-5.89)	(-9.83)	(0.60)	(-2.32)	(-9.21)
Interest coverage ratio	0.03	0.19*	-0.01	0.58***	0.04	-0.47	0.76	-1.79	-1.35	2.15
	(0.02)	(0.19)	(-0.01)	(0.58)	(0.03)	(-0.36)	(0.72)	(-0.94)	(-1.23)	(1.25)
Relationship variables										
Housebank status	0.43**	0.90*	0.43			21.67**	22.61**	28.60		
	(0.33)	(0.89)	(0.26)			(16.57)	(21.33)	(14.93)		
Relationship duration	-0.01	-0.06	0.01	0.08*	-0.02	0.13	-0.15	0.38	1.48*	-0.56
	(-0.01)	(-0.05)	(0.01)	(0.08)	(-0.01)	(0.10)	(-0.14)	(0.20)	(1.35)	(-0.32)
Number of lending banks	-0.30**	-0.06	-0.41**	0.26	-0.45***	-7.44	-0.18	-16.42	6.15	-11.49
	(-0.23)	(-0.06)	(-0.24)	(0.26)	(-0.29)	(-5.69)	(-0.17)	(-8.58)	(5.64)	(-6.67)
Control variables										
Bank dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	416	208	208	201	215	416	208	208	201	215
(McFadden) Adjusted R^2	0.36	0.52	0.32	0.61	0.30	0.27	0.25	0.13	0.14	0.26
Log likelihood	-160.35	-36.52	-97.55	-29.43	-103.17	-1138.79	-631.03	-472.83	-607.38	-508.13

*,**,***: Significance at the 10%, 5% and 1% level, respectively

(a) marginal coefficients in parentheses

FIGURE 1: Relationship between Collateralization and Assets of Firms



*Corresponding asset values in millions $: (0–0.9), (0.9–3), (3–9.8), (9.8–40), (40–116), (116–3,623)

Source: own composition, for U.S. data see Federal Reserve Bulletin (2004, p.60)