

**Relationship Lending, Accounting Disclosure,  
and Credit Availability during the Asian Financial Crisis\***

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#### Abstract

We examine whether lending relationships benefit firms by making credit more available during periods of financial stress. Our main finding is that during the Asian financial crisis of July 1997 through the end of 1998, relationship lending increased the likelihood that Korean and Thai firms would obtain credit but it had no effect on Indonesian and Philippine firms. We ask if accounting disclosure might explain the observed differences among the three countries for which audit information is available. We find that for Indonesian firms with weak lending relationships, banks replace relationship lending technology with a financial-statement lending technology. Such a result does not hold for Korean and Philippine firms.

The research on bank relationships argues that establishing a lending relationship with a bank can reduce asymmetries of information and create value for the borrower. This value can take either of two forms: one form is reduced interest rates for loans and reduced prices for other services offered by the bank, and the other is a commitment from the bank to extend loans in times of crisis. Previous empirical studies of relationship lending focus primarily on the price of services, specifically loan rates, offered by the bank and do not control for the possibility that bank relationships can be intertemporal in nature.<sup>1</sup> In other words, the interest rate a firm pays can be a function of a number of factors, including the borrower's expectation of lower rates in the future, its purchases of other services, and the probability of being supported by the bank in the future, as well as the lender's commitment to doing business in times of crisis. Such diverse possibilities can cause loan rate and relationship lending to have an ambiguous correlation. To illustrate, although Berger and Udell (1995) report that relationship duration has a negative effect on the loan rate, Degryse and Van Cayseele (2000) provide evidence that the correlation is positive, and Petersen and Rajan (1994) and Elsas and Krahnen (1998) report no significant correlation.

In contrast, our study examines the association between relationship lending and credit availability in times of crisis. By focusing not on the price of services but on the extension of loans in times of crisis, our approach seeks to observe whether a bank relationship has any value when it is needed the most.

The intuition that underlies our empirical model is that a firm enters relationship lending through a concentrated business relationship. The firm's objective in doing so is to increase the

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<sup>1</sup> Boot (2000), Degryse and Ongena (2002), and Ongena and Smith (2000b) provide thorough reviews of these studies.

likelihood that it will have access to bank credit in tough times (Petersen and Rajan 1994). Alternatively, a firm may seek multiple lenders to secure more stable financing because a single bank might experience its own liquidity problem (Detragiache, Garella, and Guiso 2000). We examine the validity of these competing objectives by investigating whether firms in Indonesia, the Republic of Korea, the Philippines, and Thailand that had strong lending relationships benefited from better access to credit during the Asian financial crisis that lasted from July 1997 through the end of 1998.

We measure the intensity of the bank relationship by the number of financial institutions with which the firm does business, and we define intensity as highest if a firm uses only one bank. Our data are from a survey conducted by the World Bank; the survey includes questions about whether firms had sufficient access to credit during the crisis and how many financial institutions the firm used in the course of its business.

Another problem with prior studies - besides not controlling for the possible intertemporal nature of bank relationships- is that they do not distinguish between opaque and transparent borrowers, a distinction based on the quality of the borrower's financial statements. The effects of financial transparency and disclosure on lending are important: to the extent that banks function as information processors, the transparency and disclosure reflected in independently audited financial information can either substitute for or complement a long-term lending relationship. Berger and Udell (2005) hypothesize that the value of relationship will be weaker for transparent firms because for those firms the lender's information problem in underwriting can be addressed more cost-effectively with certified financial statements (for example) than with relationship lending. Our data set allows us to test this hypothesis because the World Bank survey includes questions about whether the firm voluntarily supplied audited

financial statements or whether the bank *required* the firm to supply audited financial statements. Such data are rarely available, and they make it possible for us to discern the effect of transparency and disclosure on credit availability.

Our main finding, after we control for the endogenous decision to post collateral, the endogenous choice of number of lending relationships, and several firm-specific characteristics, is that during the Asian financial crisis, strong lending relationships increased both the economic and the statistical likelihood of obtaining credit for Korean and Thai firms. For example, during the crisis, on average, firms in Korea with one lending relationship have a 17.7% higher chance of obtaining credit than do firms with two lending relationships. In Thailand, the comparable average is 24.2%. For Indonesian and Philippine firms, however, we observe no significant association between relationship lending and credit availability.

When we formally test the Berger and Udell (2005) hypothesis that the value of relationship is weaker for transparent firms, we find that in Indonesia, even with weak lending relationships, firms that undergo mandatory audits face less credit constraint than do firms that voluntarily provide an audit. This finding suggests that for Indonesian firms with weak lending relationships, banks replace relationship lending technology with a financial-statement lending technology. We also find that the value of a mandatory audit is stronger for firms with weaker lending relationships than for firms with stronger relationships. In contrast, in Korea and the Philippines, mandatory audits prove not to be significant. The data do not allow us to explore the Berger and Udell hypothesis for Thai firms.

Section 1 explains the rationale for our empirical model, and Section 2 outlines the model's design. Section 3 describes the sample and data, Section 4 presents the empirical results, and Section 5 extends the study by examining the effect of accounting disclosure on credit

availability in the presence of relationship lending. Section 6 describes the robustness testing of our results, and Section 7 concludes.

## **1. RATIONALE FOR MODELING ACCESS TO BANK CREDIT**

We model the likelihood of having access to bank credit in tough times as a function of lender diversity and collateral pledged to obtain bank loans. The control variables are the firm's size, leverage ratio, profitability, growth opportunities, ownership structure, and the industry in which it is operating.

The *Lender Diversity* variable is a proxy for relationship strength and measures the number of financial institutions with which a firm does business. We define intensity as highest if a firm uses only one bank. The implicit assumption in this definition is that there is an inverse monotone link between number of bank relationships and intensity of bank-firm relationships. We realize that this assumption can be considered as being strong because recent theory argues that in addition to the number of relationships, the composition of lending also matters for intensity (Minetti 2004, Minetti and Guiso 2004). However, the survey does not provide data on intensity of relationships like duration of lending relationships, or firm-specific market shares of banks.

*Collateral* is our proxy for the cost of lending. *Collateral* includes assets such as land and buildings, machinery and equipment, and stocks. Since the survey data focus on the type of asset rather than the ownership of the asset, we cannot identify whether the variable measures "inside collateral" (assets owned by the firm) or "outside collateral" (assets not owned by the firm).<sup>2</sup>

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<sup>2</sup> These two types of collateral address adverse selection and moral-hazard problems differently. "Inside collateral" defines the loan's priority over future cash flows and provides

*Lender Diversity* and *Collateral* can be endogenously determined along with the credit decision. Therefore, we allow for their endogeneity in our empirical estimation. *Lender Diversity* is endogenous because when firms choose the number of banks they will do business with, they consider the costs and benefits of having multiple bank relationships. For example, Thakor (1996) argues that in a multiple banking relationship each lender's incentive to screen is reduced, which in turn reduces the probability of the firm's obtaining a loan. Internal monitoring (as signaled by the existence of a board of directors or of independent directors on the board) can substitute for screening by lenders, and in this case having multiple lenders may not lead to a lower probability of obtaining loans. Guiso and Minetti (2004) underscore another dimension of the decision about the number of banks to do business with by showing that firms with more valuable and deployable assets tend to choose multiple banking relationships. Finally, Elsas, Henemann, and Tyrell (2004) argue that the optimal number of bank relationships is determined when firms balance the risk of lender coordination failure against the bargaining power of a pivotal relationship bank.

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incentives for the lender to monitor (Rajan and Winton 1995). When inside collateral is pledged, the lender monitors the collateral to ensure that the loan amount does not exceed the value of the collateral. While monitoring the collateral, the lender gains additional information about the firm's performance and health (Swary and Udell 1988). "Outside collateral" can reduce the borrower's adverse selection since it can be used as a signal of borrower quality (Besanko and Thakor 1987, Boot, Thakor, and Udell 1991). In addition, outside collateral increases payment to the lender when the borrower defaults (Besanko and Thakor 1987) and affects the borrower's incentives for strategic default (Bester 1994).

*Collateral* is endogenous because it is part of the implicit cost of borrowing (Brick, Kane, and Palia 2003). A firm decides on a collateral pledge at the same time it makes the borrowing decision.

We choose several variables to serve as instruments for the decision on the number of banks to do business with (*Lender Diversity*) and on the posting of collateral. These instruments are existence of a board of directors, independent directors on the board, trade with foreign countries, government incentives used by the firm, credit obtained from suppliers, and the level of the firm's tangible assets.

*Board of Directors* and *Independent Directors on the Board* capture the strength of the firm's internal monitoring. A strong monitoring mechanism can reduce the free-rider problem that lenders face with firms that have multiple bank relationships and can thus allow the firm to have banking relationships with several banks. These two variables can also be associated with *Collateral* since the board can monitor the firm's business activities, thereby affecting the firm's performance (Hermalin and Weisbach 2003). Overall, the presence of a board, and of one with outside or independent directors, can provide better corporate governance.

*Trade* with foreign countries is likely to be associated with both *Lender Diversity* and *Collateral*. Firms that trade internationally have greater investment opportunities, which can affect the number of lending relationships the firms build. On the one hand, when a firm has high growth opportunities, a bank that has an informational monopoly on the firm can extract greater rents (Petersen and Rajan 1994, Houston and James 1996). On the other hand, the firm can mitigate the lender's informational monopoly by building several lending relationships. Trade is correlated with *Collateral* because firms with greater investment opportunities may be more complex, so that lenders have greater informational problems. For instance, a firm's prospects

depend on the health not only of the domestic market but also of foreign markets.

Collateralization can address these complexities and the associated informational problems.

Government incentives used serve as a cushion and decrease the participating firm's probability of default. Alternatively, only firms in weak or poor condition can qualify to participate in government programs. For these reasons, *Government Incentives* are related to *Collateral*. Government incentives used can also affect the number of lending relationships a firm builds in that if government programs provide financial assistance, the firm's need to rely on bank loans may decrease.

Since a supplier is an additional source of credit along with financial institutions, obtaining credit from suppliers can affect *Lender Diversity*. *Supplier Credit* can measure the mitigation of lender coordination failure (Elsas, Heinemann, and Tyrel 2004), lender's negative liquidity shock (Detragiache, Garella, and Guiso 2000), and alleviation of the hold-up problem (Rajan 1992).

Finally, the tangible asset ratio (the sum of machinery, equipment, and buildings to total assets) can be considered a proxy for the liquidity cost (Guiso and Minetti 2004) and the value of collateral.

## 2. MODEL DESIGN

The probability of a firm experiencing credit constraint as a function of relationship strength (*Lender Diversity*), *Collateral*, and other control variables is

$$Credit\ Constraint^* = \beta_0 + \beta_1 * Lender\ Diversity + \beta_2 * Collateral + X_1 \beta_3 + \mu \quad (1)$$

$$Credit\ Constraint = 1 \quad [Credit\ Constraint^* > 0] \quad (2)$$

$$Credit\ Constraint = 0 \quad [Credit\ Constraint^* \leq 0] \quad (3)$$

where *Credit Constraint\** is the unobserved latent variable measuring the degree of deterioration in credit availability since the onset of the crisis. In Equation (1),  $\beta_0$  is the constant,  $\beta_1$  and  $\beta_2$  are coefficients, and  $\beta_3$  is a vector of coefficients; and  $\mu$  is the error term.  $X_1$  is a set of exogenous variables that include firm size, debt capacity, profitability, growth opportunities, ownership structure, and the industry binary variables.

The standard two-stage least-squares method is not appropriate for dealing with the potential endogeneity of *Lender Diversity* and *Collateral* since the dependent variable is binary. Instead, we adopt the two-step estimation method developed in Rivers and Vuong (1988).

To apply the Rivers and Vuong method, we model *Lender Diversity* and *Collateral* in Equation (1) as reduced-form equations

$$Lender\ Diversity = \beta_{10} + X_1\beta_{11} + X_2\beta_{12} + \nu_1 \quad (4)$$

$$Collateral = \beta_{20} + X_1\beta_{21} + X_2\beta_{22} + \nu_2, \quad (5)$$

where  $X_1$  and  $X_2$  are a set of exogenous variables, and  $\nu_1$  and  $\nu_2$  are the error terms. We use the exogenous variables  $X_2$  only in Equations (4) and (5), where they serve as instruments for the *Lender Diversity* and *Collateral* variables.

The endogeneity in the model can arise from potential correlations of *Lender Diversity*, *Collateral*, and the error term  $\mu$  in Equation (1). Rivers and Vuong (1988) assume that  $(X_1, X_2, \mu, \nu_1, \nu_2)$  is independent and identically distributed. Furthermore,  $\mu, \nu_1, \nu_2$ , conditional on  $X_1$  and  $X_2$ , have a joint normal distribution with mean zero. Under these conditions,  $\mu = \theta_L \nu_1 + \theta_C \nu_2 + \eta$ . In other words, the estimated equation is

$$\text{Credit Constraint} = \beta_0 + \beta_1 \text{Lender Diversity} + \beta_2 \text{Collateral} + X_1 \beta_3 + \theta_L \nu_1 + \theta_C \nu_2 + \eta \quad (6)$$

where  $\eta | X_1, \text{Lender Diversity}, \text{Collateral}, \nu_1, \nu_2$  is  $N(0, \sigma_{\mu\mu} - (\Sigma_{\nu\nu}^{-1} \Sigma_{\nu\mu})' \Sigma_{\nu\nu} (\Sigma_{\nu\nu}^{-1} \Sigma_{\nu\mu}))$ ,  $\Sigma_{\nu\nu}$  is a (2x2) variance-covariance matrix, and  $\Sigma_{\nu\mu}$  is a (2x1) vector. The variance of  $\eta$  is normalized to one.

We estimate Equation (6) by using a two-stage conditional maximum likelihood approach, as suggested by Rivers and Vuong (1988). In the first step, we estimate reduced-form equations of *Lender Diversity* and *Collateral* by ordinary least squares (OLS) and save the residuals,  $\hat{\nu}_1$ , and  $\hat{\nu}_2$ . In the second step, we run the probit *Credit Constraint* on  $X_1, \text{Lender Diversity}, \text{Collateral}, \hat{\nu}_1$ , and  $\hat{\nu}_2$  to obtain consistent estimates.

An advantage of the Rivers and Vuong (1988) approach is that we can directly test the exogeneity of the *Lender Diversity* and *Collateral* variables. The probit  $t$ -statistics on  $\hat{\nu}_1$  and  $\hat{\nu}_2$  are valid tests under the null hypothesis,  $H_0: \theta_L = \theta_C = 0$ . If the estimated coefficients on  $\hat{\nu}_1$  and  $\hat{\nu}_2$  are not significantly different from zero, then we fail to reject the null hypothesis that *Lender Diversity* and *Collateral* are exogenous. We can apply this test of exogeneity very broadly, even when the potentially endogenous variables are binary (Wooldridge 2002).

### 3. DATA SOURCE AND VARIABLE CHARACTERISTICS

The data for our analysis come from a private-sector firm-level survey conducted by the World Bank at the end of 1998, following the Asian financial crisis. The data cover the three years 1996–1998, which include pre-crisis and crisis periods, and the survey covers the majority

of the enterprises in five Asian countries that experienced the crisis: Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand.<sup>3</sup>

For each country, the World Bank selected the plants/firms from five to seven sectors: auto parts, chemicals, construction materials, electronics, food, garments and textiles, and machinery. These manufacturing sectors are the largest contributors to GDP, and their products are largely tradable goods. According to Hallward-Driemeier (2001) the survey included only firms with at least 20 employees, and a large majority of the survey respondents (76%) are single-plant firms.

The survey randomly chose the plants/firms of each country from pools of large, medium, and small firms, and each size category accounted for roughly one-third of the total number of surveyed firms. Most of the firms chosen were not listed on their country's stock exchange. For all countries the data collection used similar currency instruments and sampling methods so that cross-country comparisons could be made directly (Hallward-Driemeier 2001).

The stated objective of the World Bank survey was “to collect up to date information on the financial structure, labor profile, production, and management due to the impact of the Asian financial crisis on manufacturing establishments” (Hallward-Driemeier 2001). The survey asked firms to provide information for three specific periods: from the beginning of 1996 to the end of June 1997, from July of 1997 to the end of 1997, and from the beginning to the end of 1998. The second half of 1997 and the year 1998 represent the crisis period, and the period before the second half of 1997 represents the pre-crisis period.

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<sup>3</sup> Our analysis does not include Malaysia because that country's data are not accessible outside the World Bank.

Table 1 reports summary statistics of the variables used in our study.<sup>4</sup> The data include 320 Indonesian firms, 557 Korean firms, 171 Philippine firms, and 396 Thai firms. We observe that across the sample countries, the percentage of firms constrained for credit after the onset of the crisis was 41.25% in Indonesia, 54.58% in Korea, 46.80% in the Philippines, and 55.53% in Thailand.

In our sample countries there is some variation in how firms structure their relationship with banks. The mean (median) values of the variable *Lender Diversity* in Indonesia, Korea, the Philippines, and Thailand are 1.93(1), 5.96(4), 3.06(2), and 2.29(2), respectively. This distribution shows that average firms in these four Asian countries maintain several lending relationships rather than a single relationship.

Our finding supports that of Ongena and Smith (2000a) for Europe. They find that among firms in 20 European countries, single-bank relationships are relatively uncommon. However, over the entire sample of 20 European countries, they report that the mean value of the bank relationships of firms is 5.6, which is higher than the mean for our sample of Asian countries. One possible reason for the higher average in Europe is differences in the survey questions used to measure the number of bank relationships. Ongena and Smith (2000a) measure that number by taking the number of banks that firms use for cash management purposes within their own country (roughly 90% of the firms list “lending-related” activities as part of their cash management).

We observe that Indonesia shows the most concentrated bank relationship: roughly 80.0% (not reported in Table 1) of the sample firms in Indonesia do business with only two or

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<sup>4</sup> Appendix A describes how we construct these variables from the survey questions.

fewer banks. Thailand and the Philippines follow Indonesia with 73.7% and 53.2%, respectively. Korean firms show the most dispersed lending relationship with 25.9%.

Table 1 also shows that collateral posting is most frequent in Korea (85.64%), which also happens to be the country where *Lender Diversity* is the highest. The negative association between relationship strength and collateral posting supports the rationale that lending relationships build trust and mitigate information asymmetries between the lender and the borrower (Brick, Kane, and Palia 2003). Collateral posting is less frequent in Indonesia and the Philippines: 66.56% and 60.10% of firms, respectively, reported having to post collateral. The collateral information for Thailand is not available.

These numbers are similar to those of earlier studies that examine collateral posting in credit lines in the United States. For instance, Brick, Kane, and Palia (2003) report that 60% of the credit lines in their sample report having posted collateral, while Berger and Udell (1995) report 53%.

We also observe that *Required Audit*, the proportion of firms that banks require to be audited, varies widely across the three countries for which the data are available. In the Philippines the proportion is 87.70%; in Korea, 62.12%; and in Indonesia, 39.38%. In Indonesia, 38.44% of firms obtained an independent audit; in Korea, 65.53%; and in the Philippines, 91.20%.

Finally, the sample is biased toward medium and large firms—those with more than 50 employees. In our four countries, the percentage of firms with more than 50 employees ranges between 64% and 78%.

#### 4. RESULTS

Table 2 reports our first-stage OLS estimates for the *Lender Diversity* equation for the four countries (Equation 4).

We observe that the *Size* variable (measured by the logarithm of the number of employees) is positive and statistically significant in explaining the number of lending relationships in all four countries. This finding shows that smaller firms might be less likely to enter into multiple lending relationships if they will face duplication of monitoring costs and free-rider problems. Such costs will reduce the benefits of multiple relationships in mitigating hold-up costs.

*Leverage ratio* proves to be positive and significant in Indonesia, Korea, and Thailand. This observation indicates that firms that maintain relatively concentrated borrowing tend to have lower leverage ratios (Cosci and Meliciani 2002, Degryse and Ongena 2001).

The variable *Plan to Expand* has a significant positive effect on the number of lenders in the Philippines, suggesting that to avoid lenders' informational monopoly, firms with high growth potential tend to build several lending relationships. The variable *Plan to Expand* is positive but statistically insignificant in the other three countries.

Our measure of profitability, *Capacity Utilization*, affects the number of lenders differently across countries. It has a positive but insignificant effect in Korea, the Philippines, and Thailand, but a negative significant effect in Indonesia. Earlier studies also find mixed results on the effect of profitability on the number of lenders. Detriagiache, Garella, and Guiso (2000) find a positive but insignificant effect of profitability on the number of multiple relationships. Fok, Chang, and Lee (2004) and Degryse and Ongena (2001), however, do find that more profitable firms borrow from fewer banks.

Table 2 also reports the significance of the instrumental variables included in the *Lender Diversity* equation. In Korea, firms with independent directors on the board tend to maintain a greater number of lending relationships. Similarly, in the Philippines and Thailand, firms with a board of directors have more lending relationships. Hence, in these three countries firms with a board or with independent directors are not constrained to build an exclusive relationship with a lender that will commit to monitoring; rather, they build multiple relationships. In Indonesia and the Philippines, firms that use supplier credit are more likely to have many lending relationships. In Indonesia and Thailand, importers are more likely to have several lending relationships.

Table 2 shows that  $R^2$  for Equation (4) ranges from 0.26 for Indonesia to 0.35 for Thailand. The overall fit of the specification for *Lender Diversity* is comparable to that of other studies.<sup>5</sup>

Table 3 presents our OLS estimates of Equation (5), which models the incidence of collateral posting. We do not estimate Equation (5) for Thailand because in the survey data the variable *Collateral* is missing. Instead, as a proxy for collateral posting for Thai firms we use

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<sup>5</sup> For instance, Cosci and Meliciani (2002) report, depending on the estimation method, pseudo  $R^2$ s between 0.12 and 0.20. Fok, Chang, and Lee (2004) report that OLS regressions that include firm size, age, performance, and leverage, along with other bank variables, achieve an  $R^2$  of 0.22. Using Tobit regressions, Ongena and Smith (2000) achieve pseudo  $R^2$  between 0.40 and 0.80 depending on whether industry and country indicator variables (variables that measure stability, degree of concentration in banking industry, the strength of judicial system, and credit protection) are included. Degryse and Ongena (2001) analyze the factors that determine the number of bank relationships for a sample of Norwegian firms, and their regression results produce pseudo  $R^2$  between 0.06 and 0.25.

*Guarantee*, which is similar to outside collateral (Avery, Bostic, and Samolyk 1998). Given that we cannot distinguish whether the variable *Collateral* measures inside or outside collateral, substituting *Guarantee* for *Collateral* in Thailand may be inappropriate. Hence, we also estimate Equation (1) without *Guarantee* for Thailand. The results remain qualitatively unchanged.

Our measure of size, log of employees, is positively and significantly related to collateral posting in Indonesia and Thailand. For all four countries, the leverage ratio is positive and statistically significant. This result indicates that lenders require extra protection from high levered firms. In contrast, *Foreign Ownership* is negatively related to collateral posting, and has statistical significance, in Indonesia, Korea, and the Philippines. In other words, lenders view firms with foreign affiliates as less risky and do not require extra protection.

Table 3 also reports the significance of instrumental variables included in the *Collateral* equation. Several instruments have a significant effect on the collateral decision. For instance, Korean firms that use government incentives are more likely to post collateral, possibly because lenders demand that the loans be secured by the incentives. In Thailand, importers and exporters are more likely to post collateral, perhaps because these firms are more complex and can have greater informational problems. In the Philippines, firms with high tangible assets are more likely to post collateral.

In Table 4 we report the multivariate probit results that explain the determinants of the credit constraint, using *Lender Diversity*, *Collateral*, and  $\mathbf{X}_1$  as our set of explanatory variables. The coefficients of the residuals from the first-stage *Lender Diversity* and *Collateral* equations are not jointly significant. This finding shows that we fail to reject the null hypothesis of endogeneity in variables *Lender Diversity* and *Collateral*. Hence, the coefficient estimates of Equation (6) are both consistent and efficient.

We find that the direction and significance of the correlation between *Lender Diversity* and credit availability vary across our sample countries. Although we observe insignificant correlations in Indonesia and the Philippines, *Lender Diversity* and *Credit Constraint* are significant at 10% and positively related in Korea and Thailand.

We investigate whether the effect of *Lender Diversity* on credit constraint is economically significant by estimating the change in the predicted probability of credit constraint for a firm increasing its *Lender Diversity* from one to two. We hold all the other explanatory variables at their mean values. In Korea, when a firm increases its *Lender Diversity* from one to two, the average probability of credit constraint increases by 17.7%. In Thailand, the average probability increases by 24.2%. In other words, during the crisis, firms in Korea and Thailand with more lending relationships experienced greater credit constraint.

These results provide support for Petersen and Rajan (1994) arguments that relationship lending increases the likelihood to obtain bank credit in tough times. We also observe that establishing a close relationship with a bank can have different effects on credit availability in different countries. One possible explanation for this result is differences in the financial structure and health of the banking system across countries during the period in question. Appendix B summarizes the state of the banking industry before and during the crisis. When lenders are poorly capitalized, as they were in Korea and Thailand, they become more selective in their loan decisions. We observe that in such an environment, relationship lending is helpful and firms benefit from banking with a smaller number of lenders. This result supports earlier studies, which observe that having information on the borrowers reduces the adverse selection problem banks face during periods of financial distress (Bodenhorn 2003, Boot and Thakor 1994, Cole 1998, Diamond 1991, Harhoff and Korting 1998, and Petersen and Rajan 1995). In

contrast, when the banking system is healthy and well capitalized, as it was in the Philippines, the insurance role of a lending relationship during a crisis can be ineffective. During a mild crisis, one when firms are not severely liquidity constrained, the benefit of a strong lending relationship can be hard to capture. Such a scenario may be what we observe for the Philippines.

Finally, dominance by state-owned banks, as in Indonesia, can mitigate the value of relationship lending. State-owned banks differ from privately owned banks in a number of ways. First, there is evidence that state-owned banks pursue political rather than economic objectives (Sapienza 2004). For instance, state-owned banks can be mandated to supply credit to firms in specific industries, sectors, or regions. Second, government ownership can distort the state-owned banks' allocation of financial resources so that the institutions end up providing funds to firms that are not creditworthy. Third, it is possible that state-owned banks are larger and are disadvantaged in relationship lending. The absence in Indonesia of a correlation between lending relationship and credit availability may be partly attributable to our sample reflecting the general lending strategy of state-owned banks. The case of Indonesia clearly illustrates how the structure of the banking system can affect the feasibility of different lending technologies.

Unfortunately, from our survey data we cannot sort our sample firms by the kinds of banks (state owned or private) with which they have lending relationships. If our Indonesian sample includes firms that maintain lending relationships with both state-owned and private banks, then our estimation results for Indonesia can be noisy. However, if a large share of our Indonesian firms borrowed from state-owned banks, it is plausible that, on average, we would not observe the value of lending relationships in Indonesia.

The coefficient estimate for *Collateral* shows that posting collateral has a significant positive effect on *Credit Constraint* for firms in the Philippines. When evaluated at mean values

for all the other explanatory variables, posting collateral increases credit constraint by 43% in the Philippines. Having a guarantor (proxy for *Collateral* in Thailand), however, has a significant negative effect in Thailand; it decreases credit constraint by 17% in Thailand.

The firm's leverage is positive and statistically significant in Thailand. This finding indicates that high leverage firms experience greater likelihood of credit constraint during a crisis; when evaluated at mean values for all the other explanatory variables, a 1% increase in leverage ratio raises credit constraint by 0.5%. The positive correlation between leverage and credit constraint in Thailand supports the results in Holmstrom and Tirole (1997), who find that capital-poor firms are the first to get squeezed when bank capital decreases. Moreover, Korean, Philippine, and Thai firms that had plans to expand were more likely to experience credit constraint, although the coefficients are not statistically significant. It is possible that lenders viewed firms with expansion plans as too aggressive and as posing a greater credit risk to the lender. *Capacity Utilization*, which we use as a proxy for firm performance and condition, has an insignificant effect on credit constraint during the crisis.

The coefficient estimates for *Foreign Ownership* are negative and statistically significant for Indonesia, Korea, and Thailand. This finding suggests that firms with foreign affiliates are less likely to experience credit constraint during a crisis. For firms in Indonesia, having foreign direct investment can reduce credit constraint by 25% on average; in Korea and Thailand, by 30% and 25%, respectively, on average. Moreover, in Korea the crisis hit the firms in the machinery industry the hardest (in terms of increased credit constraint). Firms in the other industries were 9–20% less likely to experience greater credit constraint.

## 5. RELATIONSHIP LENDING AND ACCOUNTING DISCLOSURE

An alternative explanation for the country differences is that they may be due to variations in the banks' use of audited financial statements in each country. Relationship lending is not the only lending technology that small and medium-sized enterprises can use to get credit. Among the alternative technologies are financial-statement lending, small-business credit scoring, and asset-based lending (Berger and Udell 2005). Our survey data do not allow us to identify all the lending technologies used by lenders, but they do let us identify firms for which lenders might have used financial-statement lending technology. We examine how the use of that technology affected firms' access to credit during the crisis.

Relationship lending is based on soft information gathered through close contact with a firm. Financial-statement lending, in contrast, is based on hard information gathered from a firm's financial statements. Relationship lending is largely used for more opaque firms for which informative financial statements are not available. Financial-statement lending is used for transparent firms where the bank can rely on the informativeness of the financial statements, such as those validated in independent audits. Certification of a firm's financial statements by an independent auditor bestows on the firm's financial condition a credibility on which the lender can base its credit decision.

Which of the two technologies a lender uses depends largely on the characteristics of the individual firm. Accordingly, these two lending technologies may be substitutes for each other. We examine the interaction between relationship strength and audited financial statements in terms of the effect each has on credit availability.

Our survey data enable us to measure whether a firm procured an independent audit of its financial statements, *Audit*, or whether the firm procured an independent audit when the lender

required audited financial statements, *Required Audit*. We use these two measures as our proxy for the use of financial-statement lending technology. Use of these two measures allows us to identify firms with mandatory audit (*Required Audit* = 1, *Audit* = 1) and firms with voluntary audit (*Required Audit* = 0, *Audit* = 1).

Panels A through I of Table 5 summarize the number of firms with *Audit* and *Required Audit* for Indonesia, Korea, and the Philippines. The variables *Audit* and *Required Audit* for Thailand are not available in the survey data. Panel A reports the number of Indonesian firms with different combinations of *Audit* and *Required Audit*. Out of a total sample of 320 firms, 123 (38.4%) provide an audit when applying for a loan. Of those 123, 88 firms (27.5% of the total sample) submit mandatory audits, and 35 (10.9% of the total sample) submit voluntary audits. In Indonesia, therefore, the number of firms with mandatory audits is more than twice the number with voluntary audits.

Panels B and C of Table 5 compare *Audit* and *Required Audit* for firms in Indonesia with single lending relationships and for firms with multiple lending relationships. Of firms with multiple lending relationships, lenders require 53.1% to provide audit—nearly twice the 27.7% for the firms with a single lending relationship. These numbers show that lenders are more likely to require an audit from firms with which they have weak lending relationships than from firms with which they have strong lending relationships.

We observe a similar pattern in Korea (Panels D through F). Of firms with a single lending relationship, lenders require 26.7% to provide an audit, compared with 65.3%—a substantially higher percentage—of firms with many lending relationships.

We do not see the same pattern in the Philippines. In the Philippines, lenders require audits from a large percentage of firms regardless of the number of the firms' lending

relationships. Of firms with a single lending relationship, lenders require 91.5% to provide audits, and of firms with several lending relationships, 86.3%. This finding suggests that in the Philippines, relationship and financial-statement lending technologies may not be substitutes for each other.

### 5.1. Model Specification

To expand the model of the probability of a firm's being constrained for credit during the crisis, in Equation (7) we include an indicator of a firm's informative financial statements. We test for the joint effect of informative financial statements and the strength of a lending relationship on credit availability.

$$\begin{aligned}
 \text{Credit Constraint}^* = & \xi_0 + \xi_1 \text{Lender Diversity} + \xi_2 \text{Collateral} + \xi_3 \text{Audit} \\
 & + \xi_4 \text{Required Audit} + \xi_5 \text{Audit} * \text{Lender Diversity} + \xi_6 \text{Required Audit} * \text{Lender Diversity} \\
 & + \xi_7 \text{Audit} * \text{Required Audit} + \xi_8 \text{Audit} * \text{Required Audit} * \text{Lender Diversity} + X_1 \xi_9 + \varepsilon
 \end{aligned}
 \tag{7}$$

In Equation (7),  $\xi_0$  is the constant term;  $\xi_1, \xi_2, \xi_3, \xi_4, \xi_5, \xi_6, \xi_7,$  and  $\xi_8$  are the coefficients;  $\xi_9$  is a vector of coefficients; and  $\varepsilon$  is white noise.

The equation controls for the changes in *Lender Diversity* ( $\xi_1$ ), *Collateral* ( $\xi_2$ ), *Audit* ( $\xi_3$ ), and *Required Audit* ( $\xi_4$ ). The second-level interactions control for changes in *Lender Diversity* for audited firms ( $\xi_5$ ), changes in *Lender Diversity* for firms with required audit ( $\xi_6$ ), and variations in *Audit* and *Required Audit* ( $\xi_7$ ). The third-level interaction ( $\xi_8$ ) captures the effect of *Lender Diversity* on *Credit Constraint* for firms with mandatory audit.

As stated earlier, mandatory audit refers to a lender's requiring the borrowing firm to provide an audited financial statement and the firm's complying (*Required Audit* = 1, *Audit* = 1), but voluntary audit refers to a firm's obtaining an independent audit even though a lender has not

required it (*Required Audit* = 0, *Audit* = 1). Such a distinction allows us to test the following hypothesis about the value of audit when it is mandatory and when it is voluntary.

*HYPOTHESIS 1 (H1): Lending relationship strength affects Credit Constraint equally for firms with mandatory audits and firms with voluntary audits.*

Test of this hypothesis requires the evaluation of the equality of the following two conditional derivatives:

$$\frac{\partial E(\text{Credit Constraint})}{\partial \text{Lender Diversity}} \Big|_{\text{Required Audit}=1, \text{Audit}=1} = \frac{\partial E(\text{Credit Constraint})}{\partial \text{Lender Diversity}} \Big|_{\text{Required Audit}=0, \text{Audit}=1}$$

Evidence of the violation of this equality indicates that the effect of lending relationship strength on *Credit Constraint* differs depending on whether firms have mandatory audit or voluntary audit.

## 5.2 Empirical Results

Table 6 shows the probit analysis of *Credit Constraint* in Equation (7) when we include the variables *Audit*, *Required Audit*, *Audit\*Lender Diversity*, *Required Audit\*Lender Diversity*, *Audit\*Required Audit*, and *Audit\*Required Audit\*Lender Diversity* as additional explanatory variables. Including these variables does not materially change the findings reported in Table 4.

Lending relationship strength continues to have a statistically insignificant effect on *Credit Constraint* in Indonesia. Notably, the coefficient on the triple interaction term ( $\xi_8$ ) is negative and statistically significant, suggesting that a mandatory audit mitigates the adverse effect of weak relationship on credit availability.

In Table 6 we also report the statistical tests of Hypothesis 1. We observe that for a given change in *Lender Diversity*, the difference in the effect of mandatory audit and voluntary audit on *Credit Constraint* is negative and statistically significant. This difference measured by the set

of coefficients in equation (7) is  $-1.771 ((\xi_1+\xi_5+\xi_6+\xi_8)-(\xi_1+\xi_5)=\xi_6+\xi_8=-1.771)$  suggesting that lending relationship strength has a weaker effect on *Credit Constraint* for firms with mandatory audit than for firms with voluntary audit. The high F-statistics at 14.17 suggests that we can reject Hypothesis 1—that lending relationship affects *Credit Constraint* equally for firms with mandatory audit and firms with voluntary audit.

In other words, to make a credit decision for firms for which the use of financial-statement lending technology is suitable, lenders require audits and rely less on the soft information acquired through a lending relationship. At the same time, however, a borrower's merely providing audited financial statements does not guarantee that the lender will use the financial-statement lending technology. This result supports the Berger and Udell (2005) hypothesis that relationship lending and financial-statement lending are two separate lending technologies.

In Korea, the estimated coefficient of *Lender Diversity* continues to be positive and statistically significant. An increase in *Lender Diversity* from one to two increases the probability of credit constraint during the crisis by 16%. Unlike in Indonesia, The statistically insignificant F-statistics suggests that the effect of *Lender Diversity* on *Credit Constraint* does not differ for firms with mandatory compared with voluntary audits in Korea.

In the Philippines, *Lender Diversity* continues to have an insignificant effect on *Credit Constraint*. Moreover, neither a mandatory nor a voluntary audit mitigates the adverse effect of weak lending relationship on *Credit Constraint*. We find that the interaction of audit and relationship strength differs across our sample countries, perhaps because the audit environment itself differs across these countries.

According to Fan and Wong (2002), the use of Big Five or Big Five–affiliated auditors is widespread in Indonesia: in their sample of Indonesian firms during the 1994–1996 period, 88% used Big Five and Big Five–affiliated firms. This percentage is the highest among the eight Asian countries they analyzed. During the same period, the percentages for Korea and the Philippines were 71 and 62, respectively. Most important, in 1996, the year before the crisis, 91% of Indonesian firms used Big Five auditors, while the percentages in Korea and the Philippines were 71 and 70. This evidence suggests that the information environment in a country can affect the type of lending technologies used. In a country like Indonesia, which has strong accounting standards and reputable accounting firms, there is evidence that lenders use financial-statement lending technology. In contrast, in countries with weaker accounting standards, financial-statement lending technology might not be widely used, and in such countries we do not observe relationship-lending technology replacing the financial-statement lending technology.

We note that in the Philippines, an audit is commonly required as part of a loan application; only a few firms do not submit audited statements. In the Philippines, therefore, requiring an independent audit may be a standard procedure in loan underwriting rather than a proxy for the use of financial-statement lending technology.

It is possible that some of the banks in Korea and the Philippines used other types of lending technologies that our model does not capture. For example, banks might have made credit decisions using small-business credit scoring or asset-based lending. Data limitations, however, make it impossible for us to identify such other types of lending technologies.

## 6. ROBUSTNESS TESTS

To investigate whether the variable *Credit Constraint* really does capture the difficulty firms faced in obtaining credit during the crisis, we examine the association between the variable *Credit Constraint* and loan denials. We use the survey question “Did a bank or finance company decline to grant you a loan?” The firms responded “yes,” “no,” or “N.A.” for the periods (a) January 1 to June 30, 1997; (b) July 1 to December 31, 1997; and (c) all of 1998. If the firm responds “yes” to a particular period, we interpret the response as indicating that the firm experienced a loan denial during that period. For instance, if a firm responds “yes” to (a) and (b) but responds “no” to (c), then we code the *Loan Denial \_first half of 1997* as one, *Loan Denial \_second half of 1997* as one, and *Loan Denial \_1998* as zero. We construct the variable *LoanDenialChange*, which measures how a firm’s access to credit changes during, compared with before, the crisis. For example, *LoanDenialChange* takes a value of one if a firm was granted a loan before the crisis (*Loan Denial \_first half of 1997* = 0) but reported having been denied one during the crisis (*Loan Denial \_second half of 1997* = 1 or *Loan Denial \_1998* = 1); zero if there was no change in loan denial status (i.e., either the firm was denied a loan both before and during the crisis or did not experience loan denial in either period); and negative one if a firm was denied a loan before the crisis but was not denied one during the crisis.

We replace *Credit Constraint* with *LoanDenialChange* in our regression analysis. Firms can experience more, less, or no change in loan approval during the crisis compared with the period preceding the crisis. We test whether such a change in loan approval can be explained by the strength of the lending relationship. We find that firms with weak lending relationships were more likely to experience an adverse change (denied a loan during, but not before, the crisis) in Korea and Thailand. However, the strength of the lending relationship had an insignificant effect

in Indonesia and the Philippines. These findings are consistent with the results when we use *Credit Constraint*.

We also estimate the *Credit Constraint* equation by using an ordered probit regression for Korea and Thailand. The survey asks firms in Korea and Thailand to rate the availability of credit during the crisis ranging from one (much more restrictive) to five (much less restrictive).

However, we find only a limited number of observations in certain groups of credit constraint severity—specifically, the group reporting much less restrictive credit availability during the crisis and the group reporting somewhat less restrictive credit availability during the crisis. For instance, only 33 Korean firms responded that they experienced much less restrictive credit availability during the crisis; and in Thailand, only 5 firms responded that credit availability became much less restrictive, and 4 firms responded that it became somewhat less restrictive. So we combine different degrees of severity of credit constraint. In Korea, we combine into one group the firms with responses one (much more restrictive) and two (somewhat more restrictive), and we combine into another group the firms with responses four (somewhat less restrictive) and five (much less restrictive). We leave as one group the firms with response three (same)—firms with no change in credit constraint. We also reverse the ordering of the response so that the higher the rating, the greater the *Credit Constraint*: one (less restrictive), two (same), three (more restrictive). In Thailand, we combine responses three (same), four (somewhat less restrictive), and five (much less restrictive) into one group, and leave the other two responses as separate groups. The results remain qualitatively similar to the results when we use the binary *Credit Constraint* measure. In both Korea and Thailand, credit becomes more restrictive for firms with a greater number of lending relationships.

We also perform the multivariate probit analysis by stacking the three-country data with the addition of country-fixed effects. Table 7 shows the results. In the pooled estimation, we use only three countries because the variables *Collateral*, *Audit*, and *Required Audit* are not available for Thailand.

Column 1 of Table 7 reports the multivariate probit results explaining the determinants of credit constraint. To examine whether *Lender Diversity* matters for credit availability in different countries, we include country indicator variables and *Lender Diversity* interactive variables. In terms of equation (1), we specify *Lender Diversity* as follows:

$$(\alpha_1 + \alpha_2 * Indonesia + \alpha_3 * Philippines) * Lender Diversity .$$

Consistent with the findings we report in Section 4, the significance of the correlation between *Lender Diversity* and *Credit Constraint* varies across our sample countries. In Korea, reducing the number of lending relationships significantly reduces the likelihood of credit constraint, whereas in Indonesia and the Philippines the correlation between *Lender Diversity* and *Credit Constraint* is insignificant.

We also test the effect of *Audit* and *Required Audit* on *Credit Constraint*, controlling for the strength of lending relationships by using the pooled data. Columns 2 and 3 of Table 7 show the probit analysis of credit availability by adding the variables *Audit*, *Required Audit*, *Audit\*Lender Diversity*, *Required Audit\*Lender Diversity*, *Audit\*Required Audit*, and *Audit\*Required Audit\*Lender Diversity*, which we interact with country indicator variables as additional explanatory variables. Column 2 reports results based on all three countries pooled (Indonesia, Korea, and the Philippines). Column 3 reports results based on two countries (Indonesia and Korea). We exclude the Philippines from the sample because the loan application process in that country usually requires an audit, and therefore the variables *Audit* and *Required*

*Audit* for the Philippines may not contain the same information on the use of financial-statement lending technology that those variables contain in the other two countries.

In the pooled samples of both three and two countries, we continue to observe that in Indonesia, the value of lending relationships is weaker for firms with mandatory audits than for firms with voluntary audits. In Korea, however, the effect of *Lender Diversity* on *Credit Constraint* does not differ between firms with mandatory audits and firms with voluntary audits. In the pooled sample of three countries, for the Philippines the effect of *Lender Diversity* on *Credit Constraint* also does not differ statistically between firms with mandatory audits and firms with voluntary audits.

Finally, we construct *Lender Diversity* as a binary variable that takes the value of one if a firm has multiple relationships, and zero if it has a single relationship. Our results still hold.

## **7. CONCLUSION**

In this article we test the effects of lending relationship and accounting disclosure on credit availability across countries by using firm-level survey data covering four crisis-stricken Asian countries: Indonesia, Korea, the Philippines, and Thailand. In particular, we examine whether, during tough times, a single lending relationship is more likely to enable firms to obtain bank loans than multiple lending relationships. We also perform several tests to evaluate the benefits of accounting disclosure for firms seeking access to loans.

We find that in Korea and Thailand, firms benefit from establishing business relationships with fewer banks. In Indonesia and the Philippines, in contrast, we observe no correlation between the number of banks a firm borrows from and the availability of credit. We pursue an alternative factor—accounting disclosure—that might explain these country

differences. Consistent with Berger and Udell (2005), we find that in Indonesia, firms with even weak lending relationships benefit by having greater credit availability if these firms are required to audit and indeed do get audited, compared with firms that voluntarily provide audits of their financial statements. In other words, the value of mandatory accounting disclosure is higher than voluntary accounting disclosure for firms that have even weak lending relationships.

In contrast to Indonesia, where lending relationships fail to play a significant role and we observe the positive effect of accounting disclosure on credit availability, in Korea and the Philippines an audit requirement does not have a material effect on credit decisions. When Korean firms provide an audit, they do not benefit by obtaining more credit. A strong lending relationship is the ultimate lending technology that helps Korean firms obtain credit.

Our results support the Berger and Udell (2005) hypothesis that the lending technologies used in a country are affected by the country's financial structure, the health of its banking system, and its information environment. When the banking systems in Korea and Thailand were caught with low capital ratios during the crisis, banks used a relationship lending technology to provide credit to firms. Clearly, in those two countries, establishing a lending relationship did indeed pay off. During the same period, Philippine banks were much healthier. They were still profitable during the crisis and could continue to provide credit even to firms that did not have a strong lending relationship. Thus, the insignificant effect of lending relationship on credit availability in the Philippines might be attributable to the mildness of that country's crisis. In Indonesia, too, lending relationship had an insignificant effect on credit availability, but there we attribute the lack of correlation between lending relationship and credit availability to dominance by state-owned banks because state-owned banks can pursue political rather than economic objectives. At the same time, we find evidence suggesting that financial-statement lending

technology was adopted in Indonesia. These results suggest that in Indonesia, financial-statement and relationship lending technologies are substitutes for each other, for the effect of lending relationship strength on credit availability is weaker for firms with mandatory audit. Plausibly, Indonesia's lending infrastructure—namely, strong accounting standards and the widespread use of reputable accounting firms—promoted the adoption of a financial-statement lending strategy. In contrast, in countries with weaker accounting standards (such as Korea and the Philippines), financial-statement lending technology may not be widely used. Hence, in those countries we do not observe substitutability between relationship and financial-statement lending technologies. We cannot test for the substitutability between relationship lending and financial-statement lending technologies in Thailand because the audit measures (our financial-statement lending technology proxy) are not available in the survey data.

## APPENDIX A

### SURVEY QUESTIONS AND VARIABLE CONSTRUCTION

**Credit Constraint.** Firms in Korea and Thailand were asked, “For each source, how has the availability of credit to your plant changed since the onset of the crisis?” The question indicated the following possible sources: domestic banks, foreign banks, other domestic financial institutions, local moneylenders, family/friends, suppliers, partner firms, bond market, and the equity market. The firms were then asked to indicate the severity of credit availability by marking one through five, where one equals much more restrictive, two equals somewhat more restrictive, three equals same, four equals somewhat less restrictive, five equals much less restrictive. Our *Credit Constraint* variable takes the value of one if the response was one or two for domestic banks and other domestic financial institutions, and zero otherwise. In other words, we assume that firms did not experience credit constraint if they responded same, somewhat less restrictive, or much less restrictive. The questionnaire asked firms in Indonesia and the Philippines a slightly different question: “Which creditors have become more restrictive in making credit available to your firm since the onset of the regional financial crisis (July 1997)?” The types of creditors were the same as those in the Korean and Thai survey, but firms were not asked to rate the strength of the restrictiveness. Instead, they were asked to identify the source(s) that became more restrictive. In the case of Indonesia and the Philippines, the *Credit Constraint* variable takes the value of one if the response shows that the firm has observed more restrictive credit from domestic banks and other domestic financial institutions, and zero otherwise.

**Lender Diversity** is constructed from answers to the question “With how many financial institutions do you currently do business?”

**Collateral** is a binary variable equal to one if the firm had to pledge collateral for a loan, and zero otherwise. We construct this variable from answers to the question “Do you typically have to provide collateral to receive bank loans with maturities less than six months, six months to 12 months, 12 months or more?” If a respondent marks any of these three maturities, we classify the firm as one that posts collateral.

**Guarantee** is a binary variable used as an alternative measure for *Collateral*. *Guarantee* takes the value of one if a firm has guarantee in its financing, and zero otherwise. For Indonesia and the Philippines, the variable shows the number of “one equals yes” responses to the question “Do you have guarantees on your financing?” For Korea, the variable shows the number of “1 = Yes” responses—for any one of (a) other banks, (b) affiliated firms, (c) finance companies, (d) government, and (e) other—to the survey question “Do you have guarantees on your financing?”

**Audit and Required Audit** are binary variables. *Required Audit* is a binary variable that takes the value of one if firms answer “Yes” to the question “Do you typically need audited statements to apply for and receive bank loan?” and zero otherwise. *Audit* is a binary variable that takes the value of one if firms answer “Yes” to the question “Are your financial statements audited by an independent accounting firm?” and zero otherwise. Hence, the *Audit* variable includes both voluntary and mandatory types of audits that a firm can obtain.

**Plan to Expand** is a binary variable that takes the value of one if firms answer “Yes” to the question “Before the onset of the crisis, did this firm have expansion plans for this plant?”

**Number of Employees.** The log transformation of *Number of Employees* measures the firm’s size. **Leverage Ratio** is constructed as the percentage of working capital coming from bank loans as of December 1996. The survey asked the firms to report the composition of working

capital in terms of bank loans, retained earnings, and other sources as of the end of 1996. We take the ratio of bank loans to working capital as our proxy for a firm's leverage before the crisis.

**Capacity Utilization** is constructed from the survey question "What is the amount of output actually produced relative to the maximum amount that can be produced?" The survey asked the firms to report this number as of the end of 1996. Hence, the variable measures firm capacity utilization just before firms were entering the crisis.

**Foreign Ownership** is a binary variable constructed from survey responses indicating whether the firm has foreign direct investment (FDI). The survey asked firms to identify the type of ownership of the enterprise, and classified ownership as domestic, foreign owned, or joint ventures with a foreign firm. The survey defined a foreign-owned firm as one with at least a 10% FDI. We define foreign ownership as present if a firm is foreign owned or has a joint venture with a foreign firm.

**Board of Directors** and **Independent Directors on the Board** are two binary variables indicating whether a firm has a board of directors and whether a firm has outside/independent directors on the board.

**Industry** is an indicator variable of the firm's industry. The *industry* variables include auto parts, chemicals, construction materials, electronics, food, garments and textiles, and machinery.

**Outside Credit** is a binary variable that takes the value of one if a firm has outstanding credit, and zero otherwise. The survey question used to derive this variable is "Does this factory have outstanding loan/credit?" to which the firms respond either "yes" or "no."

**Government Incentive** is a binary variable that takes the value of one if firms participate in government incentive programs, and zero otherwise.

***Trade (Import and Export)*** is a binary variable indicating whether a firm trades with (imports from or exports to) foreign countries. We construct it from two survey questions: “Does this plant export some of its output?” and “Does your plant import some of its raw materials or supplies?” If a firm answers “yes” to either of these questions, the *Trade (Import Export)* variable takes a value of one, and zero otherwise.

***Supplier Credit*** is a binary variable that take the value of one if a firm obtains credit from a supplier, and zero otherwise.

***Log Tangible Assets Ratio in 1996*** is a variable that we construct by dividing the sum of machinery, equipment, and buildings by total assets as a proxy for the liquidity cost and the value of collateral.

## Appendix B

### State of the Banking Industry in Sample Countries before and during the Asian Financial Crisis (1996-1998)

Country	Macroeconomic Effects of the Crisis	Description of the Banking Sector before the Crisis	Effect of the Crisis on the Banking Sector	Credit Availability
Indonesia	Hardest hit country during the Asian financial crisis. Average GDP growth rate fell from 7.94% before crisis (1996:2Q–1997:2Q) to –6.98% during the crisis (1997:3Q–1998:3Q). 70% devaluation of exchange rate. Interest rate soared	228 banks 50% were state owned	83 banks were closed. End of 1998, nonperforming loans constituted 57% of total loans. After 2000, share of state-owned banks increased to 80%.	The banking crisis sharply contracted available credit.
Korea	Average GDP growth rate fell from 6.60% before crisis (1996:2Q–1997:2Q) to –1.50% during the crisis (1997:3Q–1998:3Q). As a result of a tight monetary policy, interest rate rose.	56 banks 26 publicly traded banks 30 merchant banks	After the government's intervention, mergers, and branch closures, there remained 17 publicly traded banks and 13 merchant banks.	There was a credit crunch through the lending channels. Moreover, there was evidence of a flight to quality in bank lending and deposits. Banks increased their holdings of government securities.
Philippines	Average GDP growth rate fell from 5.80% before crisis (1996:2Q–1997:2Q) to 1.96% during the crisis (1997:3Q–1998:3Q).	52 commercial banks made up almost 90% of the market share. Small number of banks controlled a large share of the market; the banking system resembled an oligopoly.	End of June 1998, Philippine banks remained relatively well capitalized with average capital to weighted risk ratio of 15.5%. At the end of 1998, impaired loans reached 16%.	Neither the general risk premium nor bank borrowers' spreads showed notable increases.
Thailand	Prolonged period of high interest rates caused GDP to contract 8% in 1998.	17 banks. 91 financial companies. 5 largest private banks made up 60% of the banking system.	In 1998, 6 commercial banks were nationalized, 1 bank closed, 1 bank merged with a state-owned bank, and 56 finance companies were closed. Nonperforming loans reached 45% at the end of 1998.	Massive closures of financial institutions reduced the available credit. In particular, the closure of many finance companies resulted in a reduced source of financing for small businesses.

Note: Compiled from (*Economist* 1998); (Barth, Brumbaugh, Ramesh, and Yago 1998); (Ding, Domac, and Ferri 1998); (Dwor-Frecaut, Colaco, and Hallward-Driemeier 2000); and (Batunanggar 2002).

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**Table 1**  
**Summary Statistics**

		Indonesia	Korea	Philippines	Thailand
Panel A - Binary Variables (in %)					
Credit Constraint		41.25	54.58	46.80	55.53
Collateral		66.56	85.64	60.10	---
Guarantee		38.75	1.26	30.54	9.7
Audit		38.44	65.53	91.20	---
Required Audit		39.38	62.12	87.70	---
Plan to Expand		59.06	44.52	42.36	31.94
Foreign Ownership		6.88	15.26	29.56	20.88
Industry	Auto parts	---	30.88	---	21.38
	Chemicals	31.88	31.60	22.66	---
	Electronics	10.94	15.98	20.69	9.58
	Food	35.00	---	20.69	5.41
	Textiles	22.19	21.54	35.96	63.64
Import		29.69	66.61	74.54	43.5
Export		35.31	75.94	60.21	55.09
Board of Directors		47.19	82.41	80.43	52.58
Independent Directors on the Board		5.31	25.85	12.50	6.62
Supplier Credit		49.06	90.31	81.84	87.37
Government Incentive		36.88	44.88	38.59	---
Panel B - Other Variables					
Lender Diversity	Mean	1.93	5.96	3.06	2.29
	Median	1.00	4.00	2.00	2.00
	Maximum	13.00	80.00	13.00	28.00
	SD	1.59	7.43	2.40	2.27
Capacity Utilization (%)	Mean	80.94	84.84	77.93	79.67
	Median	80.00	88.00	80.00	80.00
	SD	16.50	14.18	20.08	18.21
Leverage Ratio (%)	Mean	35.43	38.75	61.03	38.74
	Median	30.00	30.00	69.00	40.00
	SD	30.62	32.41	29.17	33.13
No. of Employees	< 50	30.00	21.72	27.09	36.36
	50 – 99	20.31	31.06	19.22	22.36
	>=100	49.69	47.22	53.69	41.28
Log Tangible Assets Ratio in 1996 (%)	Mean	6.31	41.38	35.37	4.51
	Median	6.30	37.00	31.00	4.50
	SD	0.95	42.01	23.17	0.83
Share of Finished Products	Mean	65.00	53.79	1.31	27.54
	Median	90.00	70.00	1.00	0.00
	SD	42.66	43.20	0.46	33.25
Number of firms		320	557	171	396

**Table 2**  
**Determinants of Lender Diversity (OLS)**

Variables	(1) Indonesia		(2) Korea		(3) Philippines		(4) Thailand					
<i>Control Variables:</i>												
Constant	-0.228	(0.299)	-1.076	***	(0.241)	-0.492	*	(0.257)	-0.742	***	(0.261)	
Log of Employees	0.148	***	(0.044)	0.359	***	(0.040)	0.211	***	(0.044)	0.070	*	(0.037)
Leverage Ratio	0.002	**	(0.001)	0.003	***	(0.001)	-0.001		(0.002)	0.001	*	(0.001)
Plan to Expand Capacity	0.081		(0.058)	0.075		(0.059)	0.213	**	(0.091)	0.055		(0.062)
Utilization	-0.003	*	(0.002)	0.003		(0.002)	0.001		(0.002)	0.0004		(0.001)
Foreign Ownership	-0.215		(0.148)	0.059		(0.093)	-0.038		(0.143)	-0.006		(0.077)
<i>Instrumental Variables:</i>												
Log Tangible Assets Ratio in 1996	-0.014		(0.056)	-0.0004		(0.0004)	0.0004		(0.002)	0.223	***	(0.058)
Government Incentives	0.138	*	(0.076)	-0.014		(0.058)	-0.085		(0.172)	-----		-----
Board of Directors Independent	0.060		(0.079)	0.095		(0.077)	0.264	**	(0.107)	0.091	*	(0.054)
Directors on the Board	0.210		(0.142)	0.209	***	(0.075)	-0.024		(0.134)	-0.125		(0.138)
Supplier Credit	0.104	*	(0.059)	0.083		(0.092)	0.200	*	(0.108)	-0.084		(0.078)
Import	0.130	*	(0.077)	0.070		(0.061)	0.176		(0.123)	0.242	***	(0.067)
Export	0.065		(0.087)	0.090		(0.066)	0.002		(0.155)	0.017		(0.062)
Number of Observations:	320			557			171			396		
<i>F-statistics</i>	8.90	***	[0.000]	14.15	***	[0.000]	5.80	***	[0.000]	13.97	***	[0.000]
R-squared:	0.263			0.333			0.292			0.347		

NOTES: This table provides estimates of models, using the data from Indonesia, Korea, the Philippines, and Thailand. The dependent variable is *Lender Diversity*, which measures the number of financial institutions from which the firm borrows.

\*\*\* Indicates statistical significance at the 1% level, \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level. The standard errors are in parentheses and p-values are in brackets.

**Table 3**  
**Determinants of Collateral (OLS)**

	(1)		(2)		(3)		(4)					
Variables	Indonesia		Korea		Philippines		Thailand					
<i>Control Variables:</i>												
Constant	0.321	(0.221)	0.617	***	(0.122)	0.317	(0.251)	0.068	(0.162)			
Log of Employees	0.069	**	(0.031)	0.020	(0.018)	-0.003	(0.039)	0.045	**	(0.021)		
Leverage Ratio	0.005	***	(0.001)	0.001	***	(0.0005)	0.003	**	(0.001)	0.001	**	(0.0004)
Plan to Expand Capacity Utilization	0.061		(0.053)	0.049	(0.030)	0.025	(0.078)	0.077	**	(0.038)		
Foreign Ownership	-0.0004		(0.001)	-0.0003	(0.001)	-0.002	(0.002)	-0.001		(0.001)		
	-0.116	**	(0.098)	-0.192	***	(0.052)	-0.281	***	(0.101)	-0.060	(0.045)	
<i>Instrumental Variables:</i>												
Log Tangible Assets Ratio in 1996	-0.026		(0.042)	0.0002	(0.0003)	0.004	**	(0.002)	-0.016	(0.033)		
Government Incentives	-0.027		(0.059)	0.080	***	(0.028)	0.044	(0.102)	-----	-----		
Board of Directors Independent	-0.060		(0.065)	0.071	(0.046)	-0.012	(0.098)	-0.001		(0.032)		
Directors on the Board	-0.003		(0.089)	0.046	(0.029)	-0.081	(0.114)	-0.044		(0.066)		
Supplier Credit Import	0.043		(0.051)	0.038	(0.054)	0.145	(0.092)	-0.058		(0.041)		
Export	-0.120	*	(0.065)	0.044	(0.036)	0.082	(0.097)	0.078	*	(0.040)		
	0.042		(0.073)	-0.042	(0.037)	0.133	(0.099)	0.062	**	(0.028)		
Number of Observations	320			558		171		397				
F-statistics	6.23	***	[0.000]	3.92	***	[0.000]	4.14	***	[0.000]	2.81	***	[0.000]
R-squared:	0.192			0.104		0.191		0.152				

Note: \*\*\* Indicates statistical significance at the 1% level, \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level. The standard errors are in parentheses and p-values are in brackets.

**Table 4****Determinants of Credit Availability (Probit)**

	(1)		(2)		(3)		(4)	
Variables	Indonesia		Korea		Philippines		Thailand	
Constant								
Lender Diversity	-0.366	(0.592)	1.124	(1.176)	-1.764 *	(0.983)	-0.648	(0.474)
Collateral (Guarantee)	-0.911	(0.688)	1.011 *	(0.523)	-0.590	(0.780)	0.891 *	(0.469)
Log of Employees	0.586	(1.418)	-1.273	(1.092)	2.082 *	(1.061)	-2.567 *	(1.543)
Leverage Ratio	0.046	(0.187)	-0.150	(0.207)	0.114	(0.227)	0.025	(0.111)
Plan to Expand	0.011	(0.009)	0.002	(0.002)	-0.001	(0.005)	0.013 ***	(0.003)
Capacity Utilization	-0.035	(0.206)	0.196	(0.126)	0.405	(0.278)	0.313	(0.190)
Foreign Ownership	-0.005	(0.005)	-0.005	(0.004)	0.001	(0.005)	-0.003	(0.004)
	-0.792 *	(0.474)	-0.791 ***	(0.278)	-0.118	(0.387)	-0.642 ***	(0.201)
Lender Diversity residual ( $v_1$ )	0.903	(0.700)	-0.924 *	(0.530)	0.347	(0.807)	-0.724	(0.486)
Collateral (Guarantee) residual ( $v_2$ )	0.028	(1.429)	1.933 *	(1.101)	-0.619	(1.082)	2.868 *	(1.574)
$H^0: v_1 = v_2 = 0$	2.14	[0.342]	4.20	[0.122]	0.38	[0.826]	3.79	[0.151]
Number of Observations:	320		557		171		396	
Wald $X^2$ :	43.68 ***	[0.000]	49.89 ***	[0.000]	55.11 ***	[0.000]	48.54 ***	[0.000]
Pseudo R-squared:	0.110		0.075		0.251		0.091	

Note: \*\*\* Indicates statistical significance at the 1% level, \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level. The standard errors are in parentheses and p-values are in brackets.

**Table 5: Number of Institutions with *Audit* and *Required Audit***

**INDONESIA:**

**A. All (N=320)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	159 (49.7%)	38 (11.9%)	197 (61.6%)
	1	35 (10.9%)	88 (27.5%)	123 (38.4%)
Total		194 (60.6%)	126 (39.4%)	320 (100.0%)

**B. Single Lending Relationship (LD=1, N=173)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	107 (61.9%)	18 (10.4%)	125 (72.3%)
	1	18 (10.4%)	30 (17.3%)	48 (27.7%)
Total		125 (72.3%)	48 (27.7%)	173 (100.0%)

**C. Multiple Lending Relationship (LD>1, N=147)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	52 (35.4%)	20 (13.6%)	72 (49.0%)
	1	17 (11.6%)	58 (39.5%)	75 (51.1%)
Total		69 (47.0%)	78 (53.1%)	147 (100.0%)

**KOREA**

**D. All (N=557)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	167 (30.0%)	25 (4.5%)	192 (34.5%)
	1	44 (7.9%)	321 (57.6%)	365 (65.5%)
Total		211 (%)	346 (62.1%)	557 (100.0%)

**E. Single Lending Relationship (LD=1, N=45)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	28 (62.2%)	0 (0.0%)	28 (62.2%)
	1	5 (11.1%)	12 (26.7%)	17 (37.8%)
Total		33 (73.3%)	12 (26.7%)	45 (100.0%)

**F. Multiple Lending Relationship (LD>1, N=512)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	139 (27.2%)	25 (4.9%)	164 (32.1%)
	1	39 (7.6%)	309 (60.4%)	348 (68.0%)
Total		178 (34.8%)	334 (65.3%)	512 (100.0%)

**PHILIPPINES****G. All (N=171)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	6 (3.5%)	9 (5.3%)	15 (8.8%)
	1	15 (8.8%)	141 (82.5%)	156 (91.2%)
Total		21 (12.3%)	150 (87.7%)	171 (100.0%)

**H. Single Lending Relationship (LD=1, N=47)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	1 (2.1%)	4 (8.5%)	5 (10.6%)
	1	3 (6.4%)	39 (83.0%)	42 (89.4%)
Total		4 (8.5%)	43 (91.5%)	47 (100.0%)

**I. Multiple Lending Relationship (LD>1, N=124)**

		<i>Required Audit</i>		
		0	1	Total
<i>Audit</i>	0	5 (4.0%)	5 (4.0%)	10 (8.1%)
	1	12 (9.7%)	102 (82.3%)	114 (91.9%)
Total		17 (13.7%)	107 (86.3%)	124 (100.0%)

**Table 6**  
**Determinants of Credit Availability with Audit and Required Audit**

Variables	(1)		(2)		(3)	
	Indonesia		Korea		Philippines	
Constant	-0.375	(0.661)	1.110	(1.225)	-2.727 *	(1.542)
Lender Diversity	-1.191	(0.831)	1.142 *	(0.593)	0.632	(1.385)
Audit	-0.645	(0.435)	-0.431	(0.457)	0.570	(1.478)
Required Audit	0.522	(0.528)	-1.205	(0.958)	1.714	(1.485)
Required Audit*Audit	0.285	(0.550)	1.434	(1.059)	-1.151	(1.606)
Audit*Lender Diversity	1.772 ***	(0.468)	0.089	(0.351)	-0.917	(1.304)
Required Audit*Lender Diversity	-0.352	(0.475)	0.548	(0.624)	-1.734	(1.313)
Audit*Required Audit*Lender Diversity	-1.419 **	(0.673)	-0.672	(0.702)	1.369	(1.403)
Collateral	0.852	(1.227)	-1.041	(1.150)	1.915 *	(1.118)
Log of Employees	0.047	(0.165)	-0.164	(0.202)	0.115	(0.226)
Leverage Ratio	0.011	(0.007)	0.002	(0.003)	-0.000	(0.005)
Plan to Expand	-0.020	(0.179)	0.199	(0.131)	0.427	(0.311)
Capacity Utilization	-0.007	(0.006)	-0.006	(0.004)	0.001	(0.006)
Foreign Ownership	-0.881	(0.491)	-0.722 ***	(0.278)	-0.166	(0.418)
Lender Diversity residual ( $v_1$ )	1.058	(0.817)	-1.037 *	(0.569)	0.393	(0.842)
Collateral residual ( $v_2$ )	-0.196	(1.247)	1.706	(1.162)	-0.451	(1.152)
$H^0: v_1 = v_2 = 0$	2.73	[0.256]	4.34	[0.114]	0.27	[0.874]
Hypothesis 1:						
$(\xi_1 + \xi_5 + \xi_6 + \xi_8) - (\xi_1 + \xi_5)$	-1.771		-0.124		-0.365	
F Test: $\xi_1 + \xi_5 + \xi_6 + \xi_8 = \xi_1 + \xi_5$	{14.17}	*** [0.000]	{0.15}		[0.694]	{0.62} [0.433]
Number of Observations:	320		557		171	
Wald $\chi^2$ :	65.16 ***	[0.000]	50.82 ***	[0.000]	63.00 ***	[0.000]
Pseudo R-squared:	0.148		0.078		0.261	

Note: \*\*\* Indicates statistical significance at the 1% level, \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level. The standard errors are in parentheses, F-statistics are in {}, and p-values are in brackets.

**Table 7**  
**Determinants of Credit Availability with Audit, Using Pooled Data (Probit)**

Variables	(1)		(2)		(3)				
	Without Audit (3 Countries)		With Audit (3 Countries)		With Audit (2 Countries)				
Constant	-0.685	(0.848)	1.076	(2.234)	1.964	(1.738)			
Lender Diversity	0.684	*	(0.404)	2.844	*	(1.681)	1.153	*	(0.617)
Indonesia*Lender Diversity	-0.394	***	(0.145)	-0.320	(0.275)	-0.321	(0.265)		
Philippines*Lender Diversity	-0.378	**	(0.154)	1.363	(1.260)	-----	-----		
Audit	-----	-----	-0.180	(0.463)	-0.284	(0.437)			
Indonesia*Audit	-----	-----	-0.633	(0.547)	-0.970	*	(0.536)		
Philippines*Audit	-----	-----	1.230	(1.571)	-----	-----			
Required Audit	-----	-----	-1.830	**	(0.930)	-0.635	*	(0.366)	
Indonesia*Required Audit	-----	-----	2.560	*	(1.393)	1.926	**	(0.882)	
Philippines*Required Audit	-----	-----	5.280	**	(2.199)	-----	-----		
Required Audit*Audit	-----	-----	1.229	(0.940)	1.364	*	(0.698)		
Indonesia*Required Audit*Audit	-----	-----	-0.725	(0.982)	-0.392	(0.737)			
Philippines*Required Audit*Audit	-----	-----	-2.746	(1.877)	-----	-----			
Audit*Lender Diversity	-----	-----	0.085	(0.332)	0.025	(0.321)			
Indonesia*Audit*Lender Diversity	-----	-----	1.346	**	(0.534)	1.367	***	(0.523)	
Philippines*Audit*Lender Diversity	-----	-----	-1.711	(1.351)	-----	-----			
Required Audit*Lender Diversity	-----	-----	0.643	(0.506)	0.115	*	(0.063)		
Indonesia*Required Audit*Lender Diversity	-----	-----	-0.769	(0.689)	-0.323	(0.462)			
Philippines*Required Audit*Lender Diversity	-----	-----	-2.858	**	(1.451)	-----	-----		
Audit*Required Audit*Lender Diversity	-----	-----	-0.711	(0.591)	-0.478	(0.374)			
Indonesia*Audit*Required Audit*Lender Diversity	-----	-----	-0.865	(0.857)	-1.050	(0.708)			
Philippines*Audit*Required Audit*Lender Diversity	-----	-----	2.866	*	(1.544)	-----	-----		
Collateral	0.197	(1.150)	-1.244	(2.517)	-2.831	(2.095)			
Log of Employees	-0.120	(0.122)	-0.703	(0.467)	-0.283	(0.189)			
Leverage Ratio	0.004	(0.003)	0.002	(0.005)	0.010	**	(0.004)		
Plan to Expand	0.125	(0.101)	-0.001	(0.138)	0.261	**	(0.120)		
Capacity Utilization	-0.001	(0.003)	-0.004	(0.003)	-0.003	(0.003)			
Foreign Ownership	-0.492	(0.300)	-0.935	(0.628)	-1.084	**	(0.457)		
Indonesia	0.574	(0.383)	1.659	*	(0.899)	0.068	(0.417)		
Philippines	0.537	(0.373)	-2.051	(1.665)	-----	-----			
Lender Diversity residual ( $v_1$ )	-0.487	(0.408)	-2.694	(1.673)	-0.954	(0.593)			
Collateral residual ( $v_2$ )	0.555	(1.150)	2.006	(2.520)	3.415	(2.096)			
$H^0: v_1 = v_2 = 0$	1.44	[0.488]	3.05	[0.218]	3.05	[0.218]			
Number of Observations:	1141		1147		985				
Wald $\chi^2$ :	129.72	***	[0.000]	163.50	***	[0.000]	116.52	***	[0.000]
Pseudo R-squared:	0.090		0.104		0.086				

Note: \*\*\* Indicates statistical significance at the 1% level. \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level. The standard errors are in parentheses and p-values are in brackets.