Banking relationships and the credit cycle: Evidence from the Asian financial crisis

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ABSTRACT

When are banking relationships valuable? Using a unique dataset on small manufacturing firms during the Asian financial crisis of 1997-98, I present evidence that the benefits of relationships are substantially magnified when credit conditions are poor or deteriorating. At the onset of the crisis, I find firms with close bank relationships were less likely to be denied credit by banks, less likely to report that bank credit availability had worsened, and less likely to cite lack of bank finance as a cause of declining firm output. The results are most pronounced for the concentration measure of bank relationship strength. Relationship variables are not correlated with changes in the availability of other sources of credit (trade credit, or loans from moneylenders or family and friends), suggesting relationship strength is not simply a proxy for general firm quality or creditworthiness. Firms with close bank relationships did not have significantly greater access to credit prior to the crisis, emphasising the link between the benefits of relationships and the state of the 'credit cycle'.

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1. Introduction

Banks and related financial institutions are a key source of finance for small and medium sized firms. Moreover, firms often form banking *relationships*, interacting repeatedly with a small number of institutions. For example, in the 1998 US Survey of Small Business Finance only 14 per cent of firms reported borrowing from more than two financial institutions, and firms had been dealing with their primary institution for an average of 8 years.

Banking relationships hold the promise of cheaper and more plentiful finance by reducing transaction costs and ameliorating informational problems. Petersen and Rajan (1994) and Berger and Udell (1995) present evidence that firms with close banking relationships do enjoy preferential access to credit. This paper is directed at a related but less-explored question; I instead ask 'when are relationships valuable?' In particular, I study whether relationships are particularly important during times of poor or deteriorating credit availability, caused for example by a financial system disruption or an aggregate shock to firm creditworthiness. During such periods, do banks cut back lending to all firms proportionately, or do they maintain finance to firms with whom they have exclusive or long-standing relationships? I study this question empirically using a unique dataset of small and medium sized manufacturing firms during the Asian financial crisis of 1997-98. This episode, characterized by financial instability, falling firm profits, rapidly declining lending volumes, and higher credit application refusal rates by financial institutions, provides a natural setting for studying the question at hand.

Understanding the link between banking relationships and the 'credit cycle' is of interest to economists for several reasons. From a microeconomic corporate finance perspective, since banking relationships are pervasive it is important to understand why banks and firms choose to form them. Perhaps relationships should be viewed more as an 'insurance policy' that pays off during periods of tight credit than is generally recognized? In Appendix A I present a simple

model that suggests the answer to this question is theoretically ambiguous, underlining the need for empirical evidence.

From a macroeconomic perspective, several papers have found that small firms and young firms are more volatile than larger and older firms, and are disproportionately affected during recessions and bank credit crunches.[1] But the underlying channels that generate these patterns are only partially understood, and several different stories regarding the role of bank relationships are possible. One is that banks explicitly maintain lending to 'relationship' firms during periods of tight credit; since the youngest or smallest firms have not had time to develop strong bank relationships, this helps explain why such firms are more sensitive to economic cycles. Another is that relationships are a wash; perhaps all firms are proportionately rationed by banks, but small and young firms are less able to draw on retained earnings or alternative sources of finance, such as direct finance from capital markets. Yet another is that conditional on age, relationships actually protect small firms (relative to large firms) against fluctuations in credit conditions, because small firms tend to have more *concentrated* banking relationships.

Distinguishing between these alternatives adds to our understanding of how 'credit crunches' and the bank lending channel of monetary policy affect real activity. There are also potential implications for the conduct of prudential policy. Evidence that relationship capital becomes very valuable during a financial crisis or bank capital crunch strengthens the case for bailing out failing banks during such episodes. See Diamond (2001) for a discussion of how bank-firm relationships affect the welfare costs and benefits of recapitalizing failing banks.

[1] Hall (1987) and Evans (1987) find that large and old firms are less volatile than small and young firms. Gertler and Gilchrist (1994) argue that financial constraints explain why small US manufacturing firms shrink more following monetary contractions. Perez-Quiros and Timmerman (2000) show that small US public firms' stock returns are more sensitive to measures of credit market conditions. Domaç and Ferri (1999) present evidence of a 'flight to quality' in lending during the Asian crisis, including a fall in lending to small firms. Hancock and Wilcox (1998) show that during the US credit crunch of the early 1990s, shocks to the capital of small banks (who lend disproportionately to small businesses) had a larger effect on economic activity than shocks to capital of large banks.

The evidence in this paper comes from a World Bank survey of primarily small and medium-sized manufacturing firms during the Asian financial crisis of 1997-98. The estimation approach is essentially difference-in-differences.[2] The Asian crisis was associated with a large exogenous decline in the availability of internal and external sources of finance. I test whether this shock to aggregate credit conditions disproportionately affected firms with weak relationships, using several measures of the change in credit conditions experienced by individual firms, and two measures of relationship strength: the number of financial institutions the firm deals with (a measure of the concentration of lending relationships), and the length of time the firm had been dealing with its primary relationship bank.

Several pieces of evidence suggest that bank relationships became more important in determining access to credit as the Asian financial crisis took hold. I find that firms with strong relationships became less likely to be refused credit by a financial institution, were less likely to self-report that availability of credit from banks had deteriorated, and were less likely to cite lack of bank finance as a contributor to declining output. These empirical findings are economically as well as statistically significant. For example during the second half of 1997, conditional loan refusal rates increase by 3 percentage points for firms who dealt exclusively with a single financial institution, but by between 9 and 17 percentage points for firms who dealt with multiple dispersed lenders. I also find that the results are stronger for the 'concentration' dimension of bank relationships than the 'length' dimension. I discuss a potential explanation for this result, drawing on recent theoretical work by Dell'Ariccia and Marquez (2005).

As a check on potential endogeneity problems, I show that the bank relationship variables are *not* correlated with the change in the availability of non-bank forms of credit (including trade credit, loans from moneylenders and loans from family and friends). This

[2] See Angrist and Krueger (1999) and Meyer (1995) for a discussion of difference-in-differences.

suggests the bank relationship variables are not just general proxies for unmeasured firm quality or creditworthiness, which would affect the availability of all sources of finance. Strikingly, measures of relationship strength are not significantly correlated with the probability of being denied credit by a financial institution in the *pre*-crisis period, highlighting the link between the benefits of relationships and the state of the 'credit cycle'.

The rest of the paper proceeds as follows. Section 2 of the paper reviews related literature on banking relationships. Section 3 describes the World Bank dataset I use, and briefly discusses the origins and features of the Asian financial crisis. Section 4 describes the empirical strategy in more detail. Section 5 presents the main empirical results. Section 6 concludes. The theoretical model is presented in Appendix A.

2. Related Literature

A large theoretical literature argues that incumbent banks over time become more efficient delegated monitors of firms, or accumulate private information about firms they lend to (see Boot, 2000, for a review). Influential papers by Sharpe (1990) and Rajan (1992) emphasise the tradeoff implied by relationship-building: relationship lending reduces informational problems, but also provides the opportunity for an incumbent lender to 'hold-up' the firm and extract monopoly rents ex-post due to the difficulty of switching to another less informed bank.[3]

Corresponding empirical work has generally, although not unanimously, found that strong banking relationships do improve firms' access to credit. Relationships are generally measured along two dimensions: 'length' (the amount of time the bank and firm have interacted) and 'concentration' (fewer banks offering a broad range of financial services is assumed to imply stronger relationships with each institution). Petersen and Rajan (1994) show that US firms with longer or more concentrated banking relationships rely less on costly late-paid trade

[3] See also Von Thadden (2004), who highlights an error in Sharpe and provides a corrected analysis.

credit. Berger and Udell (1995) find that strong bank-firm relationships are associated with lower interest rates on credit lines. Cole (1998) finds that prior relationships are associated with lower rejection rates on loan applications. D'Auria, Foglia and Reedtz (1999) using Italian credit registry data find that more concentrated banking relationships are correlated with lower loan interest rates, although longer relationships are not. Degryse and Van Cayseele (2000) find that loan interest rates are *increasing* in relationship length (ie. the opposite of Berger and Udell), but decreasing in the concentration of relationships.

Since bank-firm relationships are formed endogenously, it is difficult to rule out the possibility that relationship strength is simply a proxy for firm 'quality' or creditworthiness. Partially in response to this problem, a different strand of literature uses an event study approach to study how bank failures affect the stock prices of client firms (Slovin, Sushka and Polonchek (1993), Bae, Kang and Lim (2002), Brewer, Genay, Hunter and Kaufman (2003)). These papers generally find that that client stock prices *do* fall after announced bank failures. By exploiting discontinuous shocks to the supply of relationship-bank finance, these papers provide arguably more causal evidence on the value of relationships, at least for public firms.

Unlike the research discussed above, rather than studying whether bank relationships are valuable, this paper instead asks '*when* are they valuable?', focusing in particular on the link between bank relationships and aggregate credit conditions. Most closely related, Ferri, Kang and Kim (2001) and Jiangli, Unal and Yom (2005) also study how the Asian financial crisis affected firms with strong and weak banking relationships. Ferri et al use credit registry data from Korea, while Jiangli et al employ the same World Bank firm dataset used in this paper.[4]

[4] Jiangi et al and this paper were developed independently -- we became aware of each other's work after drafts of the two papers had been completed. Jiangi et al focuses more on cross-country differences in the results, and relates these differences to accounting disclosure practices. I control for country differences using country*industry interaction dummy variables, but treat these variables more as controls, and do not study these coefficients in depth. Thus, the analysis in the two papers can be viewed as complementary.

Overall, Jiangli et al and Ferri et al find results consistent with those in this paper, namely firms with close banking relationships experienced a smaller decline in credit availability during the crisis period. However, the analysis here differs from these two papers in several important ways. Firstly, in response to the endogeneity problems discussed above, I present several pieces of evidence that suggest relationships are not just proxying for unmeasured dimensions of firm quality. (For example, I show that strong relationships reduced the decline in bank credit availability but not the availability of other types of credit, like trade credit or loans from family and friends.) Secondly, I study both the 'length' and 'concentration' dimensions of relationships, while Ferri et al and Jiangli et al focus only on concentration (measured by the number of banks the firm deals with). In fact, one of my main findings is that the results on the two dimensions of relationship strength differ; credit availability is more correlated with the concentration of relationships than with relationship length. Thirdly, the data I use is richer in several ways than Ferri et al or Jiangli et al. Ferri et al are not able to control for firm covariates other than industry. Jiangli et al use the same World Bank dataset that I do, but I use a restricted version of the dataset that contains additional data series (such as firm age) as well as more precise balance sheet information.

3. Data and Background

Firm-level data is drawn from a series of microeconomic surveys conducted in Indonesia, Korea, Thailand and the Philippines between December 1998 and February 1999.[5] The four surveys combined cover 3143 firms in seven manufacturing sectors: electronics, textiles, garnments, food processing, chemicals, machinery and auto parts.

Surveys were conducted by the respective governments of the four countries, with technical support provided by the World Bank. In each country, firms were selected randomly

[5] Data from a similar firm survey conducted in Malaysia has not been made available for researcher use.

from a public directory of manufacturing firms. Target firms were asked to report financial information and firm characteristics, retrospective accounting data for the 1996 and 1997 financial years, and answers to specific questions concerning the effects of the crisis. Data was collected partially through face-to-face interviews, and partially through a written questionaire. Response rates for the questionaire were somewhat lower, reflecting the fact that it was not an interactive face-to-face interview, and that it asked questions about accounting data which firms either were unwilling to divulge, or did not keep detailed records on. Hallward-Driemeier (2001) contains a more detailed description of the survey methodology and features.

Table 1 and Table 2 summarize basic descriptive features of the data. As the first part of Table 1 shows approximately 60 per cent of the firms are small and medium sized enterprises with less than 150 employees. The size distribution of firms is reasonably similar across countries, but firms are spread unevenly across the seven represented manufacturing industries. The largest proportion of firms are from the 'garnments and textiles' and 'chemicals' subindustries (34 per cent and 20 per cent respectively).

Table 2 summarizes the balance sheet data in more detail. Based on the reported data, firms were quite highly leveraged, with a book liabilities/assets ratio (at the end of 1996) of 0.65. Leverage varied somewhat across countries, being highest in the Philippines (0.74) and Korea (0.71) and lowest in Indonesia (0.51). Profits averaged 14 per cent of book assets.

The survey provides two different measures of the strength of banking relationships: (i) the length of time the firm has been dealing with its primary financial institution, and (ii) the concentration of relationships, measured by the number of financial institutions the firm interacts with. As discussed in Section 2, both these variables are widely used in the literature on banking relationships. Longer relationships provide banks with opportunities to learn private information and to become more efficient delegated monitors. Concentrated relationships

(interacting with one bank rather than many) is also assumed to reduce informational problems, reflecting free-riding problems in monitoring the firm with multiple lenders, and that knowledge of the firm will be diffusely spread when there are many banks. (See Ongena and Smith (2003) for cross-country evidence on determinants of the number of banking relationships.)

Firms in the sample interact with 3.8 financial institutions on average. Smaller firms have more concentrated relationships -- 74 per cent of small firms (<150 employees) deal with only a single financial institution, compared to only 10 per cent of firms with more than 500 employees. On average, firms have dealt with their primary financial institution for 11 years.

3.1 What happened in East Asia?

The Asian financial crisis began in 1997 and was characterized by large currency depreciations, a reversal of foreign capital inflows and sharp declines in output and investment in the main crisis-afflicted countries: Korea, Indonesia, Malaysia, Thailand and (to a lesser extent) the Philippines. The crisis was also associated with numerous bank failures, a buildup in bad loans held on the balance sheets of financial institutions, and a large overall decline in the lending by financial institutions relative to trend. The peak-to-trough fall in the real year-on-year growth rate of credit during the crisis period was from +50 per cent to -40 per cent in Indonesia, from +10 per cent to -10 per cent in Korea, from +30 per cent to 0 in the Phillipines, and from +25 per cent to 0 in Thailand (Domac and Ferri, 1999).[6]

The difference-in-differences approach in this paper assumes that this large decline in lending growth is not just a passive reflection of an inward shift in credit demand, but comes at least in part from a decline in credit *supply* relative to the liquidity and investment needs of firms. Such a contraction in loan supply could be driven either by firm balance sheets (ie. by a decline in firm profitability or creditworthiness that reduces firms' debt capacity) or from shocks

[6] This data is drawn from figures I3, K3, P3 and M3 in Domac and Ferri.

to bank capital or deposits that reduce the amount of available loanable funds. (See Holmstrom and Tirole (1997) for a formal model of how shocks to firm balance sheets and bank capital affect the supply of bank credit to firms.) Several papers have examined empirically whether the Asian crisis was in fact associated with a a supply-side credit contraction -- a 'credit crunch'.

Domaç and Ferri (1999) collect a substantial amount of information about credit conditions in East Asia before and during the crisis. Beyond the fact that lending growth declined, they also find: (i) a shortening of the maturity on new lending to firms (ii) a 'flight to quality' substitution by depositors from small banks to large banks (iii) a related 'flight to quality' substitution towards larger firms and away from small and medium enterprises (iv) an increase in the wedge between lending rates and market interest rates and (v) where observable, an increase in the rejection rate on new loan applications by banks.

To further isolate the supply-side component of the aggregate fall in credit, Agenor, Aizenman and Hoffmaister (2000) calculate estimates of aggregate bank excess liquid assets in Thailand – the idea being that a demand-induced drop in lending will show up as an increase in excess reserves. They find no evidence of a buildup of excess reserves, consistent with the view that the decline in lending was supply-driven. Ghosh and Ghosh (1999) estimate equations for the demand and supply of credit in Indonesian and Korea. They find during the early part of the crisis (until the first quarter of 1998) that credit supply was the short side of the market. From then on, lending was demand constrained, as Indonesia and Korea slipped into recession.

Ito and Pereira de Silva (1999), focusing on macroeconomic data and a survey of commercial banks in Thailand, find evidence of increases in credit spreads, a decline in total intermediation, and a reduction in credit even to groups (such as exporters) who might have expected to benefit from a depreciation in the Thai baht. This last piece of information in particular is cited as evidence of a supply-side reduction in credit.

Finally, evidence on the extent of explicit credit rationing by banks is presented in Table 2. In the first six months of 1997 (before the beginning of the crisis) 9 per cent of firms were refused a loan by a financial institution. This percentage doubled to 18 per cent in the second half of 1997, and increased further to 23 per cent in the first half of 1998. This piece evidence in particular appears to indicate a decline in the availability of credit to firms.

As a partially dissenting view, Hallward-Driemeier, Dwor-Frecaut, and Colaco (2000) cite evidence from the same World Bank survey used in this paper that the most important self-reported concern of firms during the crisis was a lack of aggregate demand, rather than insufficient credit from banks. However, Holmstrom and Tirole (1997) show that a credit shortage may appear as a higher cost of debt for firms rather than explicit credit rationing; this is relevant since loan spreads increased during the crisis (Domaç and Ferri, 1999 and MacCauley, 2003, Graph 6), and high interest rates were cited by firms as the third most important cause of declining output. Also, responses to other survey questions do appear to indicate a deterioration in credit conditions. Firms in Thailand and Korea were asked directly to rank how credit availability from domestic banks had evolved since the crisis began. In Thailand, 69 per cent of firms reported that bank credit availability had declined, while only 3 per cent reported that credit availability had improved. In Korea, these percentages are 50 per cent and 18 per cent respectively. Also, as mentioned above, the proportion of firms refused credit by a financial institution more than doubled from the pre-crisis period.

In summary, several different types of evidence suggest that availability of credit from financial intermediaries deteriorated substantially during the early part of the Asian crisis (the second half of 1997 and first half of 1998). The extent to which such credit shortages were a primary cause of the depth of the crisis is less certain. But for the purposes of this paper, the

period provides a useful natural experiment for understanding the role of bank relationships during a downturn in the credit cycle.

4. Empirical Strategy

The estimation approach is essentially difference-in-differences. The empirical model underlying the regressions presented in Section 5 is:

$$[1] \qquad credit.short_{it} = \tau_t + \alpha . relation_i + \delta . borrow.cond_t + \gamma[relation_i . borrow.cond_t] + \varepsilon_{it}$$

$credit.short_{it}$ measures the severity of credit constraints; the higher the index the more difficult or expensive it is for the firm to obtain finance. $relation_i$ measures the strength of bank-firm relationships (ie. the stronger the relationship, the higher is $relation_i$). $borrow.cond_t$ measures the aggregate availability of bank credit (the better are aggregate credit conditions, the higher is $borrow.cond_t$). The key coefficient of interest is γ. $\gamma < 0$ implies that a decline in financial conditions has a greater impact on credit availability for firms with weak bank relationships.

In some cases, the survey only provides a measure of the *change* in credit availability. For example: firms self report on a 1 to 5 scale whether credit from domestic banks became more or less restrictive during the crisis. In these cases, I estimate:

$$[2] \qquad \Delta credit.short_{it} = \varphi_0 + \varphi_1 . relation_i + \varepsilon_{it}$$

which is simply the first difference of [1]. Matching parameters, $\varphi_1 = \gamma.\Delta borrow.cond_t$. As long as we know the sign of '$\Delta borrow.cond_t$' (ie. that aggregate credit conditions became worse at the onset of the Asian crisis), the sign of γ can still be estimated.

The next section presents empirical estimates using several different measures of 'credit.short' and the two measures of bank relationship intensity discussed earlier: the length of

the firm's relationship with its primary financial institution (log(1 + relationship length in years)), and the concentration of the firm's relationships (log(1+no. of banking relationships)). Several firm controls are included in each specification: firm size (log assets), profitability (profits/assets) and leverage (debt/assets) all measured at the end of 1996, firm age (log(1+firm age in years)), and a set of 24 industry*country interaction dummies (6 industries x 4 countries).

4.1 Theoretical predictions

What does theory tell us about the interaction between credit conditions and the benefits of bank relationships (ie. the sign of γ)? In Appendix A I develop a simple model based on Holmstrom and Tirole (1997) to think about this question. I consider two types of firms, one with a single deep banking relationship, the other with two weaker relationships. (A relationship bank is modelled as a lender who can monitor the firm at lower cost than outside banks.) The single strong relationship minimizes monitoring costs, but it also leads to ex-post holdup by the bank, so that firm profits may be lower with a single relationship bank than with two weaker banks who compete ex-post.

In this framework, I show that a decline in aggregate credit availability has ambiguous relative effects on firms with weak and strong relationships. Firms with weak relationships experience a higher increase in the marginal cost of debt. But this does not necessarily translate into a larger fall in investment or output; answers depend on the parameter values and the shape of the firm's production function. The reason is that, even though the marginal cost of funds changes less for firms with strong relationships, the change in investment may still be larger if the marginal product of investment is very insensitive to changes in investment in the relevant region. These conclusions are related to Kaplan and Zingales (1997), who show that investment-cashflow sensitivities are not necessarily monotonic in the intensity of firm financial constraints.

Alternatively, the evidence in this paper can be viewed as an test of the 'flight to captivity' prediction of Dell'Ariccia and Marquez (2004). These authors present a model which predicts that when faced with a drop in loanable funds, banks will shift the composition of lending towards firms over which they have a large informational advantage compared to outside lenders.[7] In the current context the theory predicts that during a 'credit crunch', lending should decline least for firms with a single banking relationship (ie. where an incumbent bank has an informational monopoly over the firm). In fact, this prediction is exactly consistent with the main empirical results. I discuss this result and its interpretation further in Section 5.5.

4.2 Identification: Bad relationships or bad firms?

There are several possible reasons why otherwise similar firms might differ exogenously in the strength of their banking relationships. For example, in Sharpe (1990) and Thakor (2004), banks optimally play randomized strategies when choosing whether to continue to extend credit to client firms. Alternatively, some firms may use multiple lenders simply because of idiosyncratic gaps in the range of services offered by their original relationship bank.

On the other hand, it is also plausible that because relationships are formed endogenously, measures of relationship strength are in fact simply proxying for unobserved measures of firm quality or creditworthiness. Firms with poor management, poor credit history or other risk factors for loan default will generally have greater difficulty obtaining credit. Such firms are also likely to have shorter-lived, more dispersed lending relationships (ie. as lenders find out about the firm's lack of creditworthiness, they are unlikely to renew lines of credit or make new loans to the firm). If these firm-level default risk factors are not fully observable to

[7] The intuition is that uninformed outside lenders compete less aggressively for firms' business when information asymmetries are high, because of adverse selection problems (ie. the outside lenders will attract exactly the low quality firms that the incumbent lender has chosen to reject). For this reason, the incumbent bank makes higher profits from firms over which it has a larger informational advantage. Consequently when loanable funds are scarce (or when the incumbent bank faces increased competition), the bank will retain these high margin 'informationally captive' firms – this is what Dell'Ariccia and Marquez call a 'flight to captivity'.

the econometrician, she could easily find misleadingly strong correlations between relationship strength and the availability of credit.

There have been relatively few attempts in the literature on banking relationships to convincingly address these endogeneity problems. Although the data at hand does not offer any clean instruments for either the length or concentration of banking relationships, I do pursue two different strategies that help to disentangle 'bad relationships' versus 'bad firms' explanations of the empirical results.

Firstly, I conduct a 'false positive' test to see whether banking relationships affect the availability of non-bank forms of credit. As well as bank credit, firms in the survey also estimate the change in credit availability from trade creditors, moneylenders and family and friends. If relationships are simply a proxy for general informational problems, then weak relationships will likely be correlated with a decline in the availability of all sources of credit. If on the other hand, the relevant variables do actually capture exogenous differences in the strength of banking relationships, firms with weak relationships should experience a decline in the availability of bank credit, but not other sources of credit.

Secondly, I estimate correlations between relationships and credit availability either in first differences or using a differences in differences approach, in contrast to most other papers, who estimate these relationships in levels. The advantage of this approach is that if there are any fixed differences between the supply of credit to firms with strong and weak relationships, it will be netted out upon first differencing.

5. Evidence

5.1 Availability of credit from domestic banks

As a first measure of credit constraints, firms in Korea and Thailand were asked to assess on a five point scale how the availability of domestic bank credit to their firm had changed since the

beginning of the crisis (I convert this to a scale where 1= availability of bank credit significantly increased, 5 = availability of bank credit significantly decreased).

I regress this variable on the two measures of banking relationship strength, ln(1+relationship length) and ln(1+number of relationships). ie. I estimate equation [2], where the five point measure of the change in credit availability is used to measure $\Delta credit.short_{it}$. I include all the controls listed in Section 4.1: log(assets), log (1+firm age), profits/assets, debt/assets, and the 24 industry*country interaction dummies. Results are presented in Table 3. Since the dependent variable is measured discretely, the equation is estimated as an ordered probit model. Resulting estimates are then scaled to represent the marginal expected rate of change of the relevant right-hand side (RHS) variable on the dependent variable.[8]

Column 1 of Table 3 presents the baseline estimates, where data from both countries is combined into a pooled sample. The results suggest that on both the 'length' and 'concentration' dimensions, firms with weak banking relationships were more likely to experience a deterioration in credit availability from domestic banks. Extrapolating the estimated derivative, a doubling of relationship length improves the firm's assessment of the change in credit conditions by 0.168 points, while doubling the concentration of relationships (eg from dealing with four lenders to dealing with two) improves the respondent's view of credit conditions by 0.182 points.[9] Both estimates are statistically significant at the 1 per cent level.

The other coefficient estimates are generally consistent with accounts in the literature about a 'flight to quality' in lending during the crisis. Firstly, younger firms experienced a larger

[8] This is calculated as an average derivative across observations in the sample, ie. by adding a small increment to the value of the RHS variable for each observation and calculating the resulting rate of change in the dependent variable. The 'dprobit' command in STATA uses the same procedure to scale probit estimates to reflect the effect of a change in RHS variables on the probability of observing a value of 1 for the binary dependent variable. (There is no equivalent command for ordered probits or bivariate probits, so in these cases I hand-coded the calculation instead.)

[9] N.B. Recall however when interpreting these extrapolations that because the model is non-linear, the coefficient estimates are exactly valid only for small changes in the right-hand-side variables.

decline in the availability of bank credit conditions. The coefficient on log firm age is of similar magnitude to the coefficient on log relationship length (-0.181 compared to -0.168). Firms with higher leverage also reported a larger decline in bank credit availability; the coefficient of 0.192 implies that an all debt firm ranked the change in credit conditions 0.192 points worse than an all equity firm (significant at the 5 per cent level). Notably, firm size is not significantly correlated with changes in credit availability after controlling for other firm characteristics.

Column 2 presents a more parsimonious specification which omits several of the balance sheet variables. This implies a larger sample size (since a subset of firms, especially smaller firms, did not report complete balance sheet information, perhaps because they did not maintain detailed accrual accounting records). The results are broadly similar to before. The coefficient on relationship length is somewhat smaller, while the coefficient on the number of lenders is larger. Both are still statistically significant at the 1 per cent level. Columns 3 and 4 estimate the same model separately for Korea and Thailand. Again, the point estimates are quantitatively similar to before, although the standard errors are somewhat larger reflecting the smaller individual sample sizes (especially for Thailand, the smaller of the two subsamples).

5.2 Availability of credit from other sources

As highlighted by the discussion of identification in Section 4.1, for a causal interpretation of the above results it is important to determine whether the measures of relationship strength can in fact be reasonably viewed as reflecting exogenous variation in bank-firm relationships, rather than just being proxies for unmeasured aspects of firm creditworthiness. A first approach to distinguish between these two possibilities is to examine how firms rated the availability of non-bank sources of credit. If measured 'bad relationships' are in fact a proxy for 'bad firms', then firms with weak relationships are likely to have experienced a proportionate fall in credit availability from all sources, not just bank credit.

This ‘false positive’ test is possible because Thai and Korean firms were asked to rate changes in credit availability not just from domestic banks, but also from other sources including suppliers, family and friends and moneylenders. In each case the question is worded in the same way, and answers are measured on the same five point scale, where 1= credit availability from source ‘x’ significantly increased, 5 = credit availability from source ‘x’ significantly decreased.

Thus, I re-estimate the ordered probit model from Section 5.1, replacing the dependent variable with each of these three alternative measures of credit availability (suppliers, family and friends, and moneylenders) in turn. Unfortunately, not all firms answered the survey question for all of the credit sources, meaning that the sample is different in each case. To minimize these sample selection problems, each time I estimate a regression using one of the alternative sources of credit as the dependent variable, I also re-estimate the ‘availability of bank credit’ regression using the same sample of firms. These two regressions, which by construction are based on the same set of firms, can then be compared side-by-side. Results are presented in Table 4. The table is split in three (banks vs trade credit, banks vs moneylenders and banks vs family and friends), in each case the results for the alternative form of credit are presented in the first column, then the results for bank credit, based on the same sample, in the second column.

As in Table 3, the relationship variables are statistically significant predictors of the change in the availability of bank credit for each subsample (generally at the 5 per cent or 1 per cent level). But notably, this is not true for the alternative sources of credit. In each case, neither of the relationship variables is statistically significant, and, although the coefficients are generally correctly signed, the point estimates are always substantially smaller than the corresponding cofficient from the bank credit regression.

Overall, these results support the view that the bank relationship variables are not just proxies for firm quality. Weak banking relationships particularly affected firms’ access to credit

from domestic banks. The effect on the availability of other forms of credit was much weaker, and in fact not statistically distinguishable from zero.

5.3 Credit rationing by financial institutions

The dependent variable in Tables 3 and 4 is a qualitative ranking of the change in credit availability. I now study an alternative, quantitative measure of credit constrainedness: whether firms were refused credit by a financial institution during three different phases of the crisis.

Firms in all four countries were asked: 'Were you refused credit by a financial institution during the period [...] to [...]?' Firms answer this question for three different time periods: January-June 1997 (pre-crisis), July-December 1997 (in the early part of the crisis) and January-June 1998 (during the middle of the crisis). This allows estimation of the benefits of close relationships both before and during the crisis period, not just the change in the effect of relationships as previously. (That is, I estimate equation [1], where data on whether the firm was refused credit is used as a proxy for $credit.short_t$ for each different time period.) As shown in Table 2, loan refusal rates approximately doubled during the early part of the crisis. 9.4 per cent of firms were refused credit during the first six months of 1997. This increased to 17.8 per cent of firms in the second half of 1997 and 22.8 per cent of firms in the first half of 1998.

Two separate bivariate probit models are estimated. In the first model, the dependent variables in the two equations are dummy variables equal to one if the firm was refused credit in the pre-crisis period January-June 1997, and then the mid-crisis period January-June 1998. In the second model, the pre-crisis period January-June 1997 is compared instead to the July-December 1997 period (early part of the crisis).[10]

[10] A bivariate probit takes into account within-firm serial correlation in loan refusals (this correlation is high: 0.67 in the Table 5 regressions and 0.84 in Table 6). Two bivariate probits were estimated (rather than a trivariate probit) for practical reasons: trivariate probits are computationally difficult because of the need to evaluate triple integrals (see Greene 1997 p. 911). I did, however, estimate a bivariate probit based on the first difference of whether the firm was refused credit. That is, a bivariate probit where the dependent variables are [I(Jan-Jun 1998)- I(Jan-Jun 1997)] and [I(Jul-Dec 1997)- I(Jan-Jun 1997)], where I(x) is an indicator variable

Results for the first bivariate probit regression are presented in Table 5. First turning to the coefficient on ln(1+number of relationships), in the pre-crisis period (Jan-Jun 1997) this variable is positive, but small (0.020) and not statistically different from zero. In the mid-crisis (Jan-Jun 1998) period however, the coefficient increases from by nearly sixfold (to 0.112), and becomes statistically significant at the 1 per cent level. Thus, concentrated relationships were correlated with a lower probability of being denied credit during the crisis, but not before the crisis. The difference-in-difference parameter γ is captured by the difference between these two probabilities: 0.112 - 0.020 = 0.092.[11] As the table shows, this coefficient is statistically different from zero at the 1 per cent level (p=0.0022).

This result for relationship concentration suggests that relationships did indeed become more correlated with access to credit during the crisis. However, results for relationship length are substantially weaker. The coefficient has the expected negative sign (ie. a longer relationship with the firm's primary bank reduces the probability of being denied credit), and is slightly larger in the mid-crisis period (-0.029 compared to -0.025). But the difference between these two coefficients is economically small and statistically insignificant (p = 0.51).

Table 6 presents results for the second bivariate probit, in which the two dependent variables refer to the Jan-Jun 1997 and July-Dec 1997 periods. The results are quite similar. Again, the coefficient on the concentration of relationships, ln(1+number of relationships), is small and statistically insignificant before the crisis. But relationship concentration becomes much more important during the 'early-crisis' period. The coefficient increases from 0.021 to 0.110; the difference between these two coefficients of 0.089 is statistically significant at the 1

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equal to 1 if the firm was refused credit during period 'x'. Results from this regression (available on request) are very similar to those in Tables 5 and 6.

[11] In terms of the discussion in section 4, since the number of relationships is inversely related to bank relationship strength, this positive coefficient implies that γ is negative and statistically significant. This implies that relationships become more correlated with access to credit when aggregate credit conditions are poor.

per cent level (p = 0.0002). As in Table 5, however, there is no statistically significant change in the coefficient on log(1+relationship length).

Figure 1 provides a visual perspective on the correlation between credit rationing and bank relationship concentration. The Figure plots the probability a firm was refused credit in each of the three periods, as a function of the number of lending relationships. The graph is based on estimates from Columns 3 and 4 of Table 5 and Table 6, which use a more flexible parameterization where the ln(1+number of relationships) variable is replaced with several dummy variables (ie. dummies for whether the firm dealt with 2, 3, 4, 5 or 6+ lenders -- a single bank relationship is the omitted category). So the slope of each line in the graph reflects the coefficients on each of these dummy variables.

[INSERT FIGURE 1 HERE]

The Jan-June 1997 line is nearly flat, implying no correlation between relationship concentration and the probability of being refused credit prior to the crisis. This is consistent with the regression results, the dummy variables in column 3 of Table 5 or Table 6 are not jointly significant; (p=0.94 and p=0.19 respectively). However, in the second half of 1997 and first half of 1998, firms dealing with a single financial institution were substantially less likely to have been denied credit. During the earliest part of the crisis (July-Dec 1997) for example, the probability of being refused credit increased by 3 percentage points for firms who dealt with one institution, but by 9 percentage points for firms with two relationships, and by 17 percentage points for firms who dealt with six banks or more. In both Table 5 and Table 6 we are able to reject the null that each of the coefficients on the post-crisis 'number of lenders' dummies is equal to its pre-crisis value (p = 0.040 in Table 5 and p = 0.002 in Table 6).

5.4 Did insufficient bank finance result in lower output?

The survey asked firms in each of the four countries whether or not output from their factory had declined since the onset of the crisis. Firms who answered in the affirmative were then asked to rank the importance of different factors as causes of the decline in production. Among the reasons suggested by the survey were (i) insufficient bank finance for working capital (ii) insufficient finance from suppliers and (iii) insufficient revenue. Survey respondents ranked each factor on a five point scale from 1 (not at all important) to 5 (very important).

As a final exercise, I analyze these ranking variables using the same 'false positive' approach applied earlier. In turn, I regress the ranking of each explanation for declining output on the relationship variables and firm controls, using an ordered probit. (That is, I estimate equation [2] using the rankings as measures of $\Delta credit.short_t$). I first test whether the relationship variables predict the contribution of insufficient bank finance to the firm's output decline. I then check to make sure the relationship variables are uncorrelated (or at least *less* correlated) with the other explanations for declining output, to make sure the bank relationship variables are not simply proxies for general firm quality.

Results are presented in Table 7. Column 1 examines whether strong- and weak-relationship firms differed in the extent to which they ranked 'lack of bank finance for working capital' an important determinant of lower output. Both measures of relationships are correctly signed (ie. longer and more concentrated relationships are correlated with bank credit being a less important determinant of lower output). The coefficient on log(1+number of relationships) implies that doubling bank-relationship concentration reduces the importance of bank credit as an explanation for lower output by 0.327 (significant at the 1 per cent level). However, as in Tables 5 and 6, results for the 'length' dimension of relationships are much weaker. The coefficient of -0.053 is correctly signed but not statistically different from zero.

These results can be compared to Column 2 (dependent variable: inadequate revenue as a cause of output declines) and Column 3 (dependent variable: inadequate credit from suppliers as a reason for output declines). In Column 2, the 'concentration' measure of bank relationships drops by 2/3 relative to Column 1, and is only statistically significant at the 10 per cent level. The 'length' measure of bank relationships is still not statistically significant. In Column 3, the lending concentration measure of bank relationships is significant at the 5 per cent level, although the point estimate is only around half as large as Column 1.

Sample selection is a potential source of bias in these results because only 72 per cent of firms reported a decline in output since the onset of the crisis; firms whose output had not declined were not asked to rank the importance of different factors for changes in output. Unfortunately, no obvious instruments are availabile that affect the probability of output declining but are uncorrelated with the importance of different explanations for that decline; this makes estimating a valid Heckman (1976) selection model difficult. As a robustness check, I did still estimate a Heckman selection model using the same regressors in the selection equation as in the regressions in Table 7. The inverse Mills ratio λ is not statistically different from zero in the three models corresponding to the three columns of Table 7 (the p-values on λ are 0.779, 0.437 and 0.564 respectively). In the selection equation, the coefficient on the number of relationships has the expected positive sign -- firms with less concentrated relationships were more likely to have experienced a decline in output (significant at the 10 per cent level). But the coefficient on the length of the firm's primary relationship has the opposite sign to expected. Firms with longer primary relationships were statistically significantly more, rather than less, likely to have experienced a decline in output.

To sum up, results on the 'concentration' dimension of relationships appear consistent with previous evidence. Firms who dealt exclusively with a single bank were less likely to cite

inadequate bank credit as a reason for declining output. Concentrated relationships are much less correlated with the importance of other explanations for declining output (although, unlike the previous results, the correlations are not zero). From the first stage of the Heckman selection model, firms with concentrated lending relationships were also less likely to have experienced a decline in output per se. However, results on the 'length' dimension of relationships are less supportive -- firms with a long relationship with their primary bank were not statistically less likely to cite declining bank credit availability as a reason for lower output.

5.5 Summary and Discussion

The results presented in this section suggest that banking relationships became more important for the availability of finance as the Asian crisis took hold in the second half of 1997 and the first half of 1998. As Figure 1 shows, there is essentially *no* correlation between the concentration of lending relationships and the probability of being refused a loan before the crisis began. But during the crisis, firms with multiple banks were more than twice as likely to be refused a loan by financial institutions as those with a single relationship. Table 3 shows that firms with concentrated relationships were less likely to report that bank credit availability had declined, while results in Table 4 and 7 show that bank relationship variables are in particular correlated with changes in the supply of credit from domestic banks. They are either not correlated, or at most much less correlated, with changes in the supply of other types of credit (trade credit, loans from family and friends, loans from moneylenders) or the importance of other reasons for declining output (insufficient revenue, or insufficient trade credit). This suggests that observed measures of bank relationships are not just general proxies for firm quality or creditworthiness.

In most cases, results for the 'length' dimension of bank relationships are weaker than for the 'concentration' dimension. Firms with a long-standing primary bank relationship *were*

significantly less likely to report a decline in the availability of bank credit during the crisis. But elsewhere, the coefficient on primary relationship length is not statistically different from zero.

Why might the *concentration* of relationships, as opposed to the *length* of relationships, be particularly important during downturns in aggregate credit availability? The models of Petersen and Rajan (1995) and Dell'Ariccia and Marquez (2005) suggest a possible explanation, driven by bank informational monopolies. In Petersen and Rajan, banks lend initially to young unproven firms. It is unprofitable to make such loans on a spot basis, because firm quality is uncertain (there are many low-quality firms). Banks will only be willing to provide credit if they are able to extract rents from successful firms in future periods. This in turn is only possible if the loan market is relatively uncompetitive *ex post*.

Applying this idea to the current context, during times of crisis, banks have similar incentives to maintain finance to firms with which they have an exclusive relationship. For these firms, the bank has ex-post market power by virtue of the fact that it is the only relationship lender. Maintaining finance to such firms during the crisis allows the bank to exploit their informational monopoly in the future, once the crisis has subsided. This 'informational monopoly' argument does not apply in the same way for the 'length' dimension of relationships. Even if the firm has a long-standing relationship with its primary bank, this bank's *ex post* market power may be minimal if the firm also has other banking relationships. This suggests a potential explanation why the results on the 'length' dimension of relationships are weaker.

The role of informational monopolies in determining lending patterns is further explored in Dell'Ariccia and Marquez (2005). As discussed in Section 4.1, in this model adverse selection endogenously provides an informed lender with market power -- when adverse selection is severe, uninformed banks have difficulty bidding away customers from an informed bank because of lemons problems. This allows the incumbent bank to make higher profits from such

borrowers, and implies that if banks are short of loanable funds, they will thus maintain lending to the informationally captured group. This 'flight to captivity' prediction appears to be borne out exactly in the data. I find consistently that firms with few relationships (ie. where the incumbent banks' market power is greatest) enjoyed better access to credit during the crisis.

6. Conclusions

I find that the benefits of close bank relationships became substantially magnified at the onset of the Asian financial crisis. Manufacturing firms in the crisis-afflicted countries with a single relationship were approximately half as likely to be refused credit during the early part of the crisis, even though there was no statistically significant correlation between the concentration of relationships and loan refusal rates before the crisis began. Firms with close relationships were less likely to self-report that credit availability from banks had declined, and were less likely to cite lack of bank finance as a contributor to declining output. The empirical results are substantially stronger for the 'concentration' dimension of relationships (dealing a single lender rather than many) than the 'length' of relationships. This last finding in particular appears consistent with the 'flight to captivity' prediction of Dell'Ariccia and Marquez (2005).

I also present evidence that suggests the bank relationship variables are not just endogenous proxies for overall firm quality or creditworthiness, but do in fact reflect the intensity of bank-firm informational problems. Namely, I find that relationship variables are correlated with bank credit availability, but uncorrelated with the availability of non-bank forms of credit, including trade credit, loans from moneylenders and loans from family and friends.

Although it is difficult to generalize too much from a single episode, the results in this paper suggest that bank relationships perform an insurance function: they provide continued access to finance during downturns in the credit cycle (for example during periods when firm internal funds are scarce, or during a banking crisis or other disruption to the supply of credit).

Finally, the results in this paper have implications for 'flight to quality' effects during financial crises, recessions or periods of tight monetary policy. I find some direct evidence consistent with the flight to quality hypothesis: namely I find that younger firms and more indebted firms experienced larger declines in the availability of credit during the crisis. I do not find differences across size classes of firms. But since small firms tend to have more concentrated bank relationships, the results suggest that the insurance effects of relationships helped smaller firms relative to larger firms at the onset of the crisis. A broader potential implication is that without the insurance benefits of bank relationships the observed excess sensitivity of small US firms to monetary shocks and aggregate economic fluctuations might be more pronounced. Studying this hypothesis in more detail is left for future research.

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Appendix A: Theoretical Model

The model is a simple variation of Holmstrom and Tirole (1997, hereafter HT). I conduct comparative statics exercises to see how a decline in bank credit availability affects investment, output and the cost of debt for firms with strong and weak banking relationships.

The main point made below is that the effects are ambiguous. It is not necessarily true that firms with strong relationships experience a smaller decline in credit availability when bank lending contracts; the answer depends on parameter values and the shape of the firm's production function.

A.1 Setup of the model

Agents. There are three types of risk neutral agents, firms, banks and uninformed investors. Firms raise capital for an investment project that matures at the end of the period. Because of agency problems (described below) uninformed investors do not lend directly to the firm, but instead deposit funds in a bank, who then invests these deposits as well as some of its own capital in the project.

Structure of project. The project is of variable size I and succeeds with probability p_H. It produces gross return f(I) if it succeeds, and 0 if it fails. This project is partially financed by internal funds (A) and partially by borrowing. Borrowing is, however, limited by a moral hazard problem: firms have access to an alternative, negative net present value project which has a lower probability of success p_L, but produces a stream of private benefits for the entrepreneur. Outsiders can only observe whether the project succeeds or fails, not which project is chosen.

To ameliorate these moral hazard problems, the firm borrows through a bank. Each bank has access to a monitoring technology: at a cost of c.I, the bank is able reduce the firm's private benefits sufficiently so that the firm always chooses the positive net present value project.

Relationships. Holmstrom and Tirole (1997) assume the rationale for banks is that, through monitoring, they are able to reduce the degree of private benefits available to entrepreneurs. As a simple extension of this idea, I assume there are two types of firms. Type S ("strong" relationships) have a single relationship bank, which has a lower cost of monitoring the firm (c_S) than all non-relationship banks (i.e. $c_S < c_\#$, where $c_\#$ is the monitoring cost for a non-relationship bank). Type W ("weak" relationships) have two weaker relationships, where each bank has a cost of monitoring of c_M, where $c_S < c_W < c_\#$.

For type S, the presence of a single relationship bank implies relationship rents and a potential for holdup (since the firm's threat point, to borrow from an outside lender, implies higher monitoring costs $c_\#$, which must be passed onto the firm as a higher interest rate so the outside lender makes zero profits). It is assumed the relationship bank captures a share φ of these rents as per a Nash bargaining solution. For type W, there is no holdup problem, because there are two banks which compete a la Bertrand ex post.

These simple assumptions capture two key features of bank relationships: (i) strong relationships improve the delegated monitoring and reduce informational problems, but (ii) relationships introduce the possibility of ex post holdup. (NB. Diamond and Rajan (2001) make a similar type of assumption: namely that relationship lenders can liquidate the firm's assets for a higher amount than outside parties).

Banks. As mentioned above, through monitoring, banks are able to dissuade the firm from shirking and choosing the low probability project. As in HT, the bank also faces a moral hazard problem: since monitoring is costly and non-contractible, the bank must receive a minimum share of the project's returns to incentivize it to pay the cost of monitoring. Banks partially compensate the firm for these project returns by investing some of their own capital in the project. However, bank capital is scarce. I denote by β the equilibrium gross rate of return on bank capital ($\beta \geq 1$, since bank funds can always be lent to uninformed investors). As HT show, β is determined in equilibrium by the demand for and supply of bank capital. A 'credit crunch' in this setup is an exogenous decline in capital, which then increases β in equilibrium.

The firm problem. The firm solves:

$\max \pi_f = f(I) - R_b - R_u$

subject to the following constraints:

[B-IC] $p_H R_b - \beta c I \geq p_L R_b$

[B-IR] $p_H R_b \geq \beta[I_b + cI]$

[U-IR] $p_H R_u \geq I_u$

[feasibility] $I_b + I_u + A \geq I$

In words, the firm maximizes the output of the project f(I) less payments to the bank (R_b) and uninformed depositors (R_u). Payments to the bank must satisfy the bank's incentive-compatibility constraint [B-IC]: ie. the expected payoff to the bank minus the opportunity cost of monitoring the firm must be at least as great as the bank's expected payoff if it does not monitor. The bank's participation constraint [B-IR] says the bank must earn an expected gross rate of return of at least β on its investment (the amount invested in the project plus funds spent monitoring the firm). Uninformed investors require an expected return of 0 on their investment of I_u, this is [U-IR]. The feasibility constraint states that all investment must be financed by banks, uninformed investors or the firm's retained earnings, A.

Solving the model. Each of the four constraints binds in equilibrium. Combining the equations and solving, the first-order condition for equilibrium investment I* is:

[A.1] $f'(I^*) = 1/p_H + [c / (p_H - p_L)] * [\beta - (p_L / p_H)]$

Note that $f'(I^*)$ is increasing (and therefore investment is decreasing) in c and β. This first order condition is not affected by the degree of bank holdup (φ) for type-S firms, because bargaining is ex-post efficient. Another way of saying this: on the last unit of investment, the expected return from extra investment is exactly equal to the cost, so the marginal relationship rents are zero.

A.2 'Credit crunch'

HT show that in this setup, a fall in bank capital leads to a higher return on bank capital (β), lower investment and output and an increase in interest rate spreads. Here we study how it differentially affects firms with strong and weak relationships. This is measured by the cross derivative of investment, output and the cost of debt with respect to dc.dβ.

Cost of debt. The marginal cost of debt 1+r is equal to the marginal product of investment:

[A.2] $1+r = f'(I^*) = 1/p_H + [c / (p_H - p_L)] * [\beta - (p_L / p_H)]$

$1/p_H$ is the interest rate that would determine the firm's optimal level of investment in the absence of contracting problems. The second term is the deadweight cost of external finance, reflecting physical bank monitoring costs as well as the fact that the rate of return on bank capital β is greater than one.

What happens to the marginal cost of debt when β increases? The relevant derivative is $dr/d\beta = [c / (p_H - p_L)]$. This is unambigously increasing in c, implying that firms with multiple weaker relationships (c_M relative to c_L) do experience a larger increase in the marginal cost of debt. Since the Nash-bargaining over profits is Pareto optimal, this result is independent of the degree of holdup (ie. whether φ<1). (Holdup here increases the average cost of debt but not the marginal cost of debt).

Lending / Investment. As β increases, bank lending and investment falls (investment is identically equal to the difference between bank lending and internal funds, A). The relevant derivative is $dI/d\beta = [c / (p_H - p_L)] * [1 / f''(I)]$, which which is negative because $f''(I) < 0$. The second derivative is given by the complicated expression:

[A.3] $d^2I / dc.d\beta = \{[1 / (p_H - p_L)] * [1 / f''(I)]\} - \{[c / (p_H - p_L)] * [dI / dc] * [f'''(I) / f''(I)^2]\}$

The key point from this expression is that the second derivative $[d^2I / dc.d\beta]$ cannot be signed unambiguously. The first term in curly brackets is always negative because $f''(I) < 0$. The second term however is positive if $f'''(I) > 0$. If $f'''(I) >> 0$, $[d^2I / dc.d\beta]$ will be positive, and the fall in investment following a higher β is larger for firms with strong relationships ($c = c_L < c_M$). The sign of $d^2 \ln(I) / dc.d\beta$ is also ambiguous.

The intuition is that, even though the marginal cost of funds changes more for firms with weak relationships (higher c), the change in investment may still be larger for firms with strong relationships if the marginal product of investment is very insensitive to changes in investment in the relevant region. The condition $f'''(I)<0$ rules out this possibility.

In the parametric example $f(I) = I^{\alpha}$, it can be shown that the *percentage* decline in investment following a shock to β is always increasing in c. That is, $d^2 \ln(I) / dc.d\beta < 0$. Thus, type W firms (two weaker relationships and higher monitoring costs c_M) always cut investment more in percentage terms. The absolute decline in investment is larger for type W firms only under the condition $(p_H - p_L)/(\beta p_H - p_L) + c > (2-\alpha)/(1-\alpha)$. This condition is satisfied as long as α is not too close to 1.

Output. The analysis is similar to that for investment. Again, the sign of the second derivative $[d^2Y / dc.d\beta]$ is ambiguous. Assuming that $f'''(I)<0$ is a sufficient but not necessary condition for the decline in output to be larger for firms with weak relationships. However, in this case, the sufficient condition is even weaker than before. Again, in the parametric example $f(I) = I^{\alpha}$, type W firms (two weaker relationships and higher monitoring costs c_M) always experience a larger percentage decline in output. The absolute decline in investment is larger only as long as α is not too close to 1.

Finally, note as well that because ex post bargaining is Pareto optimal, these results for both investment and output are independent of the degree of holdup (φ). However, it is possible that even though type W firms have lower output and investment, they may still have higher profits than type S firms. This follows from the fact that holdup affects the firm's average cost of funds but not the marginal cost of funds.

A.3 Discussion/Summary

The framework developed above suggests that the effects of a 'lending crunch' – an exogenous decline in the provision of bank credit – do not *necessarily* fall disproportionately on firms with weak relationships. The answers depend crucially on parameter values and the shape of the firm's production function. In many respects, these conclusions are analogous to the arguments in Kaplan and Zingales (1997), who show that investment-cashflow sensitivities are not necessarily monotonic in the degree of financial constraints.

Firms with weak relationships *do* experience a larger increase in the marginal cost of debt, and the general condition that ensures that firms with weak relationships decline more quickly are relatively weak. Also, in the parametric example where $f(I) = I^{\alpha}$, the proportionate decline in lending, investment and output is larger for firms with weak relationships is always larger. This provides some theoretical support for the view that relationships are most important during times of low credit availability. However, the ambiguity in the theoretical predictions reinforces the argument that determining the interaction between relationships and the 'credit cycle' must in fact be determined empirically.

Figure 1: Denial of credit and concentration of lending relationships

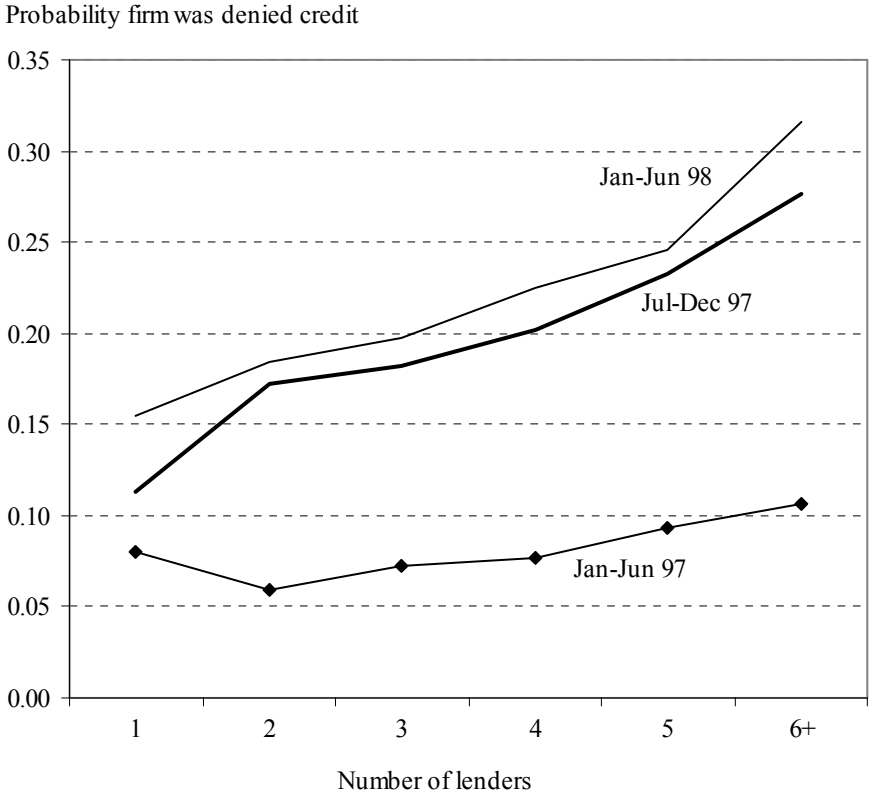

Table 1
Descriptive Statistics

	All countries	*All countries: by # banking rships*					Indonesia	Korea	Philipines	Thailand
		1	*2*	*3-5*	*>5*	*?*	*1*	*2*	*3*	*4*
Number of firms:	3143	749	713	848	419	414	940	857	694	652
Proportion of firms with:										
<150 employees	0.58	0.74	0.61	0.56	0.20	0.66	0.54	0.65	0.46	0.63
150-500 employees	0.24	0.16	0.27	0.26	0.36	0.17	0.22	0.24	0.31	0.22
> 500 employees	0.18	0.10	0.12	0.17	0.43	0.17	0.24	0.11	0.22	0.16
didn't answer question	*0.14*									
Proportion of firms with:										
1 lending relationship	0.27	1	0	0	0	na	0.48	0.08	0.21	0.35
2 lending relationships	0.26	0	1	0	0	na	0.28	0.19	0.29	0.30
3-5 lending relationships	0.31	0	0	1	0	na	0.20	0.42	0.35	0.26
>5 lending relationships	0.15	0	0	0	1	na	0.04	0.31	0.13	0.09
didn't answer question	*0.13*									
Proportion of firms by industry:										
electronics	0.16	0.15	0.16	0.17	0.20	0.14	0.20	0.17	0.16	0.13
food	0.17	0.19	0.16	0.13	0.10	0.29	0.32	0.00	0.24	0.10
autoparts	0.08	0.07	0.08	0.09	0.14	0.01	0.00	0.14	0.00	0.19
chemicals	0.20	0.18	0.16	0.22	0.25	0.22	0.29	0.28	0.17	0.00
machinery	0.05	0.02	0.05	0.08	0.09	0.00	0.00	0.18	0.00	0.00
garnments & textiles	0.34	0.39	0.40	0.31	0.22	0.34	0.34	0.23	0.38	0.54
didn't answer question	*0.00*									

Table 2
Additional Descriptive Statistics

		All countries	Indonesia	Korea	Philipines	Thailand
Number of firms:		*3143*	940	857	694	652
Assets (end 96, US$m):	mean	*80.58*	41.71	139.62	115.03	22.34
	st. dev.	*1308.64*	358.79	715.34	977.63	152.49
Profits/assets:	mean	*0.13875*	0.42	0.03	0.07	0.05
	st. dev.	*0.43*	0.63	0.13	0.80	0.39
Employment	mean	*383.7*	448.8	359.7	456.5	247.99
	median	*105*	128	97	173	72
	st. dev.	*1218.20*	1081.10	1496.70	1471.20	580.50
Liabilities/assets:	mean	*0.65*	0.51	0.71	0.74	0.63
	st. dev.	*0.48*	0.34	0.38	0.70	0.43
Rel. length with primary bank (years):	mean	*11.10*	9.83	12.24	11.45	10.97
	st. dev.	*8.06*	8.00	8.04	8.90	7.13
No. banking relationships	mean	*3.79*	2.08	6.20	3.47	2.75
	st. dev.	*5.42*	1.72	8.25	3.77	2.93
Refused credit: Jan-Jun 97		*0.094*	0.057	0.144	0.063	0.111
Refused credit: Jul-Dec 97		*0.178*	0.107	0.271	0.122	0.209
Refused credit: Jan-Jun 98		*0.228*	0.133	0.384	0.131	0.246

Table 3
Change in availability of bank credit during the crisis

Dependent variable is answer to the question: 'How has the availability of credit from domestic banks changed since the onset of the crisis?' Integer between 1 (much less restrictive) and 5 (much more restrictive). Estimation is by ordered probit. Robust standard errors. Coefficients represent the rate of change change in the expected value of the dependent variable following a small change in the RHS variable for each observation in the dataset.

	(1) baseline specification	(2) parsimonious	(3) Korea only	(4) Thailand only
Relationship variables				
log(1+relationship length)	-0.168	-0.148	-0.192	-0.170
	(0.055)***	(0.054)***	(0.079)**	(0.111)
log(1+no. of relationships)	0.182	0.214	0.147	0.268
	(0.069)***	(0.065)***	(0.089)*	(0.120)**
Controls				
log(1+firm age)	-0.181	-0.150	-0.252	-0.151
	(0.098)*	(0.091)*	(0.323)	(0.120)
log(total assets)	0.031		0.040	0.007
	(0.024)		(0.036)	(0.030)
log(total employment)		0.005		
		(0.031)		
profit / assets	0.114		-0.291	0.209
	(0.142)		(0.316)	(0.141)
liabilities / assets	0.192		0.199	0.165
	(0.083)**		(0.117)	(0.111)
industry*country dummies: F-test	0.0132**	0.0014***	0.0034***	0.701
Pseudo R2	0.0327	0.028	0.0193	0.0226
Number of observations	1057	1140	685	372

***, ** and * represents two-sided statistical significance at 1%, 5% and 10% levels respectively.

Table 4
Change in availability of credit: banks vs other sources

Dependent variable is answer to the question: 'How has the availability of credit from *'x'* changed since the onset of the crisis?' (where *'x'* is domestic banks, family and friends, suppliers or moneylenders). Integer between 1 (much less restrictive) and 5 (much more restrictive). Estimation is by ordered probit. Robust standard errors. Coefficients represent the change in the expected probability of the dependent variable following a small change in the RHS variable for each observation in the dataset (see text for more details). Each regression includes the same set of controls as column 1 of Table 3 (i.e. firm size, firm age, industry*country dummies, profits/assets, liabilities/assets), results for these variables available on request.

	Banks vs trade credit	
	Trade credit	Banks
Relationship variables		
log(1+relationship length)	-0.062	-0.160
	(0.061)	(0.072)**
log(1+no. of relationships)	0.012	0.243
	(0.075)	(0.091)***
Pseudo R2	0.030	0.030
Number of observations	673	647

	Banks vs moneylenders	
	Moneylenders	Banks
Relationship variables		
log(1+relationship length)	-0.070	-0.255
	(0.080)	(0.091)***
log(1+no. of relationships)	0.003	0.238
	(0.134)	(0.119)**
Pseudo R2	0.030	0.056
Number of observations	380	367

	Banks vs family/friends	
	Family and friends	Banks
Relationship variables		
log(1+relationship length)	-0.023	-0.209
	(0.080)	(0.089)**
log(1+no. of relationships)	0.012	0.215
	(0.107)	(0.117)*
Pseudo R2	0.030	0.030
Number of observations	444	417

***, ** and * represents two-sided statistical significance at 1%, 5% and 10% levels respectively.

Table 5
Was the firm refused credit by a financial institution?

Dependent variable is answer to the question: 'Was the firm refused credit by a financial institution between [...] and [...]?' Estimation is by bivariate probit. Robust standard errors. Coefficients represent the change in the expected probability of the dependent variable following a small change in the RHS variable for each observation in the dataset (see text for more details).

	(1)		(2)	
	Jan-Jun '97	Jan-Jun '98	Jan-Jun '97	Jan-Jun '98
Relationship variables				
log(1+relationship length)	-0.025	-0.029	-0.025	-0.026
	(0.012)**	(0.016)*	(0.011)**	(0.016)
P value: 97 coeff = 98 coeff	0.507		0.389	
log(1+no. of relationships)	0.020	0.112		
	(0.014)	(0.020)***		
P value: 97 coeff = 98 coeff	0.0022***			
No. of lenders: dummies				
no.lenders =2			-0.021	0.030
			(0.022)	(0.031)
no.lenders =3			-0.008	0.043
			(0.024)	(0.035)
no.lenders =4			-0.003	0.070
			(0.028)	(0.041)*
no.lenders =5			0.013	0.091
			(0.031)	(0.043)**
no.lenders =6 or more			0.026	0.161
			(0.026)	(0.038)***
P.value: 97 coeffs = 98 coeffs			0.040**	
Controls				
log(1+firm age)	-0.023	-0.017	-0.023	-0.023
	(0.022)	(0.031)	(0.022)	(0.032)
log(total assets)	0.011	0.011	0.011	0.017
	(0.004)**	(0.006)*	(0.004)***	(0.006)***
profit / assets	-0.027	-0.012	-0.027	-0.011
	(0.024)	(0.030)	(0.024)	(0.030)
liabilities / assets	0.015	0.070	0.015	0.073
	(0.017)	(0.022)***	(0.017)	(0.022)***
industry*country dums.: F-test	0.0023***	0.0000***	0.0011***	0.0000***
rho	0.67		0.67	
Number of observations	1879	1879	1879	1879

***, ** and * represents two-sided statistical significance at 1%, 5% and 10% levels respectively.

Table 6
Was the firm refused credit by a financial institution?

Dependent variable is answer to the question: 'Was the firm refused credit by a financial institution between [...] and [...]?' Estimation is by bivariate probit. Robust standard errors. Coefficients represent the change in the expected probability of the dependent variable following a small change in the RHS variable for each observation in the dataset (see text for more details).

	(1)		(2)	
	Jan-Jun '97	Jul-Dec '97	Jan-Jun '97	Jul-Dec '97
Relationship variables				
log(1+relationship length)	-0.025	-0.014	-0.026	-0.010
	(0.012)**	(0.015)	(0.012)**	(0.015)
P value: 97:1 coeff = 97:2 coeff	0.123		0.123	
log(1+no. of relationships)	0.021	0.110		
	(0.014)	(0.019)***		
P value: 97:1 coeff = 97:2 coeff	0.0002***			
No. of lenders: dummies				
no.lenders =2			-0.019	0.060
			(0.022)	(0.030)**
no.lenders =3			0.003	0.070
			(0.025)	(0.033)**
no.lenders =4			0.003	0.089
			(0.028)	(0.039)**
no.lenders =5			0.023	0.120
			(0.030)	(0.041)***
no.lenders =6			0.030	0.164
			(0.027)	(0.037)***
P.value: 97:1 coeffs = 97:2 coeffs			0.002***	
Controls				
log(1+firm age)	-0.022	-0.024	-0.022	-0.031
	(0.022)	(0.029)	(0.022)	(0.029)
log(total assets)	0.009	0.006	0.010	0.012
	(0.004)**	(0.006)	(0.004)**	(0.006)**
profit / assets	-0.022	-0.028	-0.023	-0.026
	(0.023)	(0.028)	(0.023)	(0.028)
liabilities / assets	0.011	0.039	0.010	0.041
	(0.016)	(0.020)**	(0.016)	(0.020)**
industry*country dummies: F-test	0.0026***	0.0067***	0.0014***	0.0009***
rho	0.842		0.843	
Number of observations	1879	1879	1879	1879

***, ** and * represents two-sided statistical significance at 1%, 5% and 10% levels respectively.

Table 7
Causes of output decline?

Dependent variable is answer to the question: 'How important would you rank x as a reason for the decline in output'. Question was asked of all firms that experienced a decline in output during the crisis. Integer between 1 (not at all important) and 5 (very important). Estimation is by ordered probit. Robust standard errors. Coefficients represent the change in the expected probability of the dependent variable following a small change in the RHS variable for each observation in the dataset (see text for more details).

	Insufficient bank loans for working capital	Insufficient revenue	Insufficient credit from suppliers
Relationship variables			
log(1+relationship length)	-0.053	0.059	-0.054
	(0.072)	(0.056)	(0.061)
log(1+no. of relationships)	0.327	0.132	0.193
	(0.092)***	(0.074)*	(0.078)**
Controls			
log(1+firm age)	-0.065	-0.072	-0.262
	(0.133)	(0.113)	(0.111)**
log(total assets)	0.001	-0.043	-0.006
	(0.033)	(0.020)**	(0.023)
profit / assets	0.062	-0.861	-0.116
	(0.012)	(9.571)	(0.105)
liabilities / assets	0.257	-0.130	0.160
	(0.095)***	(0.073)*	(0.079)**
industry*country dummies: F-test	0.000***	0.000***	0.000***
Heckit inverse Mills ratio (p-value)	0.779	0.437	0.564
Pseudo R2	0.016	0.086	0.018
Number of observations	1238	1319	1228

***, ** and * represents two-sided statistical significance at 1%, 5% and 10% levels respectively.