

Fire-Sale FDI and Liquidity Crises*

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Abstract

In placing capital market imperfections at the center of emerging market crises, the theoretical literature has associated a liquidity crisis with low foreign investment and the exit of investors from the crisis economy. However, a liquidity crisis is equally consistent with an inflow of foreign capital in the form of mergers and acquisitions (M&A). To support this hypothesis, we use a firm-level dataset to show that foreign acquisitions *increased* by 91% in East Asia between 1996 and 1998, while intra-national merger activity declined. Firm liquidity plays a significant and sizeable role in explaining both the increase in foreign acquisitions and the decline in the price of acquisitions during the crisis. This contrasts with the role of liquidity in non-crisis years and in non-crisis economies in the region. This effect is also most prominent in the tradable sector. Quantitatively, the observed decline in liquidity can explain 25% of the increase in foreign acquisition activity in the tradable sectors. The nature of M&A activity supports liquidity-based explanations of the East Asian crisis and provides an explanation for the puzzling stability of FDI inflows during the crises.

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1 Introduction

There is a growing theoretical literature that places capital market imperfections at the center of emerging market crises. A deterioration in access to liquidity is shown to induce and exacerbate a real crisis in emerging markets, even in the absence of a shock to fundamentals (Aghion, Bacchetta, and Banerjee (2000), Chang and Velasco (2001), Schneider and Tornell (2001), and Caballero and Krishnamurthy (2001).) This literature associates liquidity crises with low foreign investment and an exit of investors from the crisis economy. However, an equally plausible consequence of a liquidity crisis would involve the buy-out of domestic firms by foreign firms. This option, while raised in earlier work, is not the primary focus of recent crisis models and has not been subject to formal empirical investigation.¹

In this paper, we empirically investigate the behavior of mergers and acquisitions (M&A), both domestic and foreign, in East Asia² during the crisis of 1997-98. We find that M&A activity is consistent with the tightening of liquidity constraints for domestically owned firms but runs counter to scenarios featuring a decline in fundamentals. Specifically, nations suffering dramatic reversals in portfolio equity and debt flows simultaneously experience an *increase* in foreign acquisitions, particularly of liquidity constrained firms, a phenomenon we describe as fire-sale foreign direct investment (FDI).

Since the reversal of capital flows constitutes the defining feature of recent crises in emerging markets, understanding the behavior of these flows is crucial to identifying the precipitating shocks. Any such analysis needs to confront the surprising stability of foreign direct investment inflows into emerging markets during crisis years, a sizeable component of which are M&A's. This stability contrasts with the sharp reversals in portfolio flows and bank lending (see figure 1).

¹The possibility that firms were being sold at a discount due to illiquidity was raised early on by Krugman (1998) based on anecdotal evidence on acquisitions.

²Ideally, one would like to extend the analysis to other crisis economies such as those in Latin America. However the firm level data in the mergers and acquisitions database is particularly sparse for these economies. Also, the demarcation between crisis and non-crisis years is more clearly ascertained for the East Asian economies.

We begin our analysis in Section 2 by deriving testable implications for the behavior of mergers and acquisitions in response to a deterioration in liquidity. For this purpose, we introduce a stylized model of foreign acquisitions in emerging markets. An important assumption we make is that foreign firms bring access to greater liquidity than would otherwise be available to the acquired firm. We argue that foreign ownership brings transparency, relationships, and management that help bridge the gap between emerging markets and deeper overseas financial markets. Such benefits are unlikely to result from portfolio flows due to the small and dispersed nature of portfolio transactions. The premise that a large foreign ownership stake mitigates capital market imperfections therefore implies an important distinction between portfolio capital and FDI.

The model of Section 2 generates several predictions regarding the number and prices of acquisitions during a liquidity crisis, both at the aggregate level and across firms. To test these predictions, we employ a firm level dataset on mergers and acquisitions that records all cross-border and within-country mergers and acquisitions from 1986 through 2001. The dataset includes firm level financial characteristics of the target firm and acquisition prices, providing us with a rich information set to analyze acquisition behavior. The empirical literature on cross-border mergers and acquisitions has been limited to developed country capital markets (Froot and Stein (1991) and Blonigen (1997)) and, to our knowledge, the nature of mergers and acquisitions in emerging markets has not been studied in detail.

The results of our empirical analysis are presented in Section 3. We find that the number of foreign mergers and acquisitions in East Asia *increased* by 91% between 1996 and the crisis year of 1998. Significantly, over the same period, domestic mergers and acquisition declined by 27%. In support of the liquidity hypothesis, we find that the effect of liquidity (proxied by cash flow or sales) on the probability of being acquired changes significantly during the crisis year. While during non-crisis years high cash flow and sales has an insignificant effect on the probability of being acquired, in 1998 additional cash implies a *lower* probability of acquisition. A natural prediction of the model is that liquidity constraints should have a greater impact on firms in high-growth sectors. While the large real devaluation of East

Asian currencies in 1997-98 and the simultaneous collapse of the domestic economies limited the cash flow of firms in the nontradable sectors, they also severely reduced the firms' investment opportunities. Correspondingly, we find liquidity effects to be more prominent in the tradable sectors. Our estimates indicate that the decline in firm liquidity between 1996 and 1998 can account for 25% of the observed increase in acquisition activity in the tradable sectors. Schneider and Tornell (2001) document the relatively quick recovery of the tradable sectors as compared to the non-tradable sectors in the crisis economies. Our results show that mergers with foreign firms was one mechanism through which traded sector firms ensured access to foreign capital markets and consequently were able to recover relatively quickly from the crisis.

In regard to the price paid for an acquired firm, the median ratio of offer price to book value declined from 3.5 in 1996 to 1.3 in 1998. In support of the hypothesis that cash-strapped firms sell at a steeper discount during a liquidity crisis, cross-sectional regressions find that an additional dollar of cash has a larger impact on sale price in 1998 than in other years. In fact, the elasticity of price-to-book with respect to cash flow is roughly 0.7 in 1998 while negligible during the other years of the sample. Further, this elasticity is higher (1.12) for firms acquired in the traded sector.

We divide our sample into sub-periods to determine the role of liquidity over time and find that liquidity effects are significant and sizeable only in 1998. Given that liquidity shocks are typically thought to be short-lived, we argue this is further support for the liquidity-sale hypothesis. We also find that liquidity considerations were more important in driving foreign-domestic acquisitions than domestic-domestic acquisitions, consistent with our underlying premise regarding the advantages of foreign ownership. Lastly, as a further test of our methodology, we estimate the role of liquidity in Singapore and Taiwan (Asian economies that were not subject to large capital outflows in 1997-98) and find no evidence of liquidity based fire-sales in these economies.

In Section 4, we discuss other plausible interpretations of the evidence. One explanation based on the predominant shock being a decline in firm productivity (without a more

significant decline in liquidity) would be consistent with the decline in the average sales price of acquired firms. However, it would be inconsistent with all other evidence regarding the number of acquisitions, the responsiveness of the probability of acquisition and the price of acquisition to changes in liquidity that we identify. A second plausible explanation based on regulatory changes introduced during the crisis is consistent with the rise in the aggregate number of foreign acquisitions during the crisis. Consequently, to identify the role played by liquidity we exploit the cross-sectional variation using firm-level data. This allows us to isolate the effects of liquidity after controlling for any regulatory change at the (3-digit) industry level. Finally, hypotheses regarding cash flow as a proxy for omitted firm fundamentals have difficulty explaining the fact that high cash flow lowered the probability of being acquired in 1998 while simultaneously increasing the premium paid for the firm.

2 Empirical Hypotheses

This section presents a simple two-period model to spell out intuitively robust implications of a liquidity crisis. The goal of the model is to formalize testable predictions regarding the behavior of foreign acquisitions during a liquidity crisis.

The model makes a distinction between foreign ownership and domestic ownership. A domestic firm that is acquired by a foreign firm is assumed to gain access to superior technology and deeper credit markets. The first distinction captures the conventional wisdom that foreign direct investment from industrialized countries to emerging markets involves significant technology transfer and improves the productivity of domestic industry.³ As noted in the introduction, the second distinction rests on the premise that capital markets are deeper in industrialized countries and firms that are headquartered in such markets have greater access to outside funding. There are numerous theoretical models that provide

³Empirical evidence is however mixed. See Blomstrom and Wolff (1994) and Aitken and Harrison (1999). For the main predictions of our liquidity hypothesis the crucial assumption is the difference in access to liquidity. The assumption regarding productivity allows for acquisition of non-liquidity constrained firms in equilibrium.

microfoundations for borrowing constraints, such as imperfect and asymmetric information (see Bernanke, Gertler and Gilchrist (1998) for a survey of capital market imperfections and macroeconomics). As the goal of the paper is not to add to this already large theoretical literature, we will take as given that firms may face a borrowing constraint and this constraint is tighter for emerging market firms.

At the start of period one, a domestically owned firm, j , is characterized by an initial capital stock $K_{j,1}$, a borrowing constraint \bar{D}_j , and period-one profits $\pi_{j,1}$. In period 1, the firm chooses its optimal investment, I , subject to the borrowing constraint and anticipated period-two productivity, $A_{j,2}$ (we assume perfect foresight). Firms are price takers and the price of additional capital is normalized to one. Any differences across firms in the price of output are folded into $A_{j,2}$ (in particular, the differential impact of a real devaluation across firms will be captured by differences in $A_{j,2}$). To simplify expressions, we assume that the interest rate and discount rate are zero.

The value of a firm under domestic ownership, V^D , can then be expressed as (dropping subscript j):

$$\begin{aligned} V^D(K_1, A_2, \pi_1, \bar{D}) &= \max_I \{ \pi_1 - I + A_2 F(K_2) + (1 - \delta)K_2 \} & (1) \\ \text{s.t. } K_2 &= (1 - \delta)K_1 + I \\ I &\leq \bar{D} + \pi_1, \end{aligned}$$

where $F' > 0$, $F'' < 0$, and $\delta \in (0, 1)$ is the rate of capital depreciation. The difference between current profits and investment ($\pi_1 - I$) represents retained earnings (if positive) or (the negative of) debt due in the final period. The first constraint is a standard capital accumulation equation. The second constraint captures the borrowing constraint.

The value to a foreign owner, V^F , of the same firm is given by

$$\begin{aligned} V^F(K_1, A_2, \pi_1) &= \max_I \{ \pi_1 - I + \phi A_2 F(K_2) + (1 - \delta)K_2 \} & (2) \\ \text{s.t. } K_2 &= (1 - \delta)K_1 + I \end{aligned}$$

where $\phi > 1$ captures the superior productivity associated with foreign ownership and foreign owners are not subject to a borrowing constraint.⁴ Clearly, $V^F > V^D, \forall j$. However, the transfer of ownership to the foreign acquiror entails a fixed reorganization cost γ , which may vary across domestic firms.⁵ A foreign firm then acquires a domestic firm as long as the acquisition generates a positive surplus, that is $S \equiv V^F - V^D - \gamma \geq 0$. If acquired, the price paid for the firm is determined according to a Nash-bargaining solution :

$$P = \beta S + V^D = \beta (V^F - V^D - \gamma) + V^D, \quad (3)$$

where $\beta \in (0, 1)$ captures the domestic owners bargaining power and V^D is the outside option for the domestic firm⁶.

Figure 2 identifies the range of firms acquired. The solid line denotes the combinations of future productivity (A_2) and liquidity ($l \equiv \pi_1 + \bar{D}$) which imply zero acquisition surplus, all else equal. Firms that lie above this line will be acquired. For high enough A_2 , a domestic firm will be acquired regardless of liquidity due to the superiority (and complementarity with A_2) of foreign technology. As we reduce available liquidity for a given A_2 , a domestically owned firm will eventually become constrained and have to forego profitable investment opportunities. This widens the gap between V^F and V^D , making the acquisition efficient. The assumption that foreign firms complement existing technology (ϕ enters multiplicatively) is justified by the finding of Aitken and Harrison (1999) that foreign investment targets relatively productive domestic firms.⁷

⁴We assume no constraint on foreign ownership's debt, but the important point is that the foreign firm enjoys a higher debt limit than the domestically owned firm.

⁵We assume the cost of reorganization does not vary according to foreign partner to avoid complications arising from optimal matching.

⁶Recall that the zero outside option for the foreign investor is only a simplifying assumption.

⁷One alternative would be that foreign firms bring acquired firms to the technology frontier. However, if foreign improvements were unrelated to existing technology, the most cost-effective approach would be for foreign firms to purchase the least productive (and therefore cheapest) domestic firms. This is contradicted by existing evidence.

In regard to price, an increase in A_2 , all else equal, increases V^F more than V^D due to the superior technology employed by foreign ownership. This raises the surplus of the acquisition and therefore increases the price of the acquired firm. Similarly, extending additional liquidity to a constrained firm increases V^D , reducing the gap between V^F and V^D and raising the acquisition price. Of course, to an unconstrained firm additional liquidity has zero effect on the acquisition surplus.

2.1 Liquidity Crises and Testable Implications

Conceptually, we consider a liquidity crisis as a *ceteris paribus* decline in liquidity available to domestically owned firms. That is, conditional on firm characteristics, domestically owned firms as a group find it difficult to borrow during the crisis, a premise that is consistent with (but not necessarily implied by) the drop in capital inflows depicted in figure 1.⁸

To be precise, we define a liquidity crisis as a “leftward shift” in the distribution of l across firms. Specifically, let $G_0(l)$ denote the benchmark or “normal-period” cumulative distribution of liquidity, *conditional* on A_2 , γ , and other firm-specific characteristics (such as K_1), which we summarize as “ θ ”. If $G_1(l)$ is the equivalent distribution during a liquidity crisis, then our definition implies that G_0 “first order stochastically dominates” (*fosd*) G_1 . That is, $G_1(l) \leq G_0(l) \forall l$, with a strict inequality for a set of l with positive probability. An equivalent definition of *fosd* which we will use repeatedly is that $\int f(l)dG_1 \leq \int f(l)dG_0$ for every nondecreasing function $f(l)$.

Our first comparative static involves the number of acquisitions. Let N_i denote the fraction⁹ of firms acquired under G_i , $i = 0, 1$, where 1 is the crisis distribution. That is,

$$N_i \equiv \int \int_{S \geq 0} dG_i(l) dH(A_2, \gamma, \theta), \quad (4)$$

⁸We do not model the origins of this capital market imperfection and why it may have been exacerbated in 1997-1998, but instead derive its implications for cross-border acquisitions.

⁹We use terms such as “fraction” or “probability” of acquisition interchangeably with “number” of acquisitions. The implication is that the measure of firms is held constant across comparative statics.

where H is the distribution of firm characteristics (A_2, γ, θ) .

Proposition 1 *If G_0 $fosd$ G_1 , then $N_0 \leq N_1$.*

Proof: Let $\mathbf{1}_{\{x\}}$ equal one if x is true and zero otherwise. Then

$$N_i = \int \int \mathbf{1}_{\{S \geq 0\}} dG_i(l) dH(A_2, \gamma, \theta). \quad (5)$$

Conditional on other firm characteristics, $\mathbf{1}_{\{S \geq 0\}}$ is nonincreasing in l . The definition of *fosd* implies that $\int \mathbf{1}_{\{S \geq 0\}} dG_0(l) - \int \mathbf{1}_{\{S \geq 0\}} dG_1(l) \leq 0$. Integrating over other firm-specific characteristics preserves this inequality, implying that $N_0 \leq N_1$.

The intuition is straight forward: as more firms become constrained, more firms will be willing to pay the cost γ to gain access to foreign liquidity. While we do not model portfolio investment explicitly, it is clear that the increase in acquisitions derived above does not extend immediately to portfolio investment. As noted previously, we presume that portfolio investment does not relax liquidity constraints due to the small and anonymous nature of the transactions. Therefore, it would not be able to exploit the wedge between foreign and domestic borrowing constraints.

We will discuss alternatives to liquidity shocks as the source of crises in Section 4. However, in anticipation, we mention that the implications for N are the opposite if one interprets the Asian crisis as primarily a productivity slowdown. Given that $\mathbf{1}_{\{S \geq 0\}}$ is nondecreasing in A_2 , a *fosd* shift down in productivity *reduces* the number of acquired firms. As will be discussed in Section 4, the dichotomy between a decline in liquidity versus a decline in productivity holds for many of the implications derived in this section.

One regression we consider below involves the probability of acquisition conditional on observable firm characteristics. We take the cost of reorganization γ to be the source of unobserved, idiosyncratic variation across firms.¹⁰ That is, if $y = y(l, A_2, \theta)$ denotes the

¹⁰In this section, we treat γ as orthogonal to other firm characteristics. In the empirical work, we control for underlying firm characteristics by including firm fixed effects.

probability of acquisition conditional on firm characteristics and $\gamma \sim \Gamma(\gamma)$, then $y = \int_{S \geq 0} d\Gamma$. Recall that additional liquidity (to a constrained firm) lowers S while increased productivity increases the surplus of an acquisition. This implies:

$$\frac{\partial y}{\partial l} \quad \begin{cases} = 0, & \text{if unconstrained} \\ < 0, & \text{if constrained} \end{cases}$$

$$\frac{\partial y}{\partial A_2} > 0.$$

The population averages of the partial derivatives in (6) are obtained by taking expectations over firms. Let $E_i(x) = \int \int x dG_i(l) dH(A_2, \theta)$, $i = 0, 1$, represent the population average of a random variable x during normal period ($i = 0$) and during a liquidity crisis ($i = 1$). Assuming the distribution of γ satisfies certain conditions (see Appendix B), we have

Proposition 2 *If G_0 fosd G_1 , then (i) $E_0\left(\frac{\partial y}{\partial l}\right) \geq E_1\left(\frac{\partial y}{\partial l}\right)$ and (ii) $E_0\left(\frac{\partial y}{\partial A_2}\right) \leq E_1\left(\frac{\partial y}{\partial A_2}\right)$.*

Proof: See Appendix B.

Proposition 2 states that, on average, additional liquidity has a more negative impact on the probability of acquisition during a liquidity crisis. Similarly, the sensitivity of the probability of acquisition to firm productivity increases during a liquidity crisis. When we estimate the probability of acquisition and constrain the coefficients on liquidity and future productivity to be the same across firms, the model predicts that the coefficient on liquidity falls and that on future productivity increases during a liquidity crisis.

In terms of the price of an acquisition, a liquidity crisis will lead to a fall in the average price of the domestic firm. That is, constrained firms have a less valuable outside option (V^D), all else equal, and thus a lower price. The more constrained firms in the population, the lower the average price. Moreover, as noted at the end of the last subsection, liquidity influences the surplus of an acquisition only if the domestic firm is constrained. Thus, the

average sensitivity of price to liquidity increases during a liquidity crisis. Conversely, an increase in A_2 has a limited impact on V^D if a firm is constrained as it cannot make full use of the improved productivity. As the sensitivity of V^F to A_2 remains the same regardless of domestic liquidity, the average price of an acquired firm is less sensitive to growth prospects during a liquidity crisis. Specifically:

Proposition 3 *If G_0 fosd G_1 , then (i) $E_0\left(\frac{\partial P}{\partial l}\right) \leq E_1\left(\frac{\partial P}{\partial l}\right)$ and (ii) $E_0\left(\frac{\partial P}{\partial A_2}\right) \geq E_1\left(\frac{\partial P}{\partial A_2}\right)$.*

Proof: See Appendix B.

The empirical implication of proposition 3 concerns a regression of price on liquidity and growth prospects, conditional on other firm characteristics. The coefficient on liquidity should increase and that on future productivity should decrease during a liquidity crisis.

Given the above discussion, the empirical predictions of a liquidity crisis can be summarized as follows.

- (i) The number of acquisitions increases during a liquidity crisis;
- (ii) On average, the sensitivity of the conditional probability of acquisition to firm liquidity declines (becomes more negative) during a liquidity crisis;
- (iii) On average, the sensitivity of the conditional probability of acquisition to future productivity increases during a liquidity crisis;
- (iv) The average price of an acquisition declines during a liquidity crisis;
- (v) On average, the sensitivity of the price of an acquisition to firm liquidity increases during a liquidity crisis;
- (vi) On average, the sensitivity of the price of an acquisition to future productivity declines during a liquidity crisis.

3 Empirical Results

3.1 A brief chronology of the Asian crisis

Our empirical work focuses on five East Asian nations: South Korea, Thailand, Indonesia, Malaysia, and the Philippines. These were the nations hit hardest by the Asian crisis of 1997. As background, these five countries experienced relatively high growth rates in the 1980s and the first half of the 1990s (see Corsetti, Pesenti, and Roubini (1998)). This growth was accompanied by gradual but significant increases in foreign capital flows. Moreover, domestic bank lending increased dramatically in the early 1990s. In 1997, the domestic financial systems began to weaken in many East Asian economies, a development followed by large capital outflows. Thailand abandoned its currency peg in July of 1997, quickly followed by devaluations in Indonesia, Malaysia, and the Philippines. South Korea initially avoided the capital outflows experienced by the Southeast Asian countries. However, capital began to flow out of Korea in the fall of 1997 and it was forced to devalue its currency in November of that year. In all cases except the Philippines (which recorded zero growth), output contracted substantially in 1998, ranging from a 6% drop in Korea to a dramatic decline of 13% in Indonesia.

Our testable implications apply to liquidity crises in other regions, such as Latin America. However, the company level data for Latin American countries in our mergers and acquisitions database is extremely sparse. Moreover, the demarcation between crisis and non-crisis years is clearest for the East Asian economies. Accordingly, our analysis is restricted to these economies.

3.2 Data

Our primary dataset is Thompson Financial Securities Data Company's (SDC) mergers and acquisition database, which contains dates and details of cross-border and domestic mergers and acquisitions. Primary source material includes news sources, SEC filings and their international counterparts, trade publications, wires and proprietary surveys of investment banks, law firms and other advisors. The database includes all corporate transactions

involving at least 5% of the ownership of a company where the transaction was valued at \$1 million or more (after 1992, deals of any value are covered) or where the value of the transaction was undisclosed. Public and private transactions are covered. SDC also reports numerous details about the target and acquiring firm, including income and balance sheet items, industry, and ownership. For each firm acquired, SDC reports five years of historical data, allowing the construction of a panel of acquired firms.

We begin our sample in 1986 and include all mergers and acquisitions through the end of 2001. The start date is not highly restrictive given that very few mergers occurred prior to this year. In total, we have close to 6,000 completed deals, roughly one third of which involve a foreign acquiror.¹¹ Forty-five percent of deals involve a private target, with publicly traded firms and subsidiaries accounting for a quarter each. The remainder consists of government firms (1%) and joint-ventures (4%). Many of the regressions below require income statement and balance sheet data that are unavailable for privately held firms. Therefore, the regression samples are weighted towards publicly traded firms.

We take the announcement date as the date of the merger or acquisition. Although mergers may, in theory, be considered a mutual acquisition, SDC always identifies a “target firm” and acquiring firm(s). We use the term acquisition loosely to describe all purchases contained in the database, even though many transactions involve only a fraction of shares outstanding. Table 1 reports the distribution of the shares involved in cross-border acquisitions. The median purchase involves 49% of the firm, with over a quarter involving the entire firm. Ten percent of the deals fall short of meeting the usual FDI definition of 10% of outstanding equity.

To avoid limiting our sample to firms that were eventually acquired, we augment the SDC database with data on firms contained in Thompson Financial’s Worldscope database. This database consists of annual data on public companies in developed and emerging markets. Worldscope data is collected from corporate documents such as annual reports

¹¹A small fraction of target firms are defined as being “ultimately” owned by a foreign firm. Excluding such acquisitions does not change the results.

and press releases, exchange and regulatory agency filings, and newswires. The combined sample contains over 7,700 firms.¹² We feel this set of firms accurately reflects the universe of firms relevant for a study of cross-border acquisition – the omitted firms being privately held enterprises that were never involved in an acquisition or smaller publicly held firms that do not merit inclusion in an international database.

Table 2 summarizes key financial details of the firms used in the regressions below. All variables are reported in (log) million dollars and the precise definitions of accounting terms are provided in Appendix A.

3.3 The Probability of Acquisition

The first prediction of our theoretical model is that the number of cross-border acquisitions should increase during a liquidity crisis. A simple plot of the number of acquisitions supports this prediction. Figure 3 plots the number of acquisitions of domestic firms by foreign companies (solid line) summed over the five Asian countries¹³ and arranged by the year in which the acquisitions were announced.¹⁴ The dashed line reports the number of acquisitions of domestic firms by domestic companies for comparison. The upward trend in mergers and acquisitions from the start of the period is apparent in the plot. Moreover, there is a sharp uptick in acquisitions by foreign companies in 1998, the first full year immediately after the onset of the crises in mid- and late-1997. There is an 91% increase in foreign acquisitions between 1996 and 1998, with most of the increase taking place in 1998. Interestingly, the number of acquisitions by other domestic firms declines by 27% over this same period. While not explicitly modeled in Section 2, a straight forward extension indicates that the

¹²Some firms contained in Worldscope are also contained in SDC due to a previous (partial) acquisition by a foreign firm. We delete duplicate observations.

¹³The country-level times series of acquisitions look substantially like the aggregated data. Two exceptions are the fact that foreign acquisitions in Indonesia are constant between 1997 and 1998 and domestic-domestic acquisitions increase in Korea in 1998.

¹⁴Figure 3 includes all completed acquisitions. We include all purchases of the target's equity, regardless of the percentage of shares involved, as this value is missing for many acquisitions. Restricting to deals in which over fifty percent of the target's equity is purchased yields a similar picture.

drop in domestic-domestic acquisitions follows if the binding constraint on the number of domestic mergers is the pool of potential acquiring firms located within the country.

Figure 4 plots the number of foreign-domestic acquisitions according to whether the target firm is involved in tradable (solid line) versus nontradable production. We define tradable sectors as manufacturing (3-digit SIC codes 200-399) and nontradable as the remaining sectors. While admittedly crude, this distinction captures the traditional wisdom that real devaluations impact manufacturing differently than services, retail, etc. One may consider such nonmanufacturing sectors as agriculture and natural resources to be tradable, but these sectors are a negligible percentage of the sample. Both tradable and nontradable sectors experience an increase in acquisitions in 1998, however, the number and percentage increase in foreign acquisitions in the tradable sectors (142%), was far greater than the increase in the nontradable sectors (61%). The large devaluation combined with the drop in domestic demand reduced cash flow for nontradable firms but also restricted investment opportunities, limiting the role for foreign capital despite the reduced sales revenue.

To explore more systematically whether liquidity is driving the patterns observed in figure 3, we estimate a number of linear probability regressions using the panel of firms described in Section 3.2. (See Appendix C for the results of logit and conditional logit regressions. The results stay substantially the same). Our probability regressions take the form:

$$y_{jict} = \alpha_0 + \alpha \mathbf{X}_{jict} + \delta \mathbf{X}_{jict} * D_{98} + \mathbf{D}_{jict} + \varepsilon_{jict}. \quad (6)$$

The dependent variable y_{jict} is an indicator variable which takes the value one if firm j in industry i in country c is acquired in year t by a foreign firm, and takes the value zero otherwise.¹⁵ We explore acquisitions by other domestic firms in Section 3.5.2. Our regressors \mathbf{X} are measures of firm liquidity and potential growth while \mathbf{D} is a vector of “fixed-effect”

¹⁵SDC identifies the status of the acquisition at the date of announcement, with the vast majority of the sample being coded “Completed” or “Pending”. In our probability regressions, we report results for the sample restricted to completed acquisitions only.

dummy variables. We will discuss the content of \mathbf{X} and \mathbf{D} below. The variable D_{98} is a dummy variable for the year 1998. We take that year – the first full year after the devaluations of mid- and late-1997 – as our crisis period. This year also accounts for the sharpest uptick in the number of foreign acquisitions. The number of foreign acquisitions was 13% higher in 1997 as compared to 1996 and then 70% higher in 1998 as compared to 1997. In Section 3.5.1 we explore whether the crisis includes additional years as well. The vector δ therefore represents the change in acquisition sensitivity to firm liquidity and growth during the crisis.

Our primary measure of firm liquidity is log cash flow reported for the most recent fiscal year. Cash flow is a traditional measure of liquidity and represents the flow of cash from operations available to a firm during a given year.^{16,17} The definition of cash flow differs slightly between the SDC and Worldscope databases (see definitions in Appendix A). To verify this difference does not influence our estimates, we include results using net sales in place of cash flow. Net sales has a common definition in both databases and is highly correlated with cash flow. One concern with the use of cash flow or sales as a measure of liquidity is that it may also be associated with other relevant (but unobserved) firm characteristics. We will correct for some of this omitted variable bias through fixed effects discussed below. To the extent that firm type is time varying and correlated with cash flow, higher cash flow may be associated with a higher probability of acquisition if it signals strong firm fundamentals. On the other hand, our liquidity model implies that higher cash flow should have a negative effect on the probability of being acquired, as the surplus generated from a merger is lower. To isolate the effect due to liquidity, we will compare the change in the coefficient of cash flow during the crisis year to the coefficient estimated from the rest of the sample.

Capital expenditure (investment) reported for the most recent fiscal year is used as a

¹⁶Replacing log cash flow with the log ratio of cash flow to assets does not significantly change the analysis, but does reduce the sample size due to the fact that assets are not reported for every year. In any event, the firm fixed effects discussed below control for the average size of the firm.

¹⁷For surveys, see Bernanke et al (1998) and Hubbard (1998).

proxy for growth opportunities (as in Olley and Pakes (1996) and Pavcnik (2002)). That is, we assume that a firm that is investing in new physical capital faces relatively strong growth prospects. We do not use the more traditional measure of Tobin's Q as many of our firm's are not listed and the market prices we do observe are influenced by the potential/announcement effect of an acquisition. Replacing capital expenditures with sales growth to measure growth prospects yields similar results.

The probability of an acquisition obviously may vary with other characteristics of the firm not contained in the database. To limit the impact of omitted variables we include firm and year fixed effects, i.e. $\mathbf{D} = (D_j, D_t)$ is a vector of firm and year dummies. Thus we only use the time series variation in firm characteristics in predicting the probability of acquisition. The fixed effect will not be sufficient if liquidity is correlated with omitted time-varying firm characteristics (year dummies control for any time-varying aggregate variables). However, we will compare the coefficient on cash flow for the crisis year with other years, differencing out the general correlation with omitted variables. The remaining bias, if any, will result from *changes* to the correlation in the crisis year (a possibility we will discuss in Section 4).

As an alternative to firm fixed effects, we also specify \mathbf{D} to be a vector of indicator variables $\{D_{ict}\}$ representing the triplet of (industry, country, year). That is, we include indicator variables for industry (at the 3-digit SIC level), country and year and all interactions of these variables. This fixed effect controls for any changes in government policies, relative prices, economic prospects and other such omitted variables that may vary across industries, countries and across time.

Note that the two alternative fixed effects, D_j and D_{ict} , imply very different regressions. The former is essentially comparing a firm to itself over time, the latter exploits the cross-section of companies in a particular 3-digit industry in a particular country in a particular year. Despite this difference, we show below that the conclusions from the two fixed-effect specifications are substantially the same.

The model of liquidity introduced in Section 2, and summarized in statements (ii) and (iii) at the end of Section 2.1, implies $\delta_{\text{cash flow}} < 0$ and $\delta_{\text{capital expenditures}} > 0$. Tables 3 and 4 report the results of the benchmark probability regressions specified in (6). Standard errors adjusted for heteroscedasticity and clustering by firm are reported in parentheses. In each table, columns (1) and (3) utilize firm and year fixed effects while (2) and (4) control for industry*nation*year interactions. Table 3 includes all completed foreign acquisitions and table 4 restricts the sample to acquisitions in which the target firm is in a tradable sector.

In specifications using all sectors, the dummy for 1998 interacted with liquidity is always negative, with the difference exceeding standard significance levels in two of four cases. The magnitude of the decline is similar across all specifications, as well. This pattern is much stronger in both magnitudes and statistical significance in the traded sectors (table 4). While liquidity plays almost no role in predicting acquisition in noncrisis years, liquidity's effect becomes significantly more negative in 1998. The total effect of liquidity on acquisition is significantly negative in all specifications of table 4. In 1998, a 1% decline in sales for a tradable sector firm is associated with a 0.023 percentage point increase in the probability of acquisition (table 4 column 4).

To assess the quantitative importance of the drop in liquidity in driving the increase in acquisition between 1996 and 1998, consider that the unconditional (tradable sample) probability of acquisition increased from 0.4% to 3.6%, an increase of 3.2 percentage points. Over the same period, mean log sales fell by roughly 0.34 (i.e. sales fell 34%). According to the estimated elasticity of 0.023, this drop in log sales predicts an increase in the probability of acquisition of 0.8 percentage points, or 25% of the observed increase.

Capital expenditure is intended to capture the growth prospects of a firm. The model predicts that the coefficient on this variable should increase during the crisis year. As with liquidity, the results are strongest for the tradable sectors. The baseline coefficient on capital expenditures is positive, consistent with the premise that foreign firms target relatively productive domestic firms. As predicted, the role of capital expenditure significantly in-

creases during the crisis year in table 4. The magnitude of the increase in this relationship during the crisis, $\delta_{\text{capital expenditure}}$, relative to the base coefficient tends to be large. A 1% increase in capital expenditure is associated with a 0.025 percentage point increase in the probability of acquisition, significantly larger than the normal period elasticity.

3.4 Price of Acquisitions

An important element of liquidity-forced sales is that constrained firms are being sold at a discount. In terms of Section 2's model, liquidity constrained firms have diminished outside options, reducing the Nash bargaining price of acquisition. Figure 5 plots the median ratio of the price of acquisition (offer price) to book value of assets against year of acquisition (solid line). The dashed line is the ratio of offer price to market price, where market price is defined as the closing share price four weeks prior to the announcement of the acquisition. The plot clearly indicates that the price of acquired firms (relative to book value) declines dramatically in 1998. The market price also declines sharply, leaving the ratio of offer price to market price largely unchanged.¹⁸

To determine whether liquidity plays a role in this price decline, we estimate for an acquired firm j in industry i in country c at time t ,

$$p_{jict} = \beta_0 + \beta \mathbf{X}_{\text{jict}} + \theta \mathbf{X}_{\text{jict}} * D_{98} + \mathbf{D}_{ict} + u_{jict}. \quad (7)$$

The dependent variable, p_{jict} , is the log ratio of offer price to book value reported by SDC and \mathbf{X} , as before, represents cash flow (or sales) and capital expenditures. As before, we control for industry, time, country variations by including an indicator for each variable and all its interactions. Since we have only one price observation per firm, we cannot use

¹⁸There is a slight increase in offer price to market price during 1997. However, this is fully consistent with the fire-sale hypothesis. If the market price represents the value of the firm under domestic ownership the ratio reflects the surplus of the match, which the model of section 2 predicts should increase during a liquidity crisis. The observed ratio may understate the implied surplus as the possibility of foreign ownership may already be reflected in the pre-acquisition market value of the firm.

firm level fixed effects. According to statements (v) and (vi) in Section 2, we should expect $\theta_{\text{cash flow}} > 0$ and $\theta_{\text{capital expenditures}} < 0$.

Table 5 reports the results. Columns (1)-(3) use acquisitions in the traded sector and columns (4)-(5) use all acquisitions.¹⁹ Consistent with our probability regressions, the effect is largest in the tradable sectors. In all specifications for the tradable sector, the evidence supports the importance of liquidity during the crisis. In particular, the base coefficients on log cash flow and log sales are never significantly different from zero. However, the interaction with the 1998 dummy is always large and significantly positive, indicating that relative liquidity in 1998 exerted an unusually strong influence on the cross-section of prices. According to Table 5 (column 2), a 1% decline in sales is associated with a 1.74% decline in the offer price to book value for a firm acquired in the tradable sector. The normal period elasticity is 0.22.

3.5 Further Tests

3.5.1 Testing across Sub-periods

To test if liquidity plays a role outside of 1998, we divide our tradable sample into sub-periods and estimate separate regressions for the periods 1986-1996, 1997, 1998, 1999, and 2000-2001.²⁰ The results, reported in Table 6, indicate that 1998 is indeed a unique year. This year is the only year in which both sales and capital expenditure enter significantly in the pattern predicted by our model. It is only in 1998 that an additional dollar of sales significantly lowers the probability of being acquired. The coefficient on sales and capital expenditure are also the largest in 1998. As one would expect of a liquidity crisis, the effects are short-lived.

¹⁹Since not every acquisition reports a transaction price, we augment the regression sample by pooling all (foreign and domestic) acquisitions for which there is data.

²⁰We only estimate industry*nation*year fixed effects as our year-by-year specifications have no time-series dimension.

3.5.2 Acquisitions by Domestic Firms

Table 7 explores the role of liquidity and growth in acquisitions by domestic firms of other domestic firms. Recall from figure 3 that the number of foreign acquisitions increased in 1998, while domestic-domestic acquisitions declined. Similarly, table 7 documents additional differences between the two types of acquisitions. In particular, the change in the coefficient on sales during the crisis has mixed signs, is substantially smaller in magnitude than those reported for foreign acquisitions in table 3 and not significantly different from zero. Similarly, the significantly positive increase in sensitivity to capital expenditures seen in foreign acquisitions during the crisis is not apparent in domestic acquisitions. These results suggest that liquidity considerations were more important in driving foreign-domestic acquisitions relative to domestic-domestic acquisitions.

3.5.3 Foreign Acquisitions in Non-Crisis Economies

As a further test of our methodology, we evaluate the response of acquisitions to net sales in Singapore and Taiwan, two Asian economies that did not experience a large capital outflow in 1997-98. In support of our tests, we find that the change in the coefficient on sales during the crisis has mixed signs, are substantially smaller in magnitude as compared to coefficients reported in columns (3) and (4) of table 3 and table 4, and are not significantly different from zero. Similarly, the qualitative response of acquisitions to capital expenditure is dramatically different.

4 Discussion

The preceding section documents that the behavior of mergers and acquisitions during the Asia crisis is consistent with a liquidity crisis as defined in Section 2. One feature of the pattern of M&A is that liquidity effects are most prominent in acquisition of firms in the tradable sectors. Both in our sample of firms and in the economies in general, tradable sectors experienced relatively rapid recoveries in 1998 and 1999, as predicted by textbook

models of real devaluations. As noted in Section 2, growth prospects are important in determining whether liquidity constraints bind. While nontradable sectors faced a drop in sales during the crisis, their weak prospects make them relatively less appealing to foreign acquirors.

Undoubtedly, tradable firms possess some advantages in attracting foreign investors. It might be argued that tradable firms were able to expand *because* they enjoyed continued access to foreign capital markets, making it problematic to argue such firms were constrained (e.g. Tornell and Westermann (2001)). However, our results are not inconsistent with this scenario. We test whether liquidity predicts which tradable firms are acquired in a crisis and find a large and significant effect. The fact that tradable firms were able to record relatively healthy growth rates in the years immediately after the devaluations implies that these firms were (at least partially) able to overcome any capital market imperfections; our results show that mergers with foreign firms was one mechanism through which firms ensured access to foreign capital markets.

Another issue to bear in mind is that government policies changed in the wake of the crisis, particularly regarding foreign capital. To stem the outflow of capital, economies such as South Korea relaxed many restrictions regarding foreign direct investment while Malaysia imposed additional controls on portfolio flows. It seems likely that these regulatory changes played a significant role in raising the aggregate number of foreign acquisitions during the crisis. In identifying the role played by liquidity, we therefore also rely on the cross-sectional evidence, where we include dummies for country*year*industry interactions. This controls for any regulatory change at the (3-digit) industry level, allowing us to identify the effects of liquidity holding constant macro policies.

In arguing that our results support a liquidity crisis interpretation of the Asian crisis, we need to consider whether alternative theories explain the same set of facts. One plausible alternative hypothesis would be that the behavior of mergers and acquisitions was in response to a shock to productivity. This would be consistent with the decline in the average sales price of acquired firms. However, this explanation (without amplification through

reduced liquidity) does not square with the remainder of our results. In the terminology of Section 2, we can define a productivity crisis as a *fosd* shift down in the distribution of A_2 . Such a drop in productivity leads to a fall in acquisitions as few firms have sufficient potential to make it efficient to assess the superior technology or liquidity offered by a foreign partner.²¹ Instead, we observe a dramatic *increase* in the number of acquisitions. Similarly, a productivity crisis yields counterfactual implications for the coefficients in our linear probability regressions. In particular, a general decline in productivity implies an increase in the coefficient on liquidity during the crisis. The intuition rests on the fact that a productivity crisis limits investment opportunities, reducing the number of firms that are liquidity constrained (holding constant the distribution of liquidity). As constrained firms exhibit a negative relationship between acquisition and cash flow, a reduction in the number of constrained firms leads to an increase in the average relationship between liquidity and acquisition.²² The fact that the coefficient on liquidity falls during the crisis runs counter to this hypothesis. Further, it fails to predict that cash flow becomes more important in explaining the premium on acquisition price to book value during the crisis, as is the case empirically. In a productivity crisis, few firms find themselves constrained, making cash flow less important in determining the price of a firm. However, our estimates indicate that the role of liquidity in determining the price of an acquisition is enhanced during the Asian crisis. Diamond and Rajan (2001) make a similar argument in favor of a liquidity based explanation based on the lending behavior of local branches of foreign banks.

A second concern with our interpretation of the data may be the imperfect proxies for liquidity and growth potential. In particular, as noted in Section 3, cash flow is correlated with firm fundamentals other than liquidity. The firm fixed effect controls for constant firm attributes. Of course, any time-varying omitted factors that are correlated with cash flow will be reflected in the base coefficient. However, the focus of this study is the *change* in

²¹The proof of this follows directly from the fact that the surplus of a match is nondecreasing in A_2 . Therefore, a *fosd* shift down in the distribution of A_2 leads to a fall in the average surplus.

²²To see this formally, note that in the model of Section 2, $\frac{\partial^2 y}{\partial A_2 \partial l} \leq 0$. Therefore, a *fosd* shift down in the distribution of A_2 increases the average $\frac{\partial y}{\partial l}$.

the coefficient during 1998, which is sensitive only to the *change* in the correlation between cash flow and omitted variables. While such a change in the relationship between cash flow and firm fundamentals may occur, a mechanism that produces such a change as well as accounts for the other empirical results presented above is not readily apparent.

For instance, it is plausible that cash flow serves as a signal of the underlying productivity of a firm. This signal may become more informative during a crisis, perhaps due to the fact that performance in an extreme environment yields a better signal of the strength of a firm. That is, high cash flow in a crisis becomes a very positive signal about firm fundamentals. While this would accord with the price regressions in which cash-rich firms sold at an increased premium in 1998, the negative coefficient on crisis cash flow in table 3 would then imply that the increase in acquisitions in 1998 was motivated by increased purchases of firms suddenly revealed to be *low* productivity. Therefore, this mechanism not only rests on the hypothesized change in correlation, but additionally and counterfactually requires that foreign firms shop for low quality partners. In general, we find hypotheses regarding cash flow as proxy for omitted fundamentals fail to plausibly explain the entire set of facts documented in this paper.

5 M&A and the Stability of FDI

This section discusses the link between the dramatic increase in M&A during the crisis and the stability of inward FDI depicted in figure 1. Inward FDI is defined as the purchase by a foreign entity of 10% or more of outstanding equity of a domestic firm, plus additional inflows from the foreign parent to the domestic firm (through debt or equity) once the initial equity purchase occurs. In particular, FDI encompasses the establishment of new firms (greenfield investment) as well as purchases (minus divestitures) of existing firms. This paper has documented the dramatic increase in M&A activity during the East Asian crisis, 90% of which exceed the 10% threshold. M&A, in turn, is a significant component of inward FDI.

In table 9, we express the value of M&A (that involve more than 10% of equity) as a

fraction of FDI.²³ The first two columns of numbers are taken from the UN's World Investment Report (2000). The final two columns uses the amount of the acquisition price that was paid in cash as reported by SDC. This excludes any equity swaps, but may include locally raised cash. The fact that many transactions do not report the value of the acquisition results in an understatement of the total value of M&A. Nevertheless, by both measures, M&A as a percentage of FDI was substantial for the East Asian Economies during the crisis. The share is also higher for the year 1998 as compared to the average of the preceeding two years.

Alternative explanations of FDI's stability often focus on barriers to exit that limit divestiture during a crisis. For instance, Goldstein and Razin (2002) argue that FDI investors may face higher resale costs due to adverse selection. However, the fact that inward FDI is positive suggests that there continues to be fresh inflows of capital. The magnitude of new M&A activity suggests that mergers contributed substantially to the stability of inward FDI.

6 Conclusion

In this paper we investigate the relationship between liquidity crises and foreign acquisition activity. We find that in the case of cross-border M&A in East Asian economies liquidity played a significant and sizeable role in explaining the dramatic increase in foreign acquisition activity and the consequent continued inflow of FDI during the Asian crisis. Similarly, firm liquidity is shown to predict the price of acquisition, linking the sharp fall in the median price of acquisitions to the decline in liquidity observed during the crisis. The effects are most prominent in the tradable sectors. Moreover, proxies for liquidity have a greater impact on the probability of acquisition and the price of acquisition in 1998 than

²³The direct comparison of M&A activity to total inward FDI is complicated by the fact that acquisitions using funds raised in the domestic market (a debt outflow matched by an equity inflow) or involving a swap of equity (an equity outflow matched by an equity inflow), have zero net effect on the Balance of Payments (BoP) and the transaction may not be registered as FDI. (See World Investment Report (2000) for a full discussion). We also do not have data on divestitures. Therefore, M&A is not a strict subset of inward FDI.

in other years in the sample. This is consistent with a liquidity crisis being a short-term phenomenon. Additionally, we find no consistent evidence of liquidity based acquisitions in non-crisis economies and in acquisitions by other domestic firms in crisis economies. The nature of M&A activity supports liquidity-based explanations of the East Asian crisis and provides an explanation for the surprising stability of FDI inflows during the crises.

Appendix

A Definition of SDC Accounting Terms

Assets: Total balance sheet assets including, current assets, long-term investments and funds, net fixed assets, intangible assets, and deferred charges, as of the date of the most current financial information prior to the announcement of the transaction (million US\$). Equals total liabilities plus shareholders' equity plus minority interest.

Capital Expenditure: Gross purchases of property, plant, and equipment (million US\$). Does not include acquisition of other companies.

Cash Flow: SDC: Earnings before interest, taxes, depreciation and amortization for the most recent fiscal year prior to the announcement of the transaction (million US\$). Worldscope: Earnings before extraordinary items and preferred and common dividends, but after operating and non-operating income and expense, reserves, income taxes, minority interest and equity in earnings, plus all non-cash charges or credits.

Liabilities: All debt and obligations owed to creditors, including all current and long-term liabilities (million US\$).

Net Worth: Assets minus liabilities (million US\$).

Offer Price/Book Value: Offering price in the deal divided by target's book value per share as of the date of the most current financial information prior to the announcement of the transaction.

Offer Price/Market Value: Premium of offer price to target trading price 4 weeks prior to the original announcement date.

Sales: Primary source of revenue after taking into account returned goods and allowances for price reductions (million US\$). If not available, total revenues are used. For banks, net sales equals interest income plus non-interest income.

B Additional Proofs

Proof of Proposition 2:

Define $\gamma^* \equiv \{\gamma | S = 0\}$ to be the fixed cost at which the surplus of a match is zero. That is, $\gamma^* = V^F - V^D$. Then $y = \int_{S \geq 0} d\Gamma = \int_{\underline{\gamma}}^{\gamma^*} d\Gamma = \Gamma(\gamma^*)$, where we assume that γ^* always lies in the interior of the support of γ . Differentiation implies $\frac{\partial y}{\partial l} = \Gamma'(\gamma^*) \left(\frac{\partial V^F}{\partial l} - \frac{\partial V^D}{\partial l} \right) \leq 0$. Differentiating again implies $\frac{\partial^2 y}{\partial l^2} = -\mathbf{1}_{\{constrained\}} A_2 F''(K_2) \Gamma'(\gamma^*) + \frac{\Gamma''(\gamma^*)}{(\Gamma'(\gamma^*))^2} \left(\frac{\partial y}{\partial l} \right)^2$. The first term is nonnegative (and positive if the firm is constrained and Γ is increasing). The second term has the sign of Γ'' . In the case that γ has a uniform distribution, $\Gamma'' = 0$. More generally, as long as Γ'' is small over the support of γ^* (which is a subset of the support of γ), then $\frac{\partial^2 y}{\partial l^2} \geq 0$. The usual stochastic dominance argument then implies (i) in proposition 2. Similarly, $\frac{\partial y}{\partial A_2} = \Gamma'(\gamma^*) (\phi F(K_2^F) - F(K_2^D))$, which is strictly positive (the superscripts on K_2 indicate the capital stock under foreign and domestic ownership, respectively). Differentiating with respect to l gives: $\frac{\partial^2 y}{\partial l \partial A_2} = -\mathbf{1}_{\{constrained\}} F'(K^D) \Gamma'(\gamma^*) + \frac{\Gamma''(\gamma^*)}{(\Gamma'(\gamma^*))^2} \left(\frac{\partial y}{\partial l} \right) \left(\frac{\partial y}{\partial A_2} \right)$. The first term is nonpositive and strictly negative when the firm is constrained. Again, assuming that Γ is close to linear, then $\frac{\partial^2 y}{\partial l \partial A_2} \leq 0$ and our stochastic dominance assumption then implies (ii).

Proof of Proposition 3:

Recall that $P = \beta S + V^D = \beta (V^F - V^D - \gamma) + V^D$. An increase in π raises V^F and an unconstrained V^D one for one by the amount of additional profit. If constrained, V^D increases by an additional $(A_2 F'(l) - \delta)$. Similarly, an increase in \bar{D} leaves V^F unchanged, but increases a constrained domestic firm by $(A_2 F'(l) - \delta)$. Given the concavity of F , this latter term is strictly decreasing in l over the constrained region (and zero otherwise). Therefore, $\frac{\partial P}{\partial l}$ is nonincreasing in l and strictly decreasing over the constrained range. Our *fosd* assumption then implies (i). Similarly, $\frac{\partial P}{\partial A_2} = \beta(F(K^F) + (1 - \beta)F(K^D))$, and so $\frac{\partial^2 P}{\partial l \partial A_2} = \mathbf{1}_{constrained}(1 - \beta)(F'(l)) \geq 0$, with a strict inequality if constrained. Our *fosd* assumption then implies (ii).

C Additional Regressions

In this appendix we present logit and conditional logit regressions (table A1) to complement the linear probability results presented in table 4. The first column confirms that the sensitivity to liquidity and capital expenditure changes significantly during the crisis.

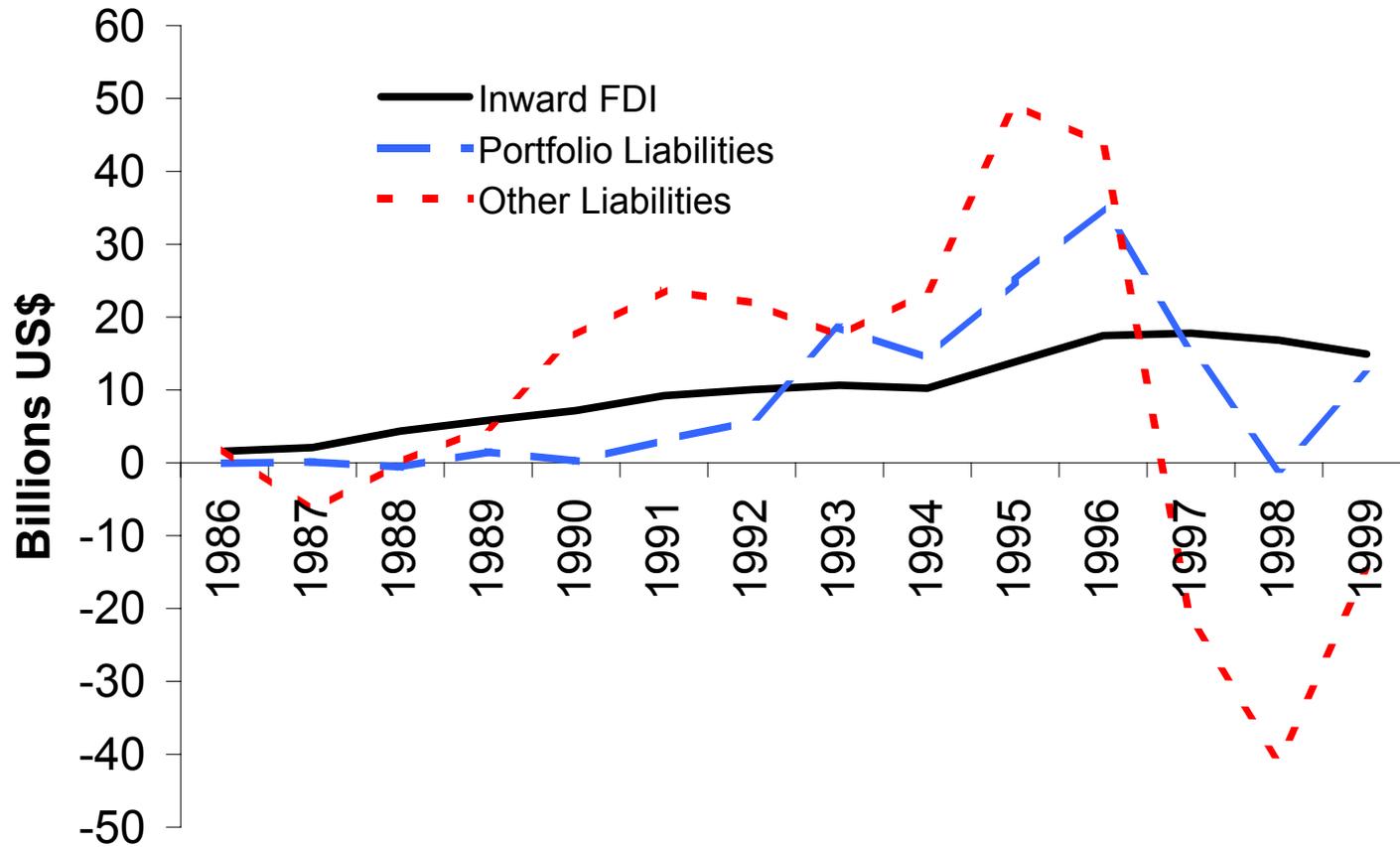
The conditional logit specification estimates the probability of acquisition *conditional* on the number of acquisitions observed within the group, where column 2 uses the firm to define a group and column 3 uses industry*nation*year triplets as the group. The point estimates support that liquidity played a more important role in 1998 than in other years of the sample. One issue with the conditional logit is that all groups in which the total number of acquisitions is zero are dropped, limiting the sample size and reducing efficiency if there is no underlying group heterogeneity. In column 2 we see that sensitivities to liquidity change significantly during the crisis in a manner that support the results of table 3. In column 3, the coefficient is negative but imprecisely estimated.

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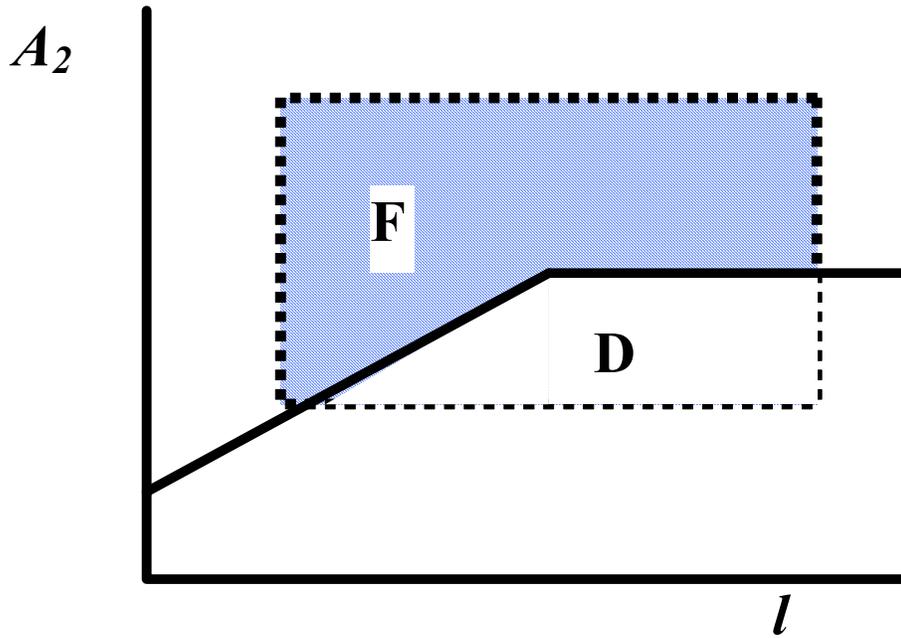
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Figure 1: Capital Inflows into East Asia



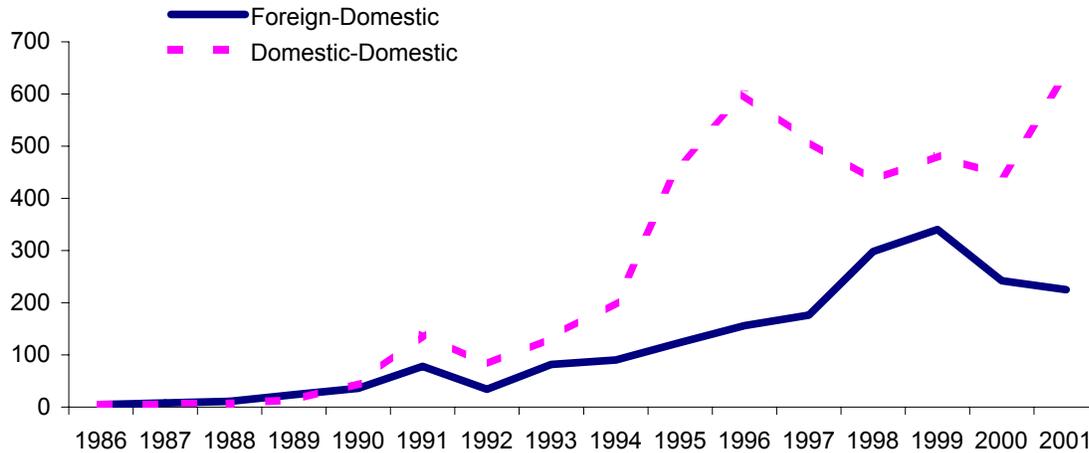
Source: IFS. Net inflows (liabilities) summed over the five East Asia nations. Categories are as defined by IFS.

Figure 2: Range of Foreign Acquisition



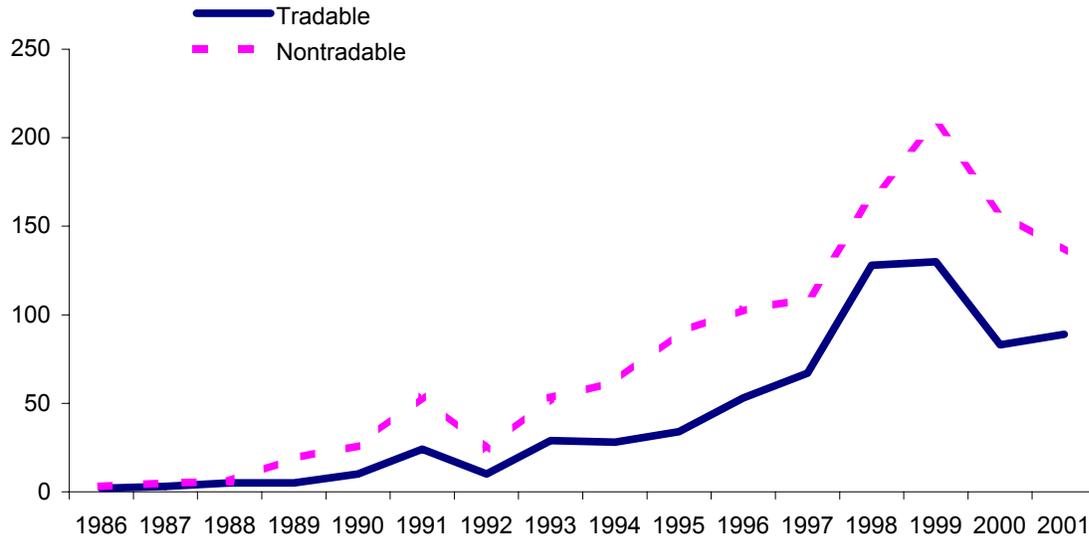
A_2 and l refer to productivity and liquidity, respectively, as defined in the text. The area within the box represents the support of firms at the start of period one. The solid line represents pairs of productivity and liquidity for which the surplus of foreign acquisition is zero (drawn for a fixed γ). The shaded area denoted “F” represents firms for which acquisition is efficient; firms within the region denoted “D” remain domestically owned.

Figure 3: Completed Acquisitions -- Foreign and Domestic



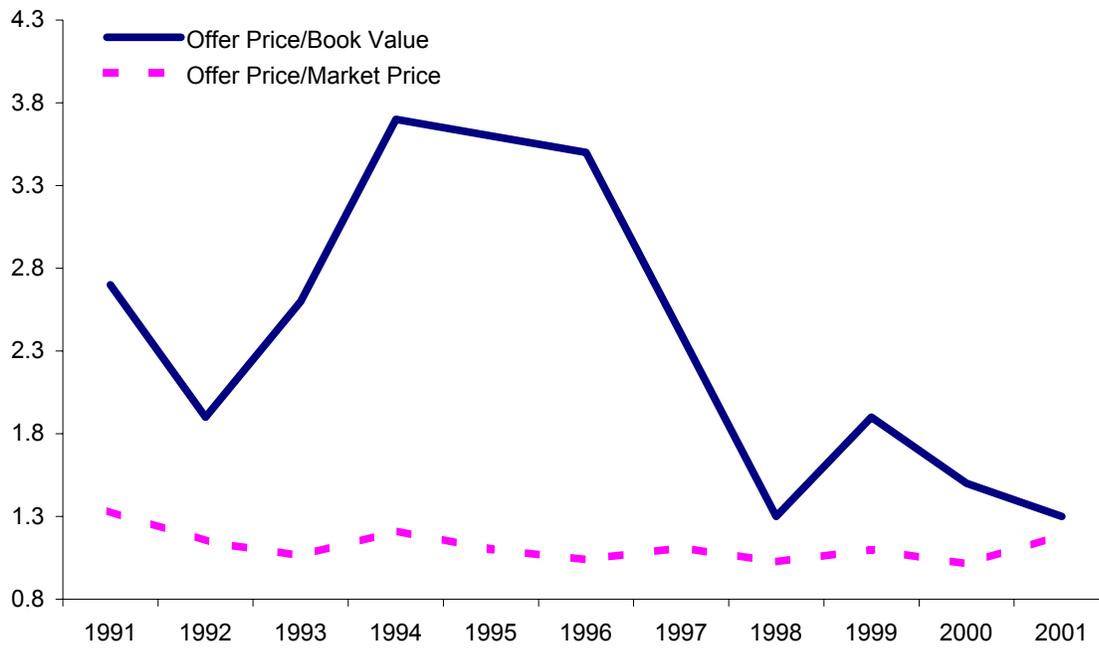
This figure depicts the number of completed acquisitions announced in the relevant year summed over the five East Asian nations. The solid line represents acquisitions by entities based outside the country of the acquired firm. The dashed line represents cases in which the acquiring firm and the target firm are based in the same country.

Figure 4: Completed Acquisitions -- Tradable vs. Nontradable Sectors



This figure depicts the number of completed acquisitions by foreign firms broken down by industry of acquired (target) firm. Tradable is defined as manufacturing and includes acquired firms with primary SIC code between 200 and 399. Acquired firms which list their primary industry outside this range are classified as nontradable.

Figure 5: Median Ratio of Offer Price to Book Value



Median offer price to book value (solid line) and offer price to market value (dotted line) as defined in text.

Table 1: Distribution of Shares Acquired

	Foreign Acquisitions		All Acquisitions	
	1986-2001	1998	1986-2001	1998
Mean	52.67	56.17	60.65	67.65
Standard Deviation	35.23	35.03	36.44	35.10
Percentiles				
10%	9	10	10	14
25%	20	24	25	35
50%	49	50	60	80
75%	100	100	100	100
Number of Acquisitions	1,696	257	5,544	636

Note: 90% of our sample acquisitions involve the purchase of at least 10% of equity, qualifying as FDI. The distribution of shares does not differ between that for all the years in our sample and for 1998.

Table 2: Descriptive Statistics of the Target Firm

	Foreign Acquisitions		All Acquisitions	
	1986-2001	1998	1986-2001	1998
Median Log Sales	5.13	5.26	4.76	5.14
Median Log Capital Expenditure	2.95	3.73	2.05	3.15
Median Log Cash Flow	3.80	3.85	3.09	3.67
Median Log Net Worth	4.70	4.71	4.41	4.59
Median Log Assets	6.15	6.52	5.68	6.31

Note: The median values for the sample excluding 1998 are very similar to the median values for the entire sample reported here.

Table 3: Probability of Acquisition by Foreign Company (1986-2001)
(Linear Probability Regression)

	(1)	(2)	(3)	(4)
ln(Cash Flow)	0.0018 (0.0024)	0.0038 (0.0024)		
* Year 1998	-0.0104 * (0.0062)	-0.0106 (0.0109)		
ln(Sales)			0.0033 (0.0033)	-0.0024 (0.0029)
* Year 1998			-0.0088 * (0.0048)	-0.0109 (0.0085)
ln(Capital Expenditure)	0.0050 *** (0.0018)	0.0014 (0.0020)	0.0017 (0.0012)	0.0045 ** (0.0025)
* Year 1998	0.0043 (0.0050)	0.0109 (0.0104)	0.0036 (0.0041)	0.0095 (0.0072)
Constant	-0.0388 (0.0296)	0.0046 (0.0045)	0.0373 (0.0239)	0.0244 ** (0.0103)
Firm & Year Fixed Effects	Yes	No	Yes	No
Year*Nation*Industry Fixed Effects	No	Yes	No	Yes
R2	0.34	0.40	0.39	0.41
Observations	9,603	9,603	11,331	11,331
Mean Dependent Variable	0.016	0.016	0.017	0.017

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. The dependent variable takes the value 1 when a domestic company is acquired by a foreign company. Acquisitions only include completed transactions.

Table 4: Probability of Acquisition by Foreign Company: Tradable Sector Firms (1986-2001)
(Linear Probability Regression)

	(1)	(2)	(3)	(4)
ln(Cash Flow)	0.0026 (0.0032)	0.0048 (0.0033)		
* Year 1998	-0.0150 ** (0.0075)	-0.0255 ** (0.0127)		
ln(Sales)			0.0005 (0.0064)	-0.0004 (0.0036)
* Year 1998			-0.0219 ** (0.0093)	-0.0223 * (0.0116)
ln(Capital Expenditure)	0.0045 * (0.0025)	0.0031 (0.0025)	0.0022 (0.0017)	0.0061 *** (0.0022)
* Year 1998	0.0058 (0.0063)	0.0224 ** (0.0102)	0.0103 (0.0067)	0.0186 ** (0.0086)
Constant	-0.0514 (0.0363)	-0.0001 (0.0063)	-0.0243 (0.0573)	0.0153 (0.0133)
Firm & Year Fixed Effects	Yes	No	Yes	No
Year*Nation*Industry Fixed Effects	No	Yes	No	Yes
R2	0.32	0.38	0.38	0.37
Observations	5,364	5,364	6,219	6,219
Mean Dependent Variable	0.015	0.015	0.016	0.016

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. The dependent variable takes the value 1 when a domestic company is acquired by a foreign company. Acquisitions only include completed transactions. Tradable and nontradable refer to the sector of the target (acquired) firm. All industries that defined as manufacturing (SIC codes 200-399) are included in tradables.

Table 5: Price of Acquisition (1986-2001)

Dependent Variable: ln(Offer Price/ Book Value)					
	Tradable Sectors			All Sectors	
	(1)	(2)	(3)	(4)	(5)
ln(Cash Flow)	-0.0583 (0.3726)			-0.0909 (0.1165)	
* Year 1998	1.1891 * (0.6536)			0.7284 *** (0.2685)	
ln(Sales)		0.2170 (0.1561)			-0.0402 (0.0768)
* Year 1998		1.5237 ** (0.6383)			0.6261 (0.4072)
ln(Capital Expenditure)	-0.0719 (0.2407)	-0.2148 (0.1460)		-0.0068 (0.0748)	-0.0123 (0.0686)
* Year 1998	-0.5569 (0.6014)	-1.1921 * (0.6721)		-0.1297 (0.2170)	-0.2326 (0.2437)
ln(Sales/Assets)			0.1979 (0.1915)		
* Year 1998			1.6207*** (0.4412)		
ln(Capital Expenditure)			-0.1823 (0.2165)		
* Year 1998			0.0093 (0.6227)		
Constant	0.7758 (0.6793)	-0.3536 (0.5553)	0.0927 (0.6227)	0.8306 *** (0.2466)	0.7278 ** (0.3325)
Year*Nation*Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
R2	0.92	0.87	0.88	0.87	0.84
Observations	243	307	306	557	706
Mean Dependent Variable	0.66	0.68	0.68	0.79	0.78

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. We include all acquisitions for which there is data on the price of the transaction. All industries that defined as manufacturing (SIC codes 200-399) are included in tradables.

Table 6: Breakdown by Periods
Probability of Acquisition by Foreign Company of Tradable Firms
 (Linear Probability Regression)

	1986-1996	1997	1998	1999	2000-2001
ln(Sales)	-0.0059 (0.0048)	-0.0164 (0.0197)	-0.0227 ** (0.0108)	-0.0099 (0.0079)	0.0085 ** (0.0043)
ln(Capital Expenditure)	0.0024 (0.0024)	0.0079 (0.0108)	0.0247 *** (0.0083)	0.0102 * (0.0062)	0.0055 ** (0.0025)
Constant	0.0306 (0.0201)	0.0736 (0.0711)	0.0992 ** (0.0405)	0.0549 ** (0.0314)	-0.0249 (0.0171)
Year*Nation*Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
R2	0.55	0.30	0.48	0.31	0.29
Observations	1,867	536	613	875	2,328
Mean Dependent Variable	0.008	0.015	0.036	0.023	0.015

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. The dependent variable takes the value 1 when a domestic company is acquired by a foreign company. Acquisitions only include completed transactions. Tradable and nontradable refer to the sector of the target (acquired) firm. All industries that defined as manufacturing (SIC codes 200-399) are included in tradables.

Table 7: Probability of Acquisition by Domestic Firm in Tradable Sector (1986-2001)
(Linear Probability Regression)

	(1)	(2)
ln(Sales)	0.0162 (0.0106)	0.0032 (0.0043)
* Year 1998	-0.0003 (0.0069)	0.0015 (0.0130)
ln(Capital Expenditure)	-0.0007 (0.0029)	0.0031 (0.0026)
* Year 1998	-0.0048 (0.0043)	-0.0018 (0.0077)
Constant	-0.2150 (0.1543)	0.0001 (0.0156)
Firm & Year Fixed Effects	Yes	No
Year*Nation*Industry Fixed Effects	No	Yes
R2	0.35	0.40
Observations	6,219	6,219
Mean Dependent Variable	0.023	0.023

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. The dependent variable takes the value 1 when a domestic company is acquired by another domestic company. Only completed acquisitions are included.

Table 8: Probability of Foreign Acquisition in Singapore and Taiwan (1986-2001)
(Linear Probability Regression)

	All Acquisitions		Acquisition of Traded Firm	
	(1)	(2)	(3)	(4)
ln(Sales)	0.0087 (0.0069)	0.0068 (0.0043)	0.0059 (0.0088)	0.0063 (0.0046)
* Year 1998	-0.0040 (0.0102)	-0.0050 (0.0092)	0.0032 (0.0142)	-0.0092 (0.0077)
ln(Capital Expenditure)	0.0037 (0.0028)	0.0006 (0.0026)	0.0029 (0.0028)	0.0031 (0.0020)
* Year 1998	-0.0048 (0.0063)	0.0012 (0.0065)	-0.0110 (0.0094)	-0.0054 (0.0037)
Constant	-0.1975 (0.0606)	-0.0102 (0.0166)	-0.0252 (0.0640)	-0.0168 (0.0185)
Firm & Year Fixed Effects	Yes	No	Yes	No
Year*Nation*Industry Fixed Effects	No	Yes	No	Yes
R2	0.31	0.35	0.34	0.50
Observations	4480	4480	2529	2529
Mean Dependent Variable	0.021	0.021	0.015	0.015

Note: Robust standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables. The dependent variable takes the value 1 when a domestic company is acquired by a foreign company.

Table 9: Mergers and Acquisitions as a Percentage of FDI Inflows into East Asia

	World Investment Report (2000)		Authors' Calculations	
	1996-1998 (1)	1998 (2)	1996-1998 (3)	1998 (4)
South Korea	51%	76%	73%	119%
Philippines	144%	109%	74%	120%
Malaysia	13%	41%	12%	34%
Thailand	30%	43%	37%	44%
Indonesia	15%	683/-356†	25%	1076/-356†

Note: World Investment Report (2000) refers to UN calculations of cross-border M&A that they estimate is comparable to FDI. Authors' calculations refer to the cash component of acquisitions as reported by SDC. Only those mergers involving at least 10% of equity are included. The denominator in all cases is net inflows of FDI as reported by the International Financial Statistics. †Indonesia experienced negative net inflows of FDI in 1998 of 356 million US dollars and positive inflow of acquisitions of USD 683 million in the UN sample and USD 1076 million in our sample.

Table A1: Probability of Acquisition by Foreign Company: Tradable Sector (1986-2001)
(Logit and Conditional Logit)

	Logit	Conditional Logit	
ln(Sales)	-0.2332 ** (0.1129)	0.0413 (0.3231)	-0.2755 (0.1764)
* Year 1998	-0.5869 ** (0.2491)	-0.8151 ** (0.3397)	-0.2291 (0.5215)
ln(Capital Expenditure)	0.4639 *** (0.0929)	-0.0935 (0.1611)	0.6038 *** (0.1550)
* Year 1998	0.4170 ** (0.2061)	0.4117 (0.2518)	0.5427 (0.4441)
Year Indicator 1998	2.500 *** (0.8359)	NA	NA
Firm & Year Fixed Effects	No	Yes	No
Year*Nation*Industry Fixed Effects	No	No	Yes
Pseudo R2	0.08	0.04	0.16
Observations	6,219	313	562
Mean Dependent Variable	0.016	0.300	0.158

Note: Standard errors are in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. Year*Nation*Industry fixed effects include fixed effects for each year, country and industry at the 3-digit SIC code, and all interactions of these variables.