

Financial Constraints on Investment in an Emerging Market Crisis: An Empirical Investigation of Foreign Ownership*

Garrick Blalock[†] Paul J. Gertler[‡] David I. Levine[§]

April 8, 2007

Abstract

We investigate whether capital market imperfections constrain investment during an emerging market financial crisis. Both large currency devaluations and banking sector failures characterize recent crises. Although a currency devaluation should increase exporters' competitiveness and investment, a failing banking system may limit credit to these firms. Foreign-owned firms, which may have greater access to overseas financing but otherwise face the same investment prospects, provide an ideal control group for determining the effect of liquidity constraints. We test for liquidity constraints in Indonesia following the 1997 East Asian financial crisis, a period when the issuance of new domestic credit shrank rapidly. Exporters' value added and employment increased after the crisis, suggesting that they profited from the devaluation and had sufficient cash flow to finance more workers. However, only exporters with foreign ownership increased their capital significantly. Our results suggest that liquidity constraints greatly retarded domestic-owned manufacturing firms' ability to take advantage of improved terms of trade. Specifically, compared to foreign-owned exporters they had resembled before the crisis, after the crisis domestic-owned exporters had more than 20% lower employment and capital and more than 40% lower value added and materials usage.

*We thank seminar participants at Dartmouth College, Di Tella University, University of Ljubljana, and University of California, Santa Cruz, and are grateful to Mark Gertler, James E. Blalock, and an anonymous reviewer for extensive comments.

[†]Cornell University, Department of Applied Economics and Management; +1 (607) 255-0307, garrick.blalock@cornell.edu

[‡]University of California, Berkeley, Haas School of Business, and NBER; gertler@haas.berkeley.edu

[§]University of California, Berkeley, Haas School of Business; levine@haas.berkeley.edu

1. Introduction

Do capital market imperfections constrain investment during emerging market financial crises? A consequence of crises, such as those that have occurred recently in East Asia, Latin America, and Russia, is both a dramatic currency devaluation and a crippling decline of the banking sector. These two events have opposing effects on new investment in the tradable goods sector. On the one hand, net exporting firms should benefit from better terms of trade and, thus, increase their investments. On the other hand, the collapse of the banking sector may limit their access to credit. Although improved terms of trade help all exporting firms, the degree to which liquidity constraints limit investment likely varies by firms' ownership. In particular, many firms with foreign ownership may be able to overcome liquidity constraints by accessing overseas credit through their parent companies.

In this paper, we use foreign ownership to test the extent to which capital market imperfections limited investment in Indonesia following the 1997–1998 East Asian financial crisis. The massive scale of Indonesia's currency devaluation and the severity of its banking sector's troubles provide a unique setting for our study. The East Asian financial crisis had a devastating effect on the Indonesian economy. The official measure of GDP dropped 13% in 1998, and investment fell 45% in 1998 alone, followed by a smaller decline in 1999 (International Monetary Fund 2000). Some of this devastation is surprising because the financial crisis was associated with the largest real devaluation in recent history. A U.S. dollar could buy four to six times the volume of Indonesian exports in early 1998 as it could in mid-1997. Although rapid Indonesian inflation eliminated roughly half the nominal devaluation, a 2:1 real devaluation remains virtually unprecedented. With this large a change in the terms of trade, conventional trade theory suggests that Indonesian firms should have enjoyed

an export boom.

In fact, Indonesian manufacturing exports rose only slightly after the crisis and, at least in part, limited credit supply is one possible explanation (Dutttagupta and Spilimbergo 2004). In Indonesia this event was not called a currency crisis, but a financial crisis (*krismon*, or monetary crisis, in Indonesian). Most banks in the nation were insolvent by 1998. The press reported that many firms, even those that wanted to export, were unable to access capital. Lenders had difficulty distinguishing between insolvent borrowers—for whom new loans would go toward old loan repayment rather than productive new investments—and firms that legitimately needed funds for ongoing operations or attractive investments. Moreover, even if a lender could identify solvent firms, IMF banking reforms may have reduced many banks' willingness to make *any* loans. Under threat of closure if they could not meet the IMF's higher reserve requirements, in the short run banks may have preferred holding cash over granting even highly profitable loans. The objective of this paper is to determine to what extent these types of credit limitation may have impeded investment.

Our identification strategy is to compare investment by domestic-owned firms with investment by a similar group of foreign-owned firms using a panel dataset of Indonesian manufacturing establishments observed before and after the crisis. This strategy is based on the literature that measures the effects of imperfect capital markets and of liquidity constraints on investment (Fazzari, Hubbard, and Petersen 1988, Bernanke and Gertler 1989, Hoshi, Kashyap, and Scharfstein 1991, and Minton and Schrand 1999; see surveys by Hubbard 1998 and Caballero and Krishnamurthy 1999). The insight of this work is that some firms, in our case foreign-owned, have easy access to capital and, thus, their investment responds to future profit opportunities. Other firms, i.e., those domestic-owned, have only limited access to capital, and consequently their investment responds to current cash flow more than to future profit

opportunities. We hypothesize that foreign owners, particularly large multinationals, could finance their Indonesian factories internally or through lines of credit available to the parent company, while domestic owners could not.

Our results show that foreign-owned exporters increased capital during the crisis, but otherwise similar domestic-owned exporters did not. In fact, the results suggest that the liquidity constraints that accompanied the financial crisis greatly retarded domestic-owned manufacturing firms' ability to take advantage of the better terms of trade. Specifically, the liquidity constraints decreased capital by 21.8%, decreased employment by 26.5%, and decreased value added by 43.5% relative to foreign exporters.

Our results are consistent with recent theoretical work, such as Caballero and Krishnamurthy 2001, that demonstrates that capital market imperfections can amplify the severity of financial crises.¹ Other empirical work consistent with these predictions include Aguiar and Gopinath 2005 and Desai, Foley, and Forbes 2004, which also used domestic and foreign ownership to identify firms at high and low risk of liquidity constraints. Aguiar and Gopinath 2005 examined mergers and acquisitions during crises and found that a decline in liquidity leads to an increase in M&A activity at "fire sale" prices. Desai, Foley, and Forbes 2004 found that U.S. firms significantly increase investment in overseas operations following a currency devaluation, while local firms often do not.

Our work follows a similar empirical approach to that of Desai, et al., and extends it in two ways. First, because our data are a full enumeration of Indonesian manufacturing establishments, our sample size is comparatively large. Second, our data contain detailed establishment-level attributes, most importantly, exporting activity

¹See Aguiar 2002, Forbes 2002, and Reinhart and Calvo 2000 for discussion of the effect of financial crises on emerging market firms in tradable and non-tradable sectors.

and employment. Exporting activity allows us to identify local firms that should benefit the most from a devaluation, and employee counts offer a proxy for output that is unaffected by unobserved price changes. The use of this granular data narrows our study to Indonesia, whereas Desai, Foley, and Forbes 2004 examines many currency devaluations. We find similar results to those of Desai et al. Domestic-owned and foreign-owned exporters in Indonesia responded to the crisis in very different ways consistent with the presence of liquidity constraints.

Our study also adds to the literature on foreign direct investment (FDI) during crises (e.g., Lipsey 2001) and to the debate on the social benefits of FDI versus local investment (e.g., Aitken and Harrison 1999 and Blalock and Gertler 2007).

We proceed as follows. Section 2 discusses the theory that motivates our analysis, and Section 3 introduces our data and methods. Section 4 presents our results, and Section 5 concludes.

2. Theory

We first review what conventional trade theory predicts should follow from a massive real devaluation. We then discuss theories of investment subject to financial constraints, a set of theories that are likely applicable during a financial crisis. We close this section with a discussion of how foreign ownership might mitigate financial constraints and increase the accuracy of trade theory predictions.

2.1. Trade Theory

Conventional trade theory assumes that relative prices are important, and no price is more important than the relative price of currency—the real exchange rate. When a country’s currency undergoes a real devaluation, its exports become more compet-

itive. In addition, domestic producers that compete against imported goods become more competitive. These increases in competitiveness should have several testable implications: higher profits, more employment, increased investment, and increased exporting. While several studies, such as Aguiar 2002, demonstrate such consequences using firm-level data in a number of countries, the aggregate trade figures in Indonesia following the financial crisis do not reflect the last prediction. Specifically, the U.S. dollar value of manufactured exports rose only slightly, from \$50 billion in 1996 to \$53 billion in 1999 (International Monetary Fund 2000, Table 42).

Trade theory also predicts that the expansionary effect of devaluation will be muted if competitors also undergo devaluations. Thailand and Malaysia, for example, also devalued around the same time as Indonesia, and China had devalued shortly before. However, because those real devaluations were much smaller than Indonesia's, standard theory still predicts higher net exports for Indonesia.

2.2. Financial Constraints

Why didn't the dollar value of manufacturing exports increase substantially? One reason may have been the poor state of the banking industry. Any economic downturn increases banks' lending risk because more of their existing and potential customers may face bankruptcy. Indonesia's notorious lack of financial transparency and weak bankruptcy laws amplified this effect because banks were unable to verify which customers were still solvent. Loans to insolvent customers were unlikely ever to be repaid. In addition, after the financial crisis banks stated that they preferred to lend to customers with whom they had an ongoing relationship (Agung, Kusmiarso, Pramono, Hutapea, Prasmuko, and Prastowo 2001). As numerous banks closed down during and after the financial crisis, relationship-specific ties were broken and some creditworthy firms may have lost access to credit. As the crisis continued, Indonesia

established new regulatory mechanisms that forced most banks to recognize their underperforming loans (Enoch, Baldwin, Frecaut, and Kovanen 2001). The resulting extremely low capital ratios in banks further discouraged lending.

Evidence from surveys and news reports support the existence of credit constraints. A World Bank-commissioned study that surveyed about 1,000 Indonesian manufacturers (Dwor-Frecaut, Colaco, and Hallward-Driemeier 2000, page 13) found that “about one third of the managers responding to a World Bank survey of Indonesian manufacturing firms reported experiencing ‘inadequate liquidity to finance production.’” The study (page 27) further adds, “40% of non-exporters and 27.2% of exporters reported experiencing inadequate liquidity to finance production.” These findings are consistent with many reports of credit constraints in the popular press at the time. For example, the New York Times (Mydans 1998) reported, “with severely diminished reserves, almost no lending and depositors terrified of the next austerity move, the banking system has virtually come to a standstill.”

In aggregate, the empirical evidence of the lower demand for and supply of credit is dramatic. Between 1996 and 2000, the real value of credit from commercial banks to the manufacturing sector fell by roughly half (comparing International Monetary Fund 2000, Table 35, on credit with the earlier tables on WPI and CPI). Presumably credit from foreign sources fell even faster as foreign capital poured out of Indonesia during the crisis.

Although much of this decline in total credit may have been attributable to lower credit demand by firms, constraints on credit supply by banks could lead to reduced investment by potentially creditworthy borrowers. Indeed, analyzing surveys of banks and of manufacturing plants, Agung, Kusmiarso, Pramono, Hutapea, Prasmuko, and Prastowo 2001 concluded that lack of bank capital (not high borrower risk) was responsible for much of the slowdown in lending.

2.3. Foreign Ownership and Financial Constraints

Above we argued that domestic banks may be unwilling to lend to firms if the banks cannot determine which firms are close to bankruptcy and unlikely to produce their way out of their problems. An Indonesian plant with substantial foreign ownership should not have this problem, because the foreign owner can document the solvency and profitability of the plant. Indeed, evidence suggests that foreign affiliates often substitute internal borrowing for external borrowing when operating in environments with poorly developed financial markets (Desai, Foley, and Hines Jr. 2003).

For firms that sell primarily to the domestic market and do not compete with imports, the benefits of foreign ownership may be low because a foreign owner would not be inclined to invest in a firm selling to the depressed Indonesian market. The hypothesis of foreign ownership as an antidote to financial crisis (and, thus, enabling high investment after a massive real devaluation) should be most visible for firms that export or compete with imports.

Three forces mitigate this hypothesis. First, some assembly plants import most of the value of sales. Even so, a devaluation greatly reduces the cost of labor—the main cost as a share of value added.

Second, the Indonesian financial crisis was accompanied by an increase in political risk. Foreign firms might have considered the weaker currency insufficient to counteract the risks of large capital losses. Risk-averse managers in particular might have been loath to invest in Indonesia if they feared the failing economy would erode the basic infrastructure, cause a civil war to break out, or lead to another catastrophic event that would depreciate assets. Riots in opposition to IMF programs presumably led all foreigners to fear for their personal safety and that of their assets.

Although plausible, it is not clear why rising political risk should have affected

foreign owners more than it did many domestic investors. A substantial majority of Indonesia's large companies were owned by individuals closely associated with Suharto (Fisman 2001), by the ethnic Chinese minority in Indonesia, or by businesspeople who were both. These groups had strong reasons to fear that either a new government would take over their businesses or a mob would destroy them. Their risks may have been larger than those faced by foreign investors.

Finally, firms with foreign equity ownership, as well as those that exported, might disproportionately have been those with foreign debt. The devaluation vastly increased the rupiah cost of servicing debt denominated in dollars, yen, or other hard currencies. The devaluation increased the real burden of debt payments most strongly for firms that borrowed overseas but sold largely to the domestic Indonesian market. Thus, in our regressions we compare firms that largely exported.

The above evidence of credit constraints that might be circumvented by foreign-owned firms leads us to consider the following simple model. All exporters face better investment opportunities, and thus their ideal level of capital increases. At the same time, the firms face an upper bound on their ability to finance new investment, I_{max} (although that constraint may not be binding if their ideal level of capital is near or below their current level). If domestic firms are more constrained than foreign firms, then $I_{max,domestic}$ may be less than $I_{max,foreign}$. In such a case, the increase in capital observed post-crisis would be less for domestic firms; and this is the hypothesis we test below.

3. Data and Methods

3.1. Data

Our analysis is based on data from the Republic of Indonesia’s *Budan Pusat Statistik* (BPS), the Central Bureau of Statistics. The principal dataset is the *Survei Tahunan Perusahaan Industri Pengolahan* (SI), the Annual Manufacturing Survey. The SI dataset is designed to be a complete annual enumeration of all manufacturing establishments with 20 or more employees from 1975 onward. The SI includes industrial classification (5-digit ISIC), ownership (public, private, foreign), capital, labor, raw material use, export volume, and other related data. We use data from 1990 to 2000. Because of the rapid rupiah devaluation during the crisis, a difference of just a few weeks in the reporting date could dramatically affect values. To avoid this bias, the estimation admits only the pre- and post-crisis years and drops 1996 to 1998.²

BPS submits a questionnaire annually to all registered manufacturing establishments, and field agents attempt to visit each non-respondent to either encourage compliance or confirm that the establishment has ceased operation.³ In recent years, over 20,000 factories have been surveyed annually. Government laws require that the collected information will only be used for statistical purposes and that plant-specific financial information will not be disclosed to tax authorities or competitors.⁴

²Although the crisis did not begin until 1997, we cannot include 1996 because capital stock was not reported in the census that year. The estimations with employment as the dependent variable are arguably less sensitive to the timing of the survey reporting relative to the crisis. Repeating our employment analysis with 1996 to 1998 included yields similar results to those that we report here.

³Some firms may have more than one factory. BPS also submits a different questionnaire to the head office of every firm with more than one factory. Although these data were not available for this study, analysis by BPS suggests that less than 5% of factories belong to multi-factory firms. We therefore generalize the results to firms.

⁴Some firms may still misreport. However, we minimize the effects of misreporting by using plant-level fixed-effect analysis, which admits only within-factory variation on a logarithmic scale. Persistent errors of under- or over-reporting will not bias the results as long as each factory consistently misreports over time.

Our main outcome indicators are profits, labor, materials usage, and capital stock. We proxy profits with value added. We use two measures of labor, the number of employees and the wage bill; for our purposes the wage bill is useful because it also varies with changes in hours per worker. The value of the capital stock is, as usual, the most difficult to measure. In a macroeconomic crisis with high inflation, book value, market value, and replacement cost of assets can diverge widely. It is unclear which plants used which concept to describe their asset values. We try to minimize the effects of systematic reporting bias in capital stock and the other outcome measures by estimating the models with plant-level fixed effects. We deflate the value added and materials figures by the 5-digit ISIC industry wholesale price index, and the capital figures by an average of machine, vehicle, and land price indexes, weighted by the share each asset represents of the economy-wide capital stock.

Finally, to better ensure the comparability of both the domestic exporters and non-exporters and the domestic and foreign exporters, we have limited our sample in two ways. First, we consider only factories with more than 100 employees. Smaller firms in Indonesia are unlikely to have access to formal credit markets and overseas buyers. Second, we consider combinations of 5-digit ISIC industries and provinces for which there is at least one domestic exporter and one foreign exporter.

3.2. Identification and Estimation

We are interested in identifying the effect of the financial crisis on firm performance measured by value added, investment, employment, and materials used. Each of the four outcome measures captures different responses to the crisis. Value added should capture profitability and reflects the overall effect of the devaluation. That is, exporting establishments with domestic raw materials and intermediate inputs should see value added rise even with no other changes in production as revenues (in hard

currency) rise relative to costs (in rupiah). We expect labor and materials to also grow due to the overall effect of the devaluation, but that growth may be limited at plants lacking access to short-term working capital. Last, capital should rise due to the expected persistent effect of the devaluation—although that increase may be limited by access to long-term financing.

We test two hypotheses. First, did exporters benefit from the devaluation? Second, were foreign-owned exporters better able to take advantage of the devaluation? We test the first hypothesis by comparing the effect of the crisis on Indonesian-owned exporters and Indonesian-owned non-exporters. Our aim is to establish exporters as beneficiaries of the rupiah devaluation. We expect that value added, labor, materials, and possibly capital stock expanded more for domestic-owned exporters than for other domestic-owned firms. We test the second hypothesis by comparing the post-crisis outcomes of Indonesian-owned exporters to foreign-owned exporters. The identifying assumption is that the rupiah devaluation should have affected foreign and domestic exporters in the same manner, all else being equal. We argue that changes in investment patterns between foreign and domestic exporters, relative to their pre-crisis trends, result from their different financing sources. Whereas domestic establishments would have to either borrow from domestic banks struggling with insolvency or convince foreign banks of their creditworthiness, foreign establishments could obtain internal credit through their parent companies.

With the first hypothesis, our objective is to identify the effect the financial crisis on domestic-owned firms that were exporters prior to the crisis. Specifically, we are interested in the firms' outcomes (value added, materials usage, employment, and investment in capital) just after the financial crisis compared to the counterfactual; that is, what domestic-owned exporters' outcomes would have been at the same point in time if the financial crisis had not occurred. Since the counterfactual is never

observed, we must estimate it. In the absence of a controlled randomized trial, we are forced to turn to non-experimental methods that mimic the ideal experiment under reasonable conditions.

A major concern is that the firms that chose to export could be different from the firms that chose not to export, and that these differences may be correlated with outcomes. For example, suppose that firms with better management were more likely to export and to have better post-crisis outcomes. In this case, the correlation between exporting and the outcomes would be confounded with the management effect. In principle, many of the types of (unobservable) characteristics that may confound identification are those that vary across firms, but are fixed over time. A common method of controlling for time invariant unobserved heterogeneity is to use panel data and estimate difference in differences models.

Therefore, without the benefit of a controlled randomized trial, we turn to a difference in differences approach, which compares the change in outcomes in the treatment group (domestic-owned exporters) before and after the intervention to the change in outcomes in the control group (domestic-owned non-exporters). By comparing changes, we control for observed and unobserved time-invariant firm characteristics. The change in the control group is an estimate of the true counterfactual; that is, what would have happened to the treatment group if there had been no intervention. Another way to state this is that the change in outcomes of the treatment group controls for time-invariant characteristics and the change in outcomes of the control group controls for time varying factors that are common to both the control and treatment groups.

Specifically, equation 1 estimates the effect of the crisis on firm outcomes.

$$\ln Outcome_{it} = \beta_0(Exporter * Post)_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where $\ln Outcome_{it}$ is the log of value added, the log of labor (either employment or the wage bill), the log of materials used, and the log of capital in the respective specifications, $(Exporter * Post)_{it}$ is the interaction of indicators for a pre-crisis (anytime during 1993 to 1995) exporting establishment i and post-crisis years (1999–2000), α_i is a fixed effect for factory i , and γ_t is a dummy variable for year t .

We use the same methodology to test our second hypothesis comparing domestic exporters with foreign exporters. Specifically, we estimate Equation 1 for just exporting establishments and substitute $(Foreign * Post)_{it}$ for $(Exporter * Post)_{it}$.

$$\ln Outcome_{it} = \beta_0 (Foreign * Post)_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (2)$$

where $Foreign$ is an indicator for plants with majority foreign ownership during 1993 to 1995.

It is important to note again that the estimation of both models uses only within-plant estimation. Time-invariant attributes of the factory, such as its management, industry, and location, are all removed by the fixed effect. Equation 1 thus asks how the domestic exporters changed after the crisis relative to domestic non-exporters, *conditional on all the unobserved static characteristics of the factories*. Likewise, Equation 2 asks how the foreign exporters changed after the crisis relative to domestic exporters, again controlling for plant unobservables.

In both models, the idiosyncratic error is a plant time-varying error and is assumed to be distributed independently of the plant and year fixed effects. These errors might be correlated across time. For example, the persistence of regional market factors could induce time-series correlation at the province level. We avoid potential biases in the estimation of the standard errors by computing them clustered at the firm level and thus allowing for an arbitrary covariance structure within firms over time.

4. Results

4.1. Summary Statistics

We first examine the characteristics of foreign-owned versus domestic-owned plants and of exporting and non-exporting plants prior to the financial crisis (Table 2). We define foreign factories as those that had majority foreign equity (50% or more) during 1993 to 1995 and exporters as those that exported anytime from 1993 to 1995.⁵

Ten percent of all factories were foreign-owned. Roughly two-fifths of domestic plants and over two-thirds of foreign-owned plants were exporters.

Foreign-owned plants were larger than domestic plants (mean 576 versus 486 employees), although most of this gap was due to the fact that exporters were larger than non-exporters. Among exporters, foreign-owned plants had fewer employees than their domestic-owned counterparts. Foreign-owned plants were far more capital-intensive than domestic-owned plants, although half that gap was erased when comparing foreign-owned plants only with other exporters.

About four-fifths of the plants survived until 2000. The survival rate was lowest for domestic-owned non-exporters (80%) and highest for foreign-owned exporters (85%).

Plants' exporting activities were fairly persistent, but less so than we had expected. Among exporters in 1993–1995 that survived until 1999–2000, only about 59% (foreign-owned) to 60% (domestic-owned) were still exporting at the later dates, a rate of exit from export markets much higher than that in pre-crisis years.⁶ Similarly, only 14% of non-exporters switched to exporting, although the rate of initiating exports was substantially higher among foreign-owned non-exporters (22%). Sjöholm

⁵Our results are similar if we choose other foreign equity share thresholds for our definition of foreign ownership. We explore the alternative definition outcomes below.

⁶See Blalock and Roy 2007 for a detailed analysis of Indonesian firms' exporting behavior after the crisis.

and Takii (2003) also report that during the 1990s plants with foreign ownership in Indonesia had above-average odds of starting to export, an effect they attributed to social networks that lowered the costs of entering export markets.

4.2. Regression Results

Table 3 presents the core results of the paper—estimates of Equations 1 and 2. The odd columns (1), (3), (5), (7), and (9) show the effect of exporting on value added, materials used, the wage bill, employment, and capital among the population of all domestic plants. The even columns (2), (4), (6), (8), and (10) show the effect of foreign ownership on value added, materials used, the wage bill, employment, and capital for the population of all exporting plants, domestic and foreign.

Consider first the effect of exporting on post-crisis outcomes. Among domestic plants, those that were exporters prior to the crisis saw their value added grow by 17% and materials usage by 25% relative to those that did not export.⁷ Further, the same exporting plants saw their wage bill and employment grow by about 9% more than those of non-exporting plants. However, the pattern does not show up for capital stock: there is no significant difference in capital post-crisis between domestic exporters and domestic non-exporters. Thus capital-to-output and capital-to-labor ratios declined after the financial crisis for exporters (relative to non-exporters), consistent with the hypothesis of liquidity constraints that reduced real investment.

Among all plants that exported prior to the crisis, in contrast, the crisis was followed by higher values of all outcomes (even rows). Exporters with majority foreign ownership (“foreign exporters”) grew value added by 44% relative to domestic exporters, materials used by 51%, employment by 27%, and capital by 22%. The key

⁷All coefficients are statistically significant at the 5% level or better, unless indicated. We use the language of percentage changes, although technically these coefficient estimates are 100 times the change in logs.

observation here is that all exporters increased their value added, materials usage, and labor after the crisis (relative to domestic-owned non-exporters), but only exporters with foreign ownership increased capital. These results are consistent with liquidity constraints weighing more heavily for domestic-owned plants. One of the interesting results is that foreign-owned exporters' wage bill rose relative to other exporters by 34%, which is a larger increase than employment (27%). Although the difference is not statistically significant, it is consistent with a rise in relative hours per week (that is, more overtime or less partial layoff) at foreign-owned exporters. Numerous studies show that in the relative short term (a few years) when output rises, capacity utilization of capital rises and employees work more hours.⁸

Finally, it is interesting to note the coefficients on the year fixed effects in the capital results in columns (9) and (10). Because 1990 is the omitted year, the coefficients should be interpreted as the percentage increase in capital from 1990. Between 1995 and 1999, the average domestic-owned firm lost roughly one-third of the value of its capital stock (comparing the year effects from either column). Only foreign-owned exporters avoided most of this decline (due to the 22% coefficient on foreign * post-crisis in column 10). This dramatic fall illustrates the severity of the crisis and the capital flight that plagued Indonesia.

4.2.1. Government Ownership

Some of the estimated effects of domestic ownership may not have been due to domestic ownership per se, but to government ownership coupled with a severe government budget crunch. Prior to the crisis, one in eight Indonesian factories had some government ownership, and these factories accounted for 14% of total manufacturing

⁸See, for example, Caballero and Lyons 1992, Fay and Medoff 1985, Rotemberg and Summers 1990, Sbordone 1996, and Burnside, Eichenbaum, and Rebelo 1993.

employment.

Many government-run plants in Indonesia were notoriously inefficient and operated under soft budget constraints afforded by public subsidy. For example, before the crisis favored plants routinely received loans at reduced interest rates and were not always required to repay all debt. Many of these plants also had political connections with the ruling Suharto family; prior to the crisis, these connections often permitted inefficient plants to flourish.

Following the decline of public subsidies and the downfall of the Suharto ruling family, we would expect these plants to contract. The crisis brought about a severe tightening of the budget constraint for plants with government ownership. First, government tax revenue plummeted, and the IMF required a reduction of the government deficit. Second, lenders were less willing to provide financing to the Suharto regime, and many of the banks linked to plants with government ownership were either out of business or rapidly retrenching. The result of all of these factors was a sharp decline in the availability of credit to plants with government ownership.

Table 4 adds the interaction of government ownership and the post-crisis years to our base estimation. As expected, government-owned plants experienced large declines in value added and employment relative to private plants. Capital also declined relative to private plants, but surprisingly, this decline is not statistically significant. The most salient observation for our study is that conditioning on government ownership is not an alternative explanation to our core finding that foreign exporters increased capital relative to domestic exporters. Because the government ownership variable is highly significant, we include it in the remainder of our estimations.

4.3. Investment Prospects

A fundamental assumption of our analysis so far is that rupiah depreciation had identical effects on the optimal investment decisions of both domestic and foreign-owned exporters. In particular, if domestic exporters benefited less from the devaluation, then their stagnant capital levels could be attributable to poor investment prospects rather than to credit constraints. To mitigate this concern, in all estimations we limit our sample to generally similar firms. Specifically, we include only establishments with more than 100 employees that are located in industry-province cells in which there are both exporters and foreign firms. Below, we adopt three additional approaches to ensure that differing investment opportunities are not the cause of our results. First, we condition on a number of firm attributes, specifically size, industry, and productivity, that might change how the crisis affected investment prospects. Second, we consider if limited access to export markets might have reduced domestic firms' investment. Third, we examine if heterogeneity in the output prices for foreign and domestic exporters might differ and thus affect the investment decision.

4.3.1. Are Results Sensitive to Additional Controls?

Large firms could have more resources that enable them to take better advantage of the improved terms of trade. For example, larger firms might be more capable of rapidly expanding production and have marketing networks that could find buyers for the new production. Because foreign exporters are larger than domestic exporters on average, we could confound size with ownership. In Table 5 we condition on the log of pre-crisis employment*post-crisis. The results are very similar with this added control.

We do not expect that the devaluation would affect all industries equally. For ex-

ample, labor-intensive industries should benefit more as their labor costs (in dollars or yen) plummeted. If foreign exporters were especially predominant in labor-intensive industries, then we might confound ownership with industry effects. Table 6 investigates this possibility by interacting an indicator for each of the 2-digit ISIC industry codes with the post-crisis dummy. The overall pattern of results is largely unchanged, although the coefficient on foreign-ownership*post-crisis in column 10 (predicting capital) does lose statistical significance, likely because of the economic power lost with the inclusion of so many control variables.

Pre-crisis productivity at a firm might also affect the change in investment opportunities brought with the devaluation. One might expect generally more competitive firms to maintain lower costs and higher quality, and thus see more long-term benefits from investment. To consider this possibility, we estimate a translog production function using the pre-crisis years to estimate firms' average total factor productivity. We then normalize the productivity measure by the mean productivity of each firm's 4-digit ISIC industry. Table 7 shows the results conditioning on this pre-crisis productivity*post-crisis. Our overall pattern of results does not change. Surprisingly, high productivity in pre-crisis years is associated with lower value added post-crisis. We expect this reflects some mean reversion—productivity is partly stochastic (particularly due to transitory measurement error) and plants that are (or appear to be) particularly productive in some years may be unable to sustain the advantage.⁹ Pre-crisis productivity has little effect on labor and has a positive effect on post-crisis investment.

⁹Because value added is typically correlated with productivity, we may introduce some endogeneity in the value added estimations by controlling for average productivity. An alternative approach that removes any such endogeneity is to estimate productivity in early years, say 1990 to 1994, and then include this measure in a sample of 1995 and later. This approach yields almost identical results.

4.3.2. Did Foreign Firms Have Better Access to Export Markets?

Access to export markets could affect optimal investment. If foreign exporters had easier access to overseas customers, then their investment prospects could have increased more rapidly after the devaluation. As a first step, we need to establish that pre-crisis exporters constitute the majority of post-crisis exporters. The data in Table 2 support this assumption, although there is more churning than we had expected. Amongst surviving firms, 60% of pre-crisis domestic exporters and 59% of pre-crisis foreign exporters continued to export post-crisis. Although we would have expected a higher share of firms to continue exporting, the rate of continuation does not vary by ownership. The shift of multinational production to China is one possible explanation, as is the unwillingness of some foreign customers to rely on suppliers in a nation perceived as increasingly unstable. Given the expense and time of establishing overseas marketing channels, our priors are that few plants that did not export before the crisis would be able to start exporting afterward. Indeed, only 13% of domestic non-exporters in the pre-crisis period started exporting later. For foreign pre-crisis non-exporters, the rate of export initiation is higher at 22%. However, because our sample is limited to pre-crisis exporters, this difference does not affect our results. Further, as shown in Table 2, the share of output exported varies modestly by ownership (53% for domestic exporters versus 60% for foreign exporters), but the difference shrinks when we control for other firm characteristics. We thus expect the currency devaluation to affect all exporting plants' investment prospects about equally.

To examine this issue more formally, we control for firms' pre-crisis export shares in Table 8. Consistent with the mean export shares of output being the nearly same regardless of ownership, our core results remain unchanged. Export shares post-crisis, however, may have changed differently for foreign and domestic exporters. To consider

this possibility, we repeat our baseline analysis with export share as the dependent variable. The coefficient on foreign*post-crisis is close to zero and insignificant (results available on request). In other words, foreign exporters do not appear to have different changes in export share than those of domestic exporters.

4.3.3. Did Foreign Firms Experience Higher Price Increases?

One potential alternative explanation of our results is that foreign exporters might have experienced larger increases in post-crisis export prices than domestic exporters. For example, foreign exporters might have better access to overseas markets and could find new direct buyers whereas domestic exporters might have to rely on distributors that insisted on a lower price. The investment opportunities for foreign exporters thus could have been better than those for domestic exporters. In particular, foreign exporters' sales revenue would have increased faster than that of domestic exporters even if total physical output changed at the same rate. In that scenario, we would see similar rates of change of materials expenditures, but higher value added for foreign exporters. In fact, in all regressions materials usage increased slightly and not statistically significantly faster at foreign-owned exporters than domestic-owned exporters (compare, for example, the coefficients on foreign*post-crisis in Table 8, columns 2 and 4).

4.4. Different Pre-crisis Trends

A concern in our analysis is that differing investment patterns between foreign and domestic exporters before and after the crisis simply reflect a long-term trend. To test for this possibility, we divided our pre-crisis sample into two time periods and repeated the analysis with 1993–1995 substituting for the actual post-crisis years. That is, we took 1990–1992 to be the pre-crisis years and assumed a “placebo crisis”

to have occurred between that period and 1993–1995. Table 9 shows the results of this “falsification exercise.” Among plants with some foreign ownership, value added, materials used, labor, and capital were all higher after the placebo crisis in 1993 than before the crisis. The magnitudes are less than those estimated after the actual crisis and the increase in capital after the placebo crisis is not significant. These results imply that some of the faster growth of foreign-owned exporters after the true crisis may have been due to the continuation of pre-crisis trends.

Table 10 further explores the possibility that foreign and domestic exporters were following separate time trends. Here, we keep the actual post-crisis period of 1999–2000, but allow separate trends for domestic and foreign exporters to begin following the placebo crisis after 1992. That is, we ask how trends that started in 1993–1995 changed after the real crisis. The general pattern of results reported above remains unchanged, which shows that our core findings are not explained by pre-existing trends. In fact, capital accumulation for domestic exporters is slightly negative, reversing some of the gains that began in 1992.

4.5. Leverage

Another possible complication comes from the likelihood that exporters and foreign factories had more debts denominated in U.S. dollars, Japanese yen, and other hard currencies than in rupiah. Because the Bank of Indonesia had historically supported a policy of slow and gradual depreciation of the rupiah against the dollar, many firms had borrowed abroad to take advantage of lower nominal interest rates. With the implicit belief that the exchange rate would not change dramatically in the short run, few firms had hedged their positions (Blustein 2001). In many cases, the change in the rupiah value of outstanding debt alone left firms insolvent following the devaluation. In contrast, those firms with debts in rupiah and revenues in hard currencies enjoyed

a large reduction in the burden of repaying their debt.

If we had clean measures of leverage, we would expect foreign-currency-denominated debt to predict a decline in investment as the rupiah value of the debt rose. We would further expect this factor to be lessened to the extent that revenues were also in hard currency—that is, among exporters and especially among foreign-owned exporters.

We have two measures of leverage (debt-to-assets ratio), each with limitations. The first indicator is of the leverage in current rupiah. Unfortunately, the dataset does not distinguish zero debt from missing values for the debt measure. Thus we analyze this variable carefully, examining only observations with non-zero debt levels.¹⁰ The second indicator is the existence of a loan from a foreign bank. This measure does not tell us the denomination of the debt, although other sources indicate that most foreign debt was in U.S. dollars (Blustein 2001). Even more important, this measure also does not indicate the share of debt denominated in foreign currency. Thus we distinguish leverage between establishments with and without any foreign bank loans, but we cannot examine the effects of changing shares of foreign-currency-denominated debt.

Given our noisy measures (with “zero” representing both zero debt and a missing value for debt, and with only an indicator for any foreign debt, but not its amount), these analyses are largely robustness checks. With these cautions in mind, for plants with positive reported debt levels, leverage (the debt-to-assets ratio) was near 60% regardless of foreign ownership or being an exporter. Among those reporting any debt, half of foreign-owned plants but only 10% of domestic plants reported having any foreign-currency-denominated debt in 1990–1996.

In Table 11 we condition on the interaction of post-crisis with pre-crisis leverage

¹⁰The results are unchanged if zero-debt responses are assumed to indicate no debt rather than a missing value.

among plants with no foreign debt and among plants with positive foreign debt. Only five of the 30 point estimates this exercise calculates are statistically significant. We cannot say whether this indicates that the role of leverage is minor, or is a reflection of our noisy data. Our prior is the latter and we thus present the results only as an additional robustness check. The general pattern of results does not change. The coefficient on foreign exporters does lose significance, likely the result of the loss of power from including three additional variables.

4.6. Regional Effects

A particular concern is regional effects: the destination of exports and the location of competition. The improvement in terms of trade after the devaluation was much less for plants exporting to neighboring crisis-afflicted countries. Thus, one possible explanation for some of the above results could be that domestic-owned plants export more to these neighbors than do foreign-owned exporters. Alternatively, domestic exporters may compete more with neighboring-country firms, who themselves benefited from a devaluation, whereas foreign exporters compete mainly with non-crisis-country rivals. Thus the devaluation may have provided fewer investment incentives to domestic exporters. Unfortunately, we do not know the country destination of exports or the location of exporters' competitors. However, we know of no particular reason to expect that export destinations differ by ownership. For example, many Japanese manufacturers maintain cross-national supply chains in Southeast Asia. One Japanese manufacturer, which kindly agreed to talk with us, exported all of its Indonesian output to Thailand and Malaysia for further assembly. With respect to the source of competition, we can say a little more. BPS conducted a post-crisis follow-up survey of 900 surviving manufacturing firms. The survey asked establishments to list the country of their major competitor. Among the several hundred exporters in the sample, no

significant differences were apparent in the geographical distribution of competitors for plants with foreign ownership compared to those with domestic ownership.

4.7. Foreign Parents in Crisis-affected Countries

We investigated whether exporters with foreign ownership based in other crisis-stricken countries invested differently than other foreign exporters. Specifically, we created an indicator variable for crisis-country ownership and interacted this variable with the foreign-owner*post-crisis variable in our estimations. The interaction term is -.21 (n.s., $t=1$), whereas the interaction term foreign-owner*post-crisis is 0.25 ($t=1.84$). Adding the two terms yields a net effect of near zero for firms with a parent in a crisis-affected country; that is, foreign-owned plants with a parent in a crisis nation had a point estimate on investment that was almost identical to that of Indonesian-owned plants. This result is consistent with liquidity constraints among parent firms in crisis-hit nations.

4.8. Definition of Foreign Ownership

The results above are based on foreign ownership being defined as majority 50% foreign equity or above. We have tried various alternative definitions, e.g., any foreign equity, 25%, or 95%. The pattern of results remains unchanged, but the difference in investment for foreign versus domestic exporters grows as we increase the cutoff. If we define a foreign exporter as one with any foreign equity, the coefficient on foreign-ownership*post-crisis in predicting the capital stock (after plant and year fixed effects, as in Table 3) is 0.18. This coefficient grows to 0.28 as we increase the foreign equity cutoff to 95%. Although the increase in the coefficient is not statistically significant, it is consistent with our hypothesis. One would expect the ability of an exporter to obtain credit from its parent company to be better the greater the ownership share

of the parent.

On the subject of foreign ownership share, it is interesting to note that foreign-owned exporters had, on average, 5% greater foreign ownership after the crisis. Because there is no counterfactual comparison group, this finding alone does not demonstrate that this injection of capital was attributable to post-crisis credit constraints. However, it is consistent with the mechanism we propose as foreign owners injected liquidity and increased their equity shares.

4.9. Differential Plant Survival

Table 12 shows the effect of pre-crisis exporting and foreign ownership on plant survival. The dependent variable is survival until the year 2000, which we estimate using a probit model with the coefficients expressed as probabilities. As expected, the more capital-intensive plants before the crisis had higher survival rates after the crisis. Conditioning on those variables, 3-digit industry indicators, and province indicators, exporting (among domestic-owned plants) and foreign ownership (among exporters) have no large or statistically significant effect on survival.

The zero effect of exporting on survival is unexpected for domestic exporters. For foreign ownership, the zero effect is less surprising because our data do not distinguish between plants closed by bankruptcy and plants that relocated. Bernard and Sjöholm (2003) found that before the crisis foreign plants had a roughly 30% higher exit rate in Indonesia than otherwise similar domestic-owned plants. Our results are not statistically significant, and we cannot reject somewhat higher excess mortality rates among foreign-owned plants. However, it seems likely that the post-crisis excess mortality of foreign firms is lower than the pre-crisis level Bernard and Sjöholm reported.

Columns (2) and (4) of Table 12 consider the effect of a plant's pre-crisis produc-

tivity on survival. Productivity is the difference between a plant's fixed effect in a translog production function estimation minus the mean fixed effect of other plants in the same 4-digit ISIC industry. That is, positive values indicate high productivity, and negative values indicate low productivity. Pre-crisis productivity had little effect on the survival of Indonesian firms in general, but it had a positive effect on the survival of exporters.

5. What Have We Learned?

Our findings provide evidence that capital market imperfections may reduce exporters' investment and thus amplify emerging market crises. Trade theory suggests that exporting firms should increase profits, increase material inputs, expand labor, and invest in new capital following a real devaluation. For domestic Indonesian exporters, however, we observe only the first three effects, but do not see increased investment. Liquidity constraints are a likely explanation. Whereas increases in materials used and labor could usually be financed through cash flow (with some declines if liquidity constraints reduced working capital), capital investment typically would have required obtaining credit from a struggling financial sector. In contrast, Indonesian exporters with foreign ownership did expand capital. A priori, we see no reason other than financing availability why investment would depend on ownership. While domestic exporters may have faced a credit crunch, exporters with foreign ownership could access credit through their parent company and thus insure themselves against liquidity constraints.

Finally, we note that a surprisingly large share, 40%, of pre-crisis domestic exporters did not continue exporting following the crisis. Although this phenomenon requires further investigation, liquidity constraints, an overall decline in the regional

economy, or competition from Chinese and other East Asian exporters, may explain it.

References

- AGUIAR, MARK (2002): “Investment, Devaluation, and Foreign Currency Exposure,” Working paper, University of Chicago, Graduate School of Business.
- AGUIAR, MARK, AND GITA GOPINATH (2005): “Fire-Sale FDI and Liquidity Crises,” *Review of Economics and Statistics*, Forthcoming.
- AGUNG, JUDA, BAMBANG KUSMIARSO, BAMGANG PRAMONO, ERWIN G. HUTAPEA, ANDRY PRASMUKO, AND NUGROHO JOKO PRASTOWO (2001): “Credit Crunch in Indonesia in the Aftermath of the Crisis: Facts, Causes and Policy Implications,” Discussion paper, Bank Indonesia, Directorate of Economic Research and Monetary Policy, Jakarta.
- AITKEN, BRIAN J., AND ANN E. HARRISON (1999): “Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela,” *American Economic Review*, 89(3), 605–618.
- BERNANKE, BENJAMIN, AND MARK GERTLER (1989): “Agency Costs, Net Worth, and Business Fluctuations,” *American Economic Review*, 79(1), 14–31.
- BERNARD, ANDREW, AND FREDRIK SJOHOLM (2003): “Foreign Owners and Plant Survival,” Working paper, Dartmouth College, Tuck School of Business.
- BLALOCK, GARRICK, AND PAUL J. GERTLER (2007): “Welfare Gains from Foreign Direct Investment through Technology Transfer to Local Suppliers,” *Journal of International Economics*, Forthcoming.

- BLALOCK, GARRICK, AND SONALI ROY (2007): “A Firm-Level Examination of the Exports Puzzle: Why East Asian Exports Didn’t Increase After the 1997–1998 Financial Crisis?,” *The World Economy*, 30(1), 39–59.
- BLUSTEIN, PAUL (2001): *The Chastening: Inside the Crisis that Rocked the Global Financial System and Humbled the IMF*. Public Affairs, New York.
- BURNSIDE, CRAIG, MARTIN EICHENBAUM, AND SERGIO REBELO (1993): “Labor Hoarding and the Business Cycle,” *Journal of Political Economy*, 101(2), 245–273.
- CABALLERO, RICARDO, AND ARVIND KRISHNAMURTHY (2001): “International and Domestic Collateral Constraints in a Model of Emerging Market Crises,” *Journal of Monetary Economics*, 48(3), 513–548.
- CABALLERO, RICARDO J., AND ARVIND KRISHNAMURTHY (1999): “Emerging Market Crises: An Asset Markets Perspective,” Working paper, Massachusetts Institute of Technology.
- CABALLERO, RICARDO J., AND RICHARD K. LYONS (1992): “External Effects in U.S. Procyclical Productivity,” *Journal of Political Economy*, 29(2), 209–225.
- DESAI, MIHIR, C. FRITZ FOLEY, AND KRISTEN J. FORBES (2004): “Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Crises,” Working Paper 10545, National Bureau of Economic Research, Cambridge, MA, June.
- DESAI, MIHIR, C. FRITZ FOLEY, AND JAMES R. HINES JR. (2003): “A Multi-national Perspective on Capital Structure Choice and Internal Capital Markets,” Working Paper 9715, National Bureau of Economic Research, Cambridge, MA.

- DUTTAGUPTA, RUPA, AND ANTONIO SPILIMBERGO (2004): “What Happened to Asian Exports During the Crisis?,” *IMF Staff Papers*, 51(1), 72–95.
- DWOR-FRECAUT, DOMINIQUE, FRANCIS COLACO, AND MARY HALLWARD-DRIEMEIER (eds.) (2000): *Asian Corporate Recovery: Findings from Firm-Level Surveys in Five Countries*. The World Bank, Washington, DC.
- ENOCH, CHARLES, BARBARA BALDWIN, OLIVIER FRECAUT, AND ARTO KOVANEN (2001): “Indonesia: Anatomy of a Banking Crisis—Two Years of Living Dangerously—1997-99,” Working Paper 01/52, International Monetary Fund, Washington, DC.
- FAY, JON A., AND JAMES MEDOFF (1985): “Labor and Output Over the Business Cycle: Some Direct Evidence,” *American Economic Review*, 75(4), 638–655.
- FAZZARI, STEVEN M., R. GLENN HUBBARD, AND BRUCE C. PETERSEN (1988): “Financing Constraints and Corporate Investment,” *Brookings Papers on Economic Activity*, 1988(1), 141–195.
- FISMAN, RAYMOND (2001): “Estimating the Value of Political Connections,” *American Economic Review*, 91(4), 1095–1102.
- FORBES, KRISTIN J. (2002): “How Do Large Depreciations Affect Firm Performance?,” Working Paper 9095, National Bureau of Economic Research, Cambridge, MA.
- HOSHI, TAKEO, ANIL KASHYAP, AND DAVID SCHARFSTEIN (1991): “Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups,” *Quarterly Journal of Economics*, 106(1), 33–60.

- HUBBARD, R. GLENN (1998): “Capital-Market Imperfections and Investment,” *Journal of Economic Literature*, 36(1), 193–225.
- INTERNATIONAL MONETARY FUND (2000): “Indonesia: Statistical Appendix,” IMF Staff Country Report 00/133.
- LIPSEY, ROBERT (2001): “Foreign Direct Investors in Three Financial Crises,” Working Paper 8084, National Bureau of Economic Research, Cambridge, MA.
- MINTON, BERNADETTE A., AND CATHERINE SCHRAND (1999): “The Impact of Cash Flow Volatility on Discretionary Investment and the Costs of Debt and Equity Financing,” *Journal of Financial Economics*, 54(3), 423–460.
- MYDANS, SETH (1998): “Indonesia Begins the Rescue and Consolidation of Banks,” *The New York Times*, p. D2.
- REINHART, CARMEN, AND GUILLERMO CALVO (2000): “When Capital Inflows Come to a Sudden Stop: Consequences and Policy Options,” in *Key Issues in Reform of the International Monetary and Financial System*, ed. by P. B. Kenen, and A. K. Swoboda. International Monetary Fund.
- ROTEMBERG, JULIO J., AND LARRY SUMMERS (1990): “Labor Hoarding, Inflexible Prices and Procyclical Productivity,” *Quarterly Journal of Economics*, 105(4), 851–874.
- SBORDONE, ARGIA M. (1996): “Cyclical Productivity in a Model of Labor Hoarding,” *Journal of Monetary Economics*, 38(2), 331–361.
- SJOHOLM, FREDRIK, AND SADAYUKI TAKII (2003): “Foreign Networks and Exports: Results from Indonesian Panel Data,” Working Paper 185, European Institute of Japanese Studies.

A. Tables

1997	
July 2	Thai baht is floated and depreciates by 15-20 percent.
July 11	Widening of rupiah band.
July 24	Currency meltdown with severe pressure on baht, ringgit, peso and rupiah.
August 14	Ending of rupiah band and immediate plunge.
November 1	16 banks closed, with promise of more to follow. Deposits were not guaranteed.
November 5	Three-year standby agreement with IMF approved.
Mid-December	Almost half of Indonesian bank deposits exit the system.
1998	
Mid-January	Further downward pressure on the rupiah.
January 27	Bank deposits guaranteed by the new super-agency: Indonesia Bank Reconstruction Agency.
March 11	President Suharto re-elected.
Mid-May	Widespread rioting.
May 21	Vice President Habibie succeeds Suharto as president.

Table 1: Timeline of financial crisis. Adapted from Enoch, Baldwin, Frecaut, and Kovanen 2001.

exported 1993-95	foreign ownership 1993-95			
	No	Yes	Total	

No	3,321	161	3,482	No. factories
	339.47	418.68	343.13	No. employees
	13.23	15.21	13.32	Log (capital)
	0.80	0.81	0.80	Prob. survived until 2000
	0.00	0.00	0.00	Share output exported pre-crisis
	0.13	0.22	0.14	Prob. exported post-crisis (for survivors)
Yes	2,594	531	3,125	
	673.53	623.70	665.06	
	14.02	14.60	14.12	
	0.83	0.85	0.84	
	0.53	0.60	0.54	
	0.60	0.59	0.60	
Total	5,915	692	6,607	
	485.97	576.00	495.40	
	13.59	14.73	13.71	
	0.81	0.84	0.82	
	0.23	0.46	0.25	
	0.34	0.50	0.36	

Table 2: Descriptive statistics by establishment type in 1995. Foreign factories are those that had at least 50% foreign ownership in 1993 to 1995. Exporters are firms that exported anytime from 1993 to 1995.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.170 (.049)***		.253 (.058)***		.090 (.038)**		.094 (.031)***		-.026 (.068)	
Foreign 1993–1995 * post-crisis		.435 (.064)***		.513 (.073)***		.336 (.053)***		.265 (.038)***		.218 (.104)**
1991	.093 (.023)***	.011 (.032)	.042 (.029)	-.016 (.040)	.201 (.020)***	.133 (.029)***	.074 (.014)***	.020 (.019)	.067 (.025)***	.044 (.034)
1992	.281 (.027)***	.197 (.036)***	.164 (.034)***	.166 (.044)***	.449 (.023)***	.424 (.033)***	.134 (.017)***	.106 (.023)***	.193 (.031)***	.222 (.040)***
1993	.460 (.028)***	.438 (.036)***	.268 (.035)***	.334 (.045)***	.694 (.024)***	.695 (.032)***	.245 (.018)***	.235 (.024)***	.273 (.033)***	.358 (.040)***
1994	.546 (.030)***	.542 (.038)***	.370 (.037)***	.467 (.046)***	.887 (.026)***	.925 (.034)***	.303 (.019)***	.325 (.025)***	.381 (.036)***	.469 (.045)***
1995	.581 (.031)***	.590 (.040)***	.444 (.038)***	.572 (.047)***	1.061 (.026)***	1.092 (.036)***	.345 (.020)***	.390 (.026)***	.413 (.038)***	.539 (.047)***
1999	.413 (.042)***	.584 (.047)***	.217 (.051)***	.537 (.057)***	1.563 (.033)***	1.671 (.040)***	.178 (.026)***	.282 (.031)***	.089 (.057)	.110 (.062)**
2000	.390 (.043)***	.505 (.048)***	.166 (.051)***	.457 (.058)***	1.770 (.033)***	1.846 (.041)***	.192 (.026)***	.278 (.032)***	.049 (.057)	.115 (.060)**
Obs.	25969	12044	25179	11905	26081	12075	26079	12073	16552	7850
No. establishments	6399	1760	6168	1756	6398	1760	6398	1760	4665	1318
R ²	.054	.094	.025	.069	.449	.47	.043	.076	.044	.056
F statistic	51.753	47.261	22.696	36.893	557.532	387.424	45.576	42.169	26.721	26.366

Table 3: Standard errors are clustered by establishment. 1990 is the omitted year. Exporters are firms that exported anytime from 1993 to 1995. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.181 (.049)***		.267 (.059)***		.102 (.038)***		.101 (.031)***		-.018 (.068)	
Foreign 1993–1995 * post-crisis		.418 (.064)***		.498 (.074)***		.317 (.053)***		.252 (.037)***		.208 (.103)**
Government-owned 1993–1995 * post-crisis	-.350 (.096)***	-.443 (.088)***	-.375 (.122)***	-.379 (.109)***	-.339 (.084)***	-.472 (.089)***	-.205 (.081)**	-.333 (.092)***	-.220 (.178)	-.257 (.177)
Obs.	25969	12044	25179	11905	26081	12075	26079	12073	16552	7850
No. establishments	6399	1760	6168	1756	6398	1760	6398	1760	4665	1318
R ²	.056	.098	.026	.072	.45	.474	.045	.081	.045	.057
F statistic	46.834	42.998	20.877	33.644	501.466	350.702	40.526	38.41	23.838	23.533

Table 4: With government ownership control. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.128 (.047)***		.209 (.058)***		.056 (.037)		.071 (.031)**		-.063 (.066)	
Foreign 1993–1995 * post-crisis		.391 (.064)***		.474 (.073)***		.300 (.053)***		.241 (.037)***		.197 (.103)*
log 1995 employee count * post-crisis	.116 (.025)***	.151 (.028)***	.126 (.030)***	.145 (.032)***	.100 (.020)***	.093 (.023)***	.065 (.017)***	.059 (.020)***	.092 (.040)**	.103 (.053)*
Government-owned 1993–1995 * post-crisis	-.405	-.490	-.436	-.422	-.387	-.500	-.237	-.352	-.270	-.292
Obs.	19290	12044	18881	11905	19362	12075	19360	12073	12276	7850
No. establishments	2767	1760	2745	1756	2767	1760	2767	1760	2049	1318
R ²	.065	.104	.031	.076	.47	.476	.05	.084	.048	.059
F statistic	51.985	42.57	23.569	33.169	492.849	323.446	42.34	36.155	25.322	21.533

Table 5: With log labor size control. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

Dep. var: log of	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.151 (.051)***	.382 (.066)***	.217 (.061)***	.443 (.074)***	.085 (.039)**	.289 (.055)***	.078 (.032)**	.254 (.037)***	.007 (.072)	.148 (.098)
Foreign 1993–1995 * post-crisis										
Government-owned 1993–1995 * post-crisis	-.274 (.098)***	-.297 (.093)***	-.362 (.126)***	-.284 (.112)**	-.359 (.084)***	-.449 (.090)***	-.217 (.080)***	-.305 (.091)***	-.220 (.177)	-.307 (.174)*
Food (ISIC 31)	-.788 (.275)***	-.584 (.203)***	-.587 (.296)**	-.581 (.246)**	-.276 (.218)	-.129 (.190)	-.156 (.142)	-.030 (.129)	.124 (.306)	.140 (.286)
Textiles (ISIC 32)	-.454 (.267)*	-.088 (.188)	-.473 (.285)*	-.202 (.228)	-.235 (.212)	-.018 (.179)	-.131 (.134)	.016 (.116)	.215 (.297)	.185 (.273)
Wood (ISIC 33)	-.407 (.271)	-.188 (.193)	-.321 (.288)	-.181 (.232)	-.245 (.217)	-.080 (.183)	-.056 (.137)	.072 (.119)	.001 (.305)	-.015 (.277)
Paper (ISIC 34)	-.664 (.285)**	-.677 (.243)***	-.730 (.309)**	-.954 (.305)***	-.434 (.221)**	-.159 (.211)	-.148 (.141)	.062 (.156)	.123 (.346)	.103 (.316)
Chemicals (ISIC 35)	-.458 (.271)*	-.320 (.195)	-.325 (.287)	-.229 (.231)	-.122 (.214)	-.054 (.183)	-.021 (.136)	-.011 (.121)	.100 (.304)	.265 (.282)
Ceramics (ISIC 36)	-.914 (.345)***	-.368 (.227)	-.658 (.362)*	-.426 (.291)	-.403 (.257)	-.364 (.209)*	-.223 (.177)	-.217 (.148)	.015 (.346)	-.230 (.330)
Metals (ISIC 37)	-.375 (.336)	-.292 (.261)	-.775 (.352)**	-.114 (.299)	-.038 (.268)	-.096 (.228)	-.032 (.159)	-.135 (.150)	.295 (.390)	.504 (.385)
Machinery (ISIC 38)	-.537 (.275)*	.004 (.198)	-.540 (.294)*	.001 (.241)	-.363 (.217)*	.093 (.185)	-.250 (.138)*	.089 (.121)	.092 (.305)	.313 (.306)
Obs.	25969	12044	25179	11905	26081	12075	26079	12073	16552	7850
No. establishments	6399	1760	6168	1756	6398	1760	6398	1760	4665	1318
R ²	.062	.108	.03	.079	.453	.475	.049	.083	.047	.061
F statistic	26.499	26.362	12.631	19.892	272.503	194.594	22.579	20.971	13.002	13.681

Table 6: With 2-digit ISIC rev. 2 industry controls. ISIC 39 miscellaneous is the omitted industry. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.229 (.054)***		.241 (.067)***	.424 (.090)***	.163 (.044)***	.287 (.063)***	.113 (.035)***	.226 (.044)***	-.028 (.063)	.187 (.104)*
Foreign 1993–1995 * post-crisis		.457 (.076)***								
Productivity * post-crisis	-.596 (.073)***	-.625 (.097)***	.256 (.093)***	.197 (.120)	-.050 (.056)	-.076 (.072)	.057 (.045)	.064 (.055)	.010 (.089)	.220 (.120)*
Government-owned 1993–1995 * post-crisis	-.364 (.125)***	-.571 (.116)***	-.383 (.163)**	-.505 (.118)***	-.322 (.111)***	-.475 (.124)***	-.151 (.102)	-.365 (.118)***	-.220 (.164)	-.244 (.173)
Obs.	12938	8442	12853	8397	12983	8462	12981	8460	11738	7641
No. establishments	1894	1259	1894	1259	1894	1259	1894	1259	1894	1259
R ²	.091	.128	.04	.086	.48	.49	.056	.093	.048	.059
F statistic	46.34	33.857	21.254	25.641	330.034	229.628	32.651	27.703	25.185	20.874

Table 7: With pre-crisis productivity control. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.112 (.066)*		.219 (.081)***		.133 (.052)**		.075 (.043)*		.090 (.090)	
Foreign 1993–1995 * post-crisis		.403 (.064)***		.486 (.073)***		.315 (.053)***		.245 (.037)***		.215 (.103)**
Pre-crisis export share * post-crisis	.133 (.096)	.268 (.082)***	.092 (.118)	.225 (.099)**	-.060 (.079)	.046 (.068)	.050 (.064)	.125 (.053)**	-.206 (.117)*	-.155 (.111)
Obs.	19290	12044	18881	11905	19362	12075	19360	12073	12276	7850
No. establishments	2767	1760	2745	1756	2767	1760	2767	1760	2049	1318
R ²	.062	.1	.028	.073	.468	.474	.047	.083	.047	.058
F statistic	48.998	39.766	20.285	30.992	485.715	322.075	40.528	34.886	25.172	21.174

Table 8: With pre-crisis export share control. Sample of domestic establishments (columns 1, 3, 5) and pre-crisis exporting establishments (columns 2, 4, 6). Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-placebo crisis	.037 (.039)		.094 (.048)**		.066 (.032)**		.063 (.026)**		.147 (.045)**	
Foreign 1993–1995 * post-placebo crisis		.232 (.069)**		.334 (.084)**		.154 (.063)**		.101 (.044)**		.108 (.080)
Government-owned 1993–1995 * post-placebo crisis	-.388 (.066)**	-.403 (.076)**	-.336 (.086)**	-.318 (.099)**	-.267 (.066)**	-.254 (.083)**	-.151 (.077)*	-.098 (.090)	-.273 (.118)**	-.383 (.163)**
Obs.	13783	8536	13540	8466	13830	8557	13830	8557	9531	6052
No. establishments	2765	1760	2733	1755	2767	1760	2767	1760	2003	1300
R ²	.121	.131	.055	.088	.325	.307	.098	.116	.065	.092
F statistic	79.122	51.281	35.4	34.633	312.485	167.33	68.227	47.972	24.881	24.727

Table 9: A falsification exercise with “placebo crisis” between 1992 and 1993. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.170 (.047)***		.236 (.058)***		.078 (.037)**		.076 (.029)***		-.070 (.066)	
Exported 1993–1995 * post-placebo-crisis	.030 (.041)		.101 (.050)**		.060 (.034)*		.062 (.027)**		.135 (.048)***	
Foreign 1993–1995 * post-crisis		.351 (.061)***		.394 (.071)***		.274 (.051)***		.223 (.035)***		.170 (.102)*
Foreign 1993–1995 * post-placebo-crisis		.193 (.068)***		.293 (.081)***		.124 (.061)**		.081 (.042)*		.122 (.078)
Government-owned 1993–1995 * post-crisis	-.191 (.097)**	-.288 (.093)***	-.244 (.124)**	-.260 (.106)**	-.227 (.087)***	-.372 (.091)***	-.144 (.086)*	-.299 (.096)***	-.111 (.174)	-.106 (.175)
Government-owned 1993–1995 * post-placebo-crisis	-.351 (.069)***	-.346 (.074)***	-.293 (.089)***	-.265 (.096)***	-.248 (.069)***	-.222 (.080)***	-.137 (.079)*	-.076 (.087)	-.256 (.124)**	-.355 (.158)**
Obs.	25969	12044	25179	11905	26081	12075	26079	12073	16552	7850
No. establishments	6399	1760	6168	1756	6398	1760	6398	1760	4665	1318
R ²	.058	.102	.028	.076	.452	.475	.046	.082	.047	.06
F statistic	39.601	35.122	17.977	27.389	411.137	285.917	36.778	32.93	21.35	21.192

Table 10: Estimation allowing for differing pre-crisis time trends between exporters and non-exporters, and between foreign and domestic exporters. The “placebo crisis” is coded to have occurred between 1992 and 1993. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var: log of	value added	value added	materials	materials	wage bill	wage bill	employees	employees	capital	capital
Sample: domestic firms	X	X	X	X	X	X	X	X	X	X
Sample: exporters, foreign and domestic										
Exported 1993–1995 * post-crisis	.262 (.060)***		.342 (.071)***		.127*** (.047)***		.140 (.038)***		.075 (.078)	
Foreign 1993–1995 * post-crisis		.437*** (.088)***		.387*** (.095)***		.312 (.069)***		.191 (.049)***		.178 (.136)
Leverage and foreign bank loans * post-crisis	.001 (.003)	.004 (.002)*	.002 (.003)	.002 (.002)	.00003 (.002)	.0007 (.002)	.0004 (.002)	.0004 (.001)	-.002 (.004)	-.004 (.004)
Leverage and no foreign bank loans * post-crisis	.0003 (.001)	.001 (.001)	.001 (.001)	.002 (.002)	.002 (.0009)**	.002 (.001)*	.001 (.0007)*	.0008 (.001)	-.003 (.001)**	-.001 (.001)
Had foreign loans in 1990–1996	-.035 (.190)	-.168 (.181)	.108 (.223)	.101 (.200)	.194 (.147)	.105 (.154)	.134 (.112)	.056 (.111)	-.003 (.245)	.219 (.266)
Government-owned 1993–1995 * post-crisis	-.391 (.155)**	-.451 (.150)***	-.357 (.225)	-.234 (.196)	-.230 (.102)**	-.299 (.108)***	-.091 (.104)	-.179 (.116)	-.575 (.247)**	-.456 (.186)**
Obs.	12047	7377	11784	7303	12075	7395	12073	7393	8063	5124
No. establishments	2028	1067	1999	1065	2027	1067	2027	1067	1507	822
R ²	.075	.118	.043	.09	.491	.506	.059	.093	.06	.07
F statistic	29.204	23.524	16.01	19.64	260.076	193.474	22.538	19.436	17.082	17.402

Table 11: With leverage control. Estimations include factory and year fixed effects. Exporters are firms that exported anytime from 1993 to 1995. Standard errors are clustered by establishment. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively. Year indicators are included but not reported.

	Dep. var: survived until 2000			
	(1)	(2)	(3)	(4)
Exported 1993-1995	.076 (.053)	.073 (.054)		
Foreign equity 1993-1995			.021 (.092)	.021 (.094)
Productivity		.057 (.063)		.154 (.089)*
log(capital)	.140 (.014)***	.137 (.015)***	.168 (.020)***	.162 (.021)***
Obs.	4205	4138	2283	2264
No. establishments	.064	.064	.078	.081

Table 12: Probit estimation of probability of survival until 2000 for establishments existing in 1995. Domestic establishments (1-2) and pre-crisis exporting establishments (3-4). 3-digit ISIC industry indicators and province indicators are included but not reported. ***, **, * indicate significance at the 0.1, 1, and 5 percent levels respectively.