Foreign Firms, Trade Liberalization and Resource Allocation

Joel Rodrigue*
Department of Economics, Vanderbilt University, Nashville, TN, United States

Abstract

This paper presents a new set of findings that extend recent work on international trade and resource allocation in developing countries. The paper uses detailed plant-level information on manufacturing plants located in Indonesia to examine the impact of foreign ownership on firm-level productivity growth, industry productivity-growth and resource reallocation during trade liberalization. In particular, it emphasizes three features of trade liberalization in Indonesia. First, almost all of aggregate productivity growth across industries is explained by the process of reshuffling resources from less to more productive plants. Second, seventy-five percent of the freed resources were reallocated towards foreign-owned plants. Third, while plant-level productivity responds similarly across ownership types to changes in tariff protection before the crisis, foreign plants are able to respond much more strongly during the Asian crisis. Evidence suggests that access to credit markets may have been a particularly important advantage of foreign firms during the crisis period.

Keywords: Foreign Direct Investment, Trade Liberalization, Resource Reallocation, Aggregate Productivity
JEL Classification Numbers: C23, F12, F23, O47

* Contract Information.
Mailing Address: Department of Economics, Vanderbilt University, VU Station B #351819, 2301 Vanderbilt Place, Nashville, TN 37235-1819; Tel.: +1 615 322 2871; fax: +1 615 343 8495.
E-mail address: joel.b.rodrigue@vanderbilt.edu

1 Introduction

This paper uses detailed plant-level information on manufacturing plants located in Indonesia to examine the role of foreign-owned firms on industry and plant-level productivity growth. We exploit detailed information on Indonesian manufacturing plants during a period of trade liberalization to study the differential responses of foreign and domestic plants. It highlights the differences in plant-level productivity growth across foreign and domestically owned plants in determining their relative contributions to aggregate productivity growth. We find that foreign ownership has had a large impact on the evolution of productivity, particularly during the Asian crisis.

Considerable attention has been paid to the effect of trade liberalization on the allocation of resources across heterogeneous firms. The theoretical contributions by Melitz (2003) and Bernard, Eaton, Jensen, and Kortum (2003) clearly demonstrate the reallocation of resources towards more productive firms can cause substantial improvements in aggregate productivity and welfare. The results of these models are mirrored in empirical studies of trade liberalization. In both Canada (Trefler, 2004) and Chile (Pavcnik, 2002) it is found that a large portion of the productivity gains associated with trade liberalization can be attributed to the entry and exit decisions of firms in response to changes in trade policy.

Recently there have been a number of papers re-examining these issues in the context of foreign direct investment (FDI), foreign ownership and productivity growth. Both McGrattan and Prescott (2007) and Ramondo and Rodriguez-Clare (2009) study the impact of foreign direct investment on aggregate productivity growth within a country and its welfare implications. In both cases they find that foreign capital flows into a developing country can potentially have a large impact on aggregate productivity, particularly when the presence of foreign firms encourages technology and productivity upgrading among domestic firms. Similarly, work by Helpman, Melitz and Yeaple (2004) suggests that foreign direct investment can potentially induce large improvements in aggregate productivity, however, these authors emphasize the impact of foreign ownership and productivity on the reallocation of resources across heterogeneous firms rather than within-plant productivity growth.

This paper confirms that a small number of foreign plants can make large difference to aggregate productivity. Although only 6 percent of plants are owned by foreign investors in our sample, these plants, on average, account for 28 percent industry output, hold 26 percent of domestic market share and are responsible for 34 percent of export sales each year. As such, understanding their reaction to trade liberalization is of particular importance for measures of industry productivity and resource reallocation across heterogeneous plants. In this paper we find that the primary channel through which these foreign plants contribute to aggregate productivity growth is through resource reallocation rather than within-plant productivity growth. Moreover, as emphasized in each of the above papers regarding FDI and productivity, trade policy can potentially influence the location of multinational production and aggregate productivity. We study a specific episode trade liberalization in Indonesia in order to document the effect of trade policy on plant-level decisions and their influence on aggregate productivity.

This study also adds to the literature on trade liberalization and plant-specific productivity growth. However, it is strikingly different in that it focusses on the role of foreign-owned plants. Several studies have begun to recently re-examine the importance of within-plant productivity improvements in response to changes in trade policy (see De Loecker (2007) for example). In contrast to early work on within-plant responses, these recent studies document that there may be reason to expect plant-level productivity growth in response to trade liberalization. As in Arnold and Javorcik (2009) and Ramondo (2009) we confirm the large productivity differences across foreign and domestic plants and provide new evidence on the response of foreign plants to trade liberalization. Moreover, this is the first project to distinguish these plant-level responses during a period of growth and during a financial crisis. Although we find significant differences in plant-level productivity across foreign and domestic plants, there is little difference in their reactions to changes in the policy environment. In fact, with the exception of the 1997-1998 Asian financial crisis, there is little evidence that foreign plants respond any differently to trade liberalization than domestic plants or that trade policy has a large impact on allocating resources across foreign and domestic plants.

Last, this paper investigates the role of debt financing and its interaction with plant-level

responses and policy change on productivity growth during the Asian crisis. In this manner, this paper also contributes to the literature on financial frictions and firm dynamics as pioneered in Cooley and Quadrini (2001). Further work by Blalock, Gertler and Levine (2008), Bond, Tybout and Utar (2008) and Arellano, Bai and Zhang (2009) demonstrate that financial constraints are important determinants of plant-level investment and aggregate productivity growth in a developing country context. We find that foreign-owned plants with ready access to credit markets demonstrate the strongest growth during the crisis period. While the role of foreign ownership on the transfer of technology has often been cited as an important source of productivity growth, few papers have studied the impact of foreign ownership on debt financing and productivity growth in a developing country.[1]

The Indonesian manufacturing data employed here is uniquely suited to examine questions of this nature. It contains detailed information on all manufacturing plants with more than twenty employees located Indonesia. In particular, the data includes information on the percentage of equity held by foreign investors at the plant-level which allow us to distinguish foreign from domestically owned plants. Last, each plant is matched with detailed tariff changes at the five-digit industry level from Amiti and Konings (2007) which allows us to study the variation in plant-level in response to declines in tariff protection.

The results are striking: over 75 percent of the aggregate productivity growth across Indonesian manufacturing industries during the 1990-2000 period can be attributed to the reallocation of resources from domestically owned plants to foreign-owned plants during trade liberalization. This cannot, however, be tied to large differences in plant-level productivity growth in response to changes in policy; over the pre-Asian crisis period foreign and domestic plants experienced similar rates of productivity growth. During the Asian crisis, this result is no longer true; foreign plants grew 10-16 percent faster during the 1997-1998 crisis further encouraging resource reallocation towards these plants. Further, at least 5.2-5.5 percent of the productivity growth can be attributed to plants that appear to have better access to credit markets and hold relatively large amounts of debt.

This paper is organized as follows. The next two sections provide a brief description of the

[1] An exception is Arnold and Javorcik (2009)

history of Indonesian manufacturing and the primary sources of data. Section 4 and 5 present conceptual framework and the empirical model I will work with in this context. Section 6 presents the results and the last section concludes.

2 A Brief History of Indonesian Manufacturing

Indonesia's manufacturing sector is an attractive setting for research examining the plant-level responses to tariff policy for a number of reasons. With the fourth largest national population worldwide and a rich endowment of natural resources the country supports a large array of domestic and foreign-owned manufacturing firms across a wide set of industries. Due to the large changes in trade policy over a period of time when the Indonesian government has carefully collected an exceptionally rich data set on plant-level manufacturing activity, it is not surprising that a large number of scholars have recently chosen to study the causes and consequences of international trade in Indonesia: Amiti and Konings (2007), Bernard and Sjöholm (2003), Blalock and Gertler (2004), and Amiti and Davis (2008) are only a subset of recent examples.

During the 1970s and early eighties Indonesia pursued an explicit import substitution policy. In the mid-eighties Indonesia began to shift from a policy of import substitution to export promotion. In particular, by 1986 there were a number of policies in place aimed at reducing import tariffs, reforming customs administration and introducing a more generous duty-drawback scheme.[2] Despite the initial policies changes, in many cases, the tariffs rates and protection remained high well in the 1990s. In 1995 Indonesia became a member of the World Trade Organization agreeing to reduce all bound tariffs to 40 percent or less over a ten year period beginning that year.[3] In late 1997 and throughout 1998 the Indonesian manufacturing sector experienced steep declines during the Asian crisis often associated with a depreciating exchange rate, sharp rises in export prices, a fall in export demand and tightening credit supply.[4] In the following years, the manufacturing sector displayed positive growth, albeit at a much lower rate than the pre-crisis period.

[2]See Blalock and Gertler (2004) for details.

[3]The policy was subject to an exclusion list of products for which it did not apply. A list of the excluded products is available at: http://www.wto.org/english/tratop_e/schedules_e/goods_schedules_e.htm

[4]See Agung et al. (2001) and Ito and Sato (2006) for further details.

3 Indonesian Manufacturing and Tariff Data

The primary source of data is the Indonesian manufacturing census between 1990 and 2000. Collected annually by the Central Bureau of Statistics, *Budan Pusat Statistik* (BPS), the survey covers the population of manufacturing plants in Indonesia with at least 20 employees. The data capture the formal manufacturing sector and record detailed plant-level information on over 100 variables covering industrial classification (5-digit ISIC), revenues, intermediate inputs, labour, capital, energy, exports, imports, foreign ownership and new financing. Data on revenues, investment and inputs are combined with wholesale price indices can be used to obtain productivity estimates.[5] In 1990, there are 14,615 manufacturing plants that satisfy this criteria, while by 2000 the data covers 19,248 plants. Table 1 provides a brief set of sample statistics.[6]

Table 1: Summary Statistics, 1990-2000

Ownership Status	Trade Status	Total Revenues	Total Employment	Capital/ Worker	Labour Productivity	Energy	Materials	No. of Obs.
All	All	36.771	186.671	0.115	0.121	1.538	20.354	192253
		(275.358)	(691.235)	(5.522)	(0.800)	(15.072)	(144.356)	
All	Exporters	94.827	481.811	0.181	0.192	4.237	54.272	28215
		(466.470)	(1375.031)	(5.491)	(0.542)	(25.182)	(199.112)	
All	Importers	113.079	438.053	0.193	0.253	4.783	62.745	38832
		(441.340)	(1122.568)	(3.105)	(0.825)	(25.721)	(231.856)	
Foreign	All	172.507	524.221	0.284	0.452	5.740	95.878	11442
		(451.394)	(856.570)	(2.406)	(1.052)	(26.059)	(284.420)	

Notes: Standard deviations are in parentheses. Total revenues, capital, energy and materials are measured in millions of 1983 Indonesian Rupiahs. Labour productivity is calculated as output per worker.

Much attention has been paid to how heterogeneous productivity levels across firms affect plant behaviour and, in particular, their entry into international markets.[7] Table 1 indicates that the structure of the Indonesian manufacturing sector is similar to those reported from other developing countries.[8] In particular, a small number of firms choose to export or import, a small number of plants are foreign-owned[9] and plants that are internationally integrated in some fashion tend to be substantially larger and more productive.

[5] Price deflators are constructed as closely as possible to Blalock and Gertler (2004) and include separate deflators (1) output and domestic intermediates, (2) capital, (3) energy, (4) imported intermediates and (5) export sales. Details can be found in the appendix

[6] A expanded set of summary statistics are available in the Appendix.

[7] See Roberts and Tybout (1997) or Bernard and Jensen (1999) for early examples.

[8] See Aw, Chung and Roberts (2000), Van Biesebroeck (2004) or Kasahara and Rodrigue (2008) for examples.

[9] A foreign plant is defined as a plant where more than 10 percent of the equity is held by foreign investors. The results presented here are very robust to changes in this definition.

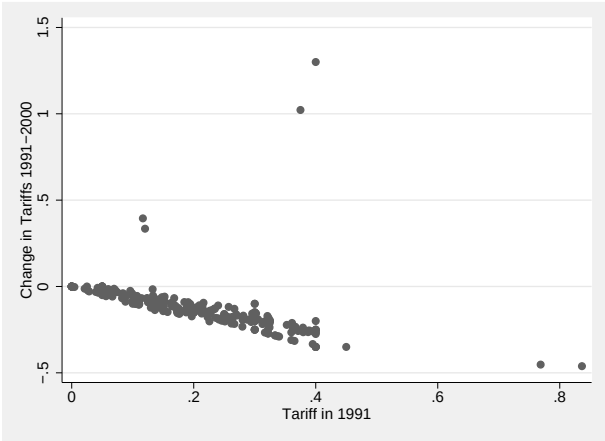

Figure 1: Change in Tariffs, 1991-2000, Relative to 1991 Level

Tariffs fell over the sample period in all industries with the exception of the liquors and wine industries (ISIC codes 31310, 31320) and rice milling industries (ISIC codes 31161, 31169).

The plant-level manufacturing data are matched with detailed plant-level tariff data from Amiti and Konings (2007). Specifically, each plant is assigned a 5-digit ISIC industry code in each year and is matched to output and input tariff rates with the same 5-digit code in the same year.[10] While the plant-level data begins in 1990, the tariff data is not available until 1991.

Figure 1 demonstrates that output tariffs have fallen across most industries in Indonesia over the 1991-2001 period with only a few exceptions. Moreover, there is substantial variation in the initial tariff levels in 1991 and the subsequent fall across 5-digit industries over the following decade. The differences are particularly useful in the present context as they allow us to identify how similar firms react differently to changes in the economic environment. They also present a potential concern: tariffs setting may be correlated with industry performance. Specifically, industries that were more competitive, organized or received larger amounts of FDI may have been chosen to be exposed to greater tariff reductions. As such, we will have to be careful to check for the endogeneity of the tariffs when documenting our results.

4 Conceptual Framework

For each period t, the ith plant's production, Y_{it}, is given by:

[10] A full description of the tariff content and construction can be found ing Amiti and Konings (2007).

$$Y_{it} = e^{a_{it}} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m}, \tag{1}$$

where K_{it}, L_{it}, M_{it} are capital, labor and intermediate materials respectively and a_{it} represents plant-specific total factor productivity. A key issue is that the plant-specific productivity shock, a_{it}, may be correlated with the input choices and bias ordinary least squares estimates of the production function coefficients. To account for the potential simultaneity bias induced by OLS estimation I extend the behavioural framework of Olley and Pakes (1996) to consider the dynamic exit and investment decisions of domestic and foreign plants.[11]

Consider a firm that at the beginning of each period makes a discrete exit decision, χ_t, by comparing its continuation value with its sell-off value, Φ. We allow that the sell-off value, which also captures the opportunity cost of operating the plant, to differ across foreign and domestic plants, $\Phi(f_t)$,

$$f_{it} = \begin{cases} 1 & \text{if the plant is foreign-owned} \\ 0 & \text{otherwise.} \end{cases}$$

To the extent that foreign owners have access to wider variety of investment opportunities worldwide we might expect that they will be more likely to exit. In contrast, if foreign owners retrieve less value for an equivalent plant they may be more willing to continue to produce. If the plant continues in operation, foreign or domestic, it chooses variable inputs (labour, materials) and investment (I_t). Capital is accumulated as $K_{t+1} = K_t(1-\delta) + I_t$ where δ is the depreciation rate.

The Bellman equation for the plant can be written as

$$V_t(a_t, k_t, f_t) = \max\{\Phi_t(f_t), \max_{i_t}\{\pi_t(a_t, f_t, k_t) - c(f_t, i_t, k_t) + \beta E[V_{t+1}(a_{t+1}, k_{t+1}, f_t)|J_t]\}\}$$

where $\pi_t(\cdot)$ is the profit after maximizing out the variable factors, $c(f_t, i_t, k_t)$ is the cost of investment, and J_t represents the information available at time t. Note that we allow that the profit function and cost function may depend on foreign ownership as foreign plants may have

[11] We abstract from the possibility of multi-plant production. BPS Indonesia estimates that 95% of plants in our sample are single plant firms.

better access to new technology or credit markets for financing investment.

The policy functions associated with the fixed point of the Bellman equation specify an exit rule and an investment decision rule. When the profit function is strictly increasing in a_{it}, the plant exit rule is characterized by the threshold value $\underline{a}_t(k_t, f_t)$ as:

$$\chi_{it} = \begin{cases} 1 & \text{if } a_t \geq \underline{a}_t(k_t, f_t) \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

The investment rule is written, respectively, as:

$$i_t = i_t^*(a_t, f_t, k_t)$$

Note that in practice we will also allow these decisions and plant-level productivity to depend on export and import status as in Amiti and Konings (2007).[12]

5 Empirical Model

Before we can describe plant-level productivity differences and the resource allocation across heterogeneous plants, we must first develop a measure of plant-level productivity since no direct measure of plant-level productivity is provided in the data. Following the method suggested by Olley and Pakes (1996) and applied to the Indonesian context in Amiti and Konings (2007), I estimate the following Cobb-Douglas production function:

$$y_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + a_{it} + \varepsilon_{it} \tag{3}$$

where the log output of plant i at time t, y_{it}, is a function of labour, l_{it}, capital, k_{it}, intermediate materials, m_{it} and plant-productivity a_{it}. Both the plant-level productivity, a_{it}, and random error term, ε_{it}, are not observed by the econometrician.

The Olley and Pakes (1996) estimation methodology accounts for potential simultaneity between input choices and productivity shocks and potential bias included by sample selection.

[12] Details can be found in the Appendix.

Following Amiti and Konings (2007), we modify the procedure to account for the plant's decisions to export or import, the Asian crisis and foreign ownership and estimate this relationship for each 3-digit industry.[13] Once we have obtained the estimates of the production function coefficients we can measure plant-level productivity as

$$\hat{a}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_m m_{it} - (y_r - \hat{y}_r) \tag{4}$$

where y_r is the mean log output of plants in my base year, 1990, and $\hat{y}_r$ is the predicted mean output in 1990. This productivity measure presents a logarithmic deviation of a plant from the mean industry practice in a base year.

To check the contribution of reshuffling resources across heterogeneous plants to aggregate productivity we compute a productivity index for each 3-digit industry. In each year we calculate the aggregate productivity index for each industry, A_t^k,as the weighted average of the plants' unweighted productivities, a_{it}, with an individual plants weight, s_{it}^k corresponding to its market share in industry k in that year. Following Olley and Pakes (1996) and Pavcnik (2002) I decompose the aggregate productivity index into the unweighted aggregate productivity measure and the total covariance between a plant's share of the industry output and its productivity:

$$\begin{aligned} A_t^k &= \sum_i s_{it} a_{it} = \bar{a}_t + \sum_i (s_{it} - \bar{s}_t)(a_{it} - \bar{a}_t) \\ &= \bar{a}_t + \sum_{i \in H} (s_{it} - \bar{s}_t)(a_{it} - \bar{a}_t) + \sum_{i \in F} (s_{it} - \bar{s}_t)(a_{it} - \bar{a}_t). \end{aligned} \tag{5}$$

where H represents the set of domestically owned plants and F represents the set of foreign-owned plants. While resource reallocation has often played an important part in previous analyses of aggregate productivity movements, this literature has yet to specifically quantify the role of foreign-owned plants.

[13] Since these methods are well-known, a detailed description of this procedure is omitted here. Details of the procedure in this context can be found the Appendix.

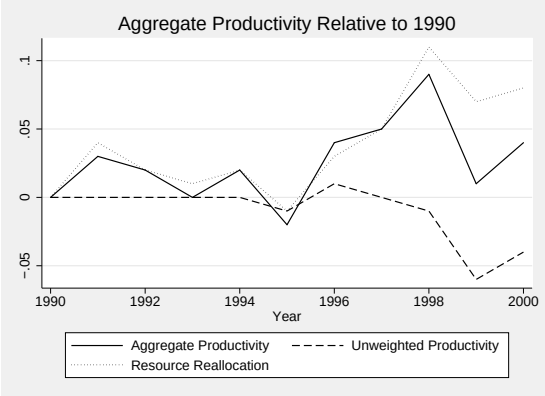

Figure 2: Productivity Decomposition

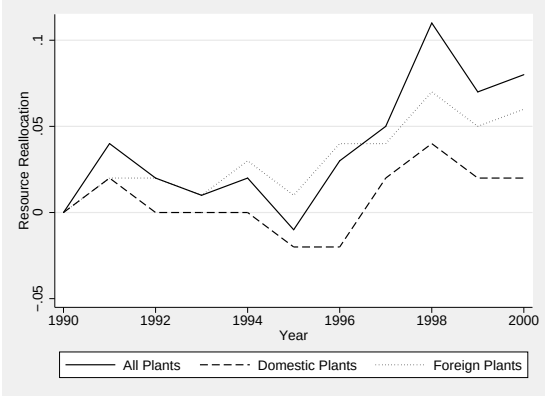

Figure 3: Reallocation Decomposition

6 Results

We will proceed to present the results in two steps. We will first present the sources resource reallocation and aggregate productivity growth. Subsequently, I will turn to examining plant-level productivity growth, exit decisions, entry patterns and debt financing.

6.1 Resource Reallocation and Aggregate Productivity

Figure 2 presents the average aggregate productivity across 3-digit industries along with the breakdown into its mean productivity component and the resource reallocation component. A positive resource reallocation term (the covariance term), it indicates that resources are being reallocated towards more productive plants. In our case we see that in each year the covariance term is positive, with the possible exception of 1993 where it was very close to 0. Over the 1990-2000 period aggregate productivity grew by approximately 4 percent and this was entirely due to the reshuffling of resources towards more productive plants. In fact, it appears that on average the reallocation of resources towards more productive plants offset a fall in mean productivity beyond 1996.[14]

Figure 3 decomposes the dashed line in Figure 2 into two components: the first corresponding to the contribution from domestically owned plants and the second corresponding to the contribution to the foreign owned plants. It shows that 75 percent of the total resource realloca-

[14]Note that it is not surprising to see mean productivity fall during the Asian crisis since the fall in total production would create excess capacity.

tion over 1990-2000 period can be explained by the covariance of market share and productivity among foreign-owned plants. This is remarkable since on average only 6 percent of plants are foreign-owned each year and only 8 percent by the year 2000. It appears that the majority of aggregate productivity growth over the period is explained by the transfer of resources from domestically-owned to foreign-owned plants. This is in stark contrast to many papers that currently emphasize the impact of foreign plants on mean productivity growth rather than their reallocative effects.[15] Among foreign plants that were present in 1990, the average market share of a 3-digit industry increased on average by 44 percent annually between 1990 and 1996. In contrast, the average market share of a domestic plant that existed in 1990 only increased 9 percent annually during the same period.[16]

While the above results suggest that foreign ownership has large effects on resource allocation, there exist alternative interpretations that may help explain this result. First, numerous studies suggest that resources may not easily reallocate across industries.[17] It is unclear if this is a concern at the 3-digit level. However, defining an industry too narrowly may induce upwards bias in the contribution from concentrated industries and downwards bias in the contribution from more competitive industries.[18] If foreign plants are predominantly located in concentrated industries we may overestimate the contribution from these plants.

To address this concern we repeat the experiment at the 5-digit level. Figure 4 decomposes average industry productivity into the mean productivity and covariance components, while Figure 5 documents the contribution from foreign and domestic firms to total reallocation.[19] The growth in aggregate productivity is again entirely explained by resource allocation, but now the contribution from foreign plants is substantially lower, as predicted. Nonetheless, foreign

[15] See McGrattan and Prescott (2007) or Ramondo and Rodriguez-Clare (2009) for examples.

[16] The market share of domestic and foreign surviving plants can simultaneously increase due to the exit of less productive plants. Market share among domestic plants that existed in 1990 fell by 21 percent during the Asian crisis, while it only fell by less than 1 percent among foreign plants.

[17] See Attanasio, Goldberg and Pavcnik (2004) and the references therein.

[18] The Appendix contains an example illustrating this effect.

[19] There are a number of other difficulties performing the experiment at the 5-digit level. First, I dropped several industries because they are not present in 1990 and enter subsequently. Second, numerous industries have a very small number of plants in each year. This may affect covariance estimates in two ways. Industries with only one plant (of which there are several each year) have a covariance term of 0 by construction. Also, industries for which there are a small number of firms may interact in a strategic fashion that is inconsistent with the model of monopolistic competition presented above. Here we only consider industries with at least 10 plants. Including the omitted plants does not greatly affect the results.

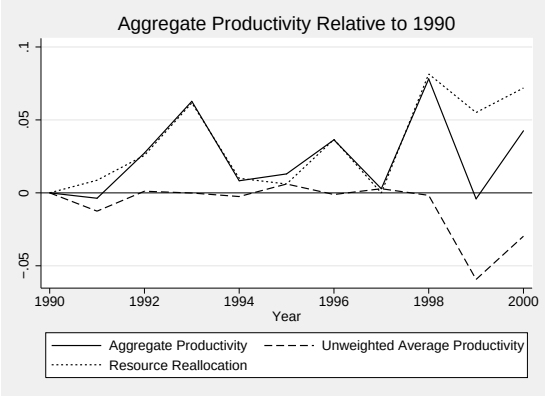

Figure 4: Productivity Decomp. (5-Digit)

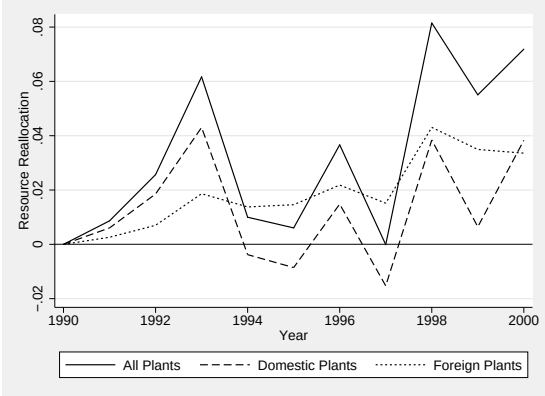

Figure 5: Reallocation Decomp. (5-Digit)

plants still account for over 60 percent of the reallocation term by 1996 and 47 percent by 2000. Moreover, they still appear to play a particularly important role during the Asian crisis where domestic plants experienced much sharper declines.[20]

A second explanation for these findings is that the size distribution of foreign and domestic plants are substantially different. While most foreign plants are large, the vast majority of domestic plants are small. If only large plants are able to invest and grow in the face of new competition (perhaps due to credit market access, for example) then we might observe that the contribution to resource reallocation from small plants may be small or even negative. By comparing foreign and domestic plants without distinguishing size differences we may expect that domestic tend to have a smaller resource reallocation contribution simply because of the presence of small domestic plants.

We repeat the above decomposition a final time, comparing the contribution from foreign and domestic plants with at least 100 employees.[21] Large foreign plants with at least 100 employees account for almost 5 percent of the total sample, or 77 percent of all foreign plants. In contrast, large domestic plants account for 26 percent of the entire sample and 27 percent of all domestic plants. In sum, 16 percent of large plants are foreign-owned. Thus, if size is the primary explanation for the difference between foreign and domestic plants we would expect that domestic plants would contribute substantially more to total resource reallocation than

[20] We also repeated the experiment for the entire manufacturing sector. In this case all positive growth in the resource reallocation component can be accounted for by foreign plants.

[21] Blalock, Gertler and Levine (2008) use the same definition of large plants in Indonesia.

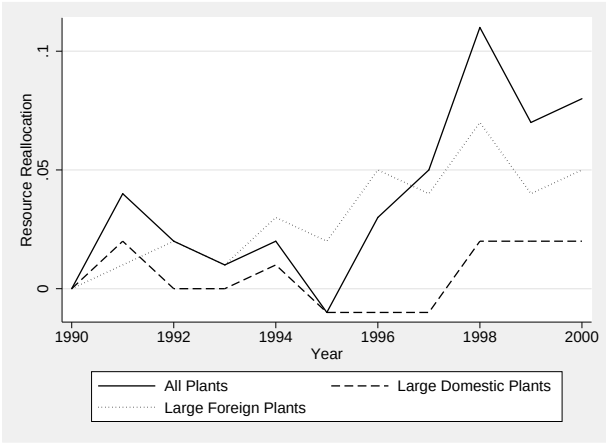

Figure 6: Reallocation Decomposition, Large Firms (3-Digit)

foreign-owned plants and the pattern above would be reversed.

Figure 6 presents the results from the above decomposition at the 3-digit level of industrial classification.[22] If anything the difference between foreign and domestic plants appears to be greater than that presented in Figure 3. In fact, while the contribution to resource reallocation from large foreign plants grows steadily throughout the 1990-2000 period, there is little change in the contribution from large domestic plants. As such, Figure 6 suggests that the earlier results were not driven by size differences between foreign and domestic plants, but rather the increased presence of foreign plants may indicate higher rates of technology transfer, better access to credit markets or other advantages held by foreign plants.

There are a number of reasons to weigh the above findings carefully. Resource reallocation across heterogeneous plants appears to be the primary determinant of aggregate productivity growth in a developing country that receives relatively large amounts of foreign direct investment. It implies that technology transfer or knowledge spillovers that improve the productivity of the average domestic firm may have a relatively small role to play in explaining aggregate productivity growth. This is in contrast to a theoretical literature that emphasizes these effects for aggregate productivity and welfare gains. Moreover, it limits that gains one might expect to find in empirical studies on productivity spillovers.[23]

[22]Similar results for the 5-digit industrial classification can be found in the Appendix.
[23]See Javorcik (2004), Blalock and Gertler (2008).

The results are also of particular importance for policymakers in developing countries. To the extent that the reallocation from domestic to foreign plants signals a increase in the proportion of profits that fall into the hands of foreign investors, it is natural to question whether total Indonesian income has risen as a result of increased foreign direct investment. While domestic plants accounted for 78 percent of all operating profits in Indonesian manufacturing, they only accounted for 67 percent by 1996.[24] In fact, total operating profits grew by 39 percent between 1991 and 1996, they only grew by 17 percent among domestic plants. In contrast, total operating profits accounted for by foreign plants grew by a much larger 118 percent over the same period. While answering this question is beyond the scope of this paper, it is an important avenue of future research.

We next turn to describing the root causes of resource reallocation in Indonesia. Moreover, we pay particular attention to the degree to which reallocation is influenced by trade policy. As noted in Helpman, Melitz and Yeaple (2004) and McGrattan and Prescott (2007) the nature of multinational location and investment decisions may depend on the costs of trade, of which tariffs would be among the most influenced by policy. Given the reduction of tariffs in Indonesia during this period, we re-examine the above results to determine how much of the differences across foreign and domestic plants can be explained by different reactions to policy change.

6.2 Plant-Level Productivity Growth

In order to describe plant-level responses to trade liberalization, I follow Amiti and Konings (2007) and estimate the following linear regression over the 1991-2000 period.

$$\hat{a}_{it}^{k} = \alpha_0 + \alpha_f f_{it} + \alpha_\tau \tau_t^k + \alpha_{f\tau} f_{it} \tau_t^k + Z_{it}\beta + \zeta_i + \epsilon_{it} \tag{6}$$

where f_{it} is a dummy variable indicating plant i's ownership status in year t, τ_t^k is the tariff applied to industry k, and Z_{it} is a matrix of control variables including export and import status, plant-level fixed effects and year-island dummies to control for trade, industry, time, regional

[24] Operating profits are calculated as total revenues less total variable costs. Note that these calculations do not necessarily account for differences in investment, fixed or sunk costs.

Table 2: Plant-level Productivity Differences

Dependent Variable: Solow Residual (a_{it})								
	1991-2000				1991-1996		1997-1998	
Foreign Ownership (f)	0.063		0.095	0.112	0.112	0.073	0.207	0.165
	(0.011)		(0.015)	(0.015)	(0.025)	(0.026)	(0.048)	(0.051)
Output Tariff (τ)		-0.052	-0.042	-0.047	-0.181	-0.032	0.085	0.191
		(0.022)	(0.022)	(0.044)	(0.037)	(0.069)	(0.085)	(0.201)
$f \times \tau$			-0.202	-0.206	-0.148	0.009	-1.568	-1.039
			(0.060)	(0.063)	(0.093)	(0.097)	(0.268)	(0.287)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	No	No	No	Yes	No	Yes	No	Yes
No. of Obs.	172186	172186	172186	172186	95111	95111	33848	33848

Notes: Standard errors are in parentheses. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

and plant-specific time invariant shocks. Importantly, there exists a sufficiently large number of foreign-owned plants to investigate differences in behaviour across ownership groups. In fact over the 11 year period the survey follows 2416 distinct foreign plants, 51 percent of which change their ownership status at least once.[25]

Table 2 reports the results from the estimation of equation (6).[26] The first column reports a simple foreign ownership premium of 6.3 percent in terms of productivity, while the second column suggests that on average a 10 percent fall in tariff protection would increase average productivity by 0.52 percent. The third column distinguishes the response across ownership class; foreign owners are estimated to be almost 10 percent more productive and to increase productivity by 2 to 2.4 percent for every 10 percent fall in tariff rates.[27] The response of domestic plants is only marginally significant in column (3) and insignificant once we control for other plant-level characteristics in column (4). It is not clear, however, whether these results are driven by higher rates of technology transfer or extreme within sample variation induced by the Asian crisis.

In columns (5) through (8) we examine the period preceding the financial crisis (1991-1996),

[25]Since the focus of this section is on the role of policy we specifically abstract from the differential impact of knowledge spillovers across plants here. In general, these effects are found to be small and insignificant across plants.

[26]A complete set of results are presented in the Appendix. We restrict our discussion the limited set of estimates presented here, as the other results are very similar to those found elsewhere in the literature.

[27]The foreign ownership premium estimated here is consistent with that found in Arnold and Javorcik (2009) and Ramondo (2009).

and the period of the financial crisis itself (1997-1998). The difference in results are striking: during the crisis, foreign ownership has a larger productivity premium and foreign plant productivity responds much more strongly to tariff reductions: column (7) suggests for every 10 percent fall in tariffs plant level productivity grows by 16 percent among foreign-owned plants. In contrast, the results in column (7) suggest that during the crisis domestic productivity did not improve whatsoever. The results over the pre-crisis period suggest that foreign and domestic plants act very similarly in response to trade liberalization. In fact, column (5) suggests that there was no statistical difference between the response foreign and domestic plants to trade liberalization.

While the Solow residual used in the estimation of equation (6) already controls for the endogeneity of foreign ownership, trade status, and other inputs and the estimates are robust to time-invariant fixed effects, our results could still be contaminated by omitted variable bias. For instance, if more concentrated industries are more likely to attract foreign firms and these industries react quickly to new foreign competition by lowering mark-ups, the productivity differences discussed above may just reflect changes in mark-ups. Similarly, to the extent that size, export or import status, or capital intensity may be correlated with foreign ownership but inadequately controlled by time-invariant fixed effects and the year-island the estimates may be biased. We add additional co-variates to address these concerns in columns 4, 6 and 8.[28]

Controlling for other plant-level characteristics does not change the coefficients substantially, with one exception in column (6). In column (6) we only examine the pre-crisis and the coefficient on tariffs suggest that neither the domestic or foreign plants respond significantly to tariff change. The difference in the results can be explained by the control variables themselves. The results indicate exporting plants do respond significantly to tariff change in Indonesia during the pre-crisis period; we estimate that a 10 percent fall in tariffs increases exporter productivity by 3.5 percent during the pre-crisis period.[29]

Another potential concern is that tariff changes may be endogenous. On one hand, we might expect that industries with large amounts of foreign ownership may have been chosen to

[28] A Herfindahl index calculated at the 4-Digit level provides a measure of industry concentration and is used as a control for mark-ups.

[29] The supplemental appendix contains the full table.

Table 3: Endogenous Tariff IV

Dependent Variable: Solow Residual (a_{it})				
	1992-2001		1992-1996	1997-1998
Foreign Ownership (f)		0.010	0.029	0.438
		(0.034)	(0.040)	(0.080)
Tariff (τ) (Instrument)	-0.453	-0.457	-0.523	-0.629
	(0.114)	(0.115)	(0.143)	(0.254)
$f \times \tau$ (Instrument)		0.067	0.157	-2.692
		(0.194)	(0.223)	(0.473)
Year-Island Effects	Yes	Yes	Yes	Yes
No. of Obs.	143286		73564	34461

Notes: Standard errors are in parentheses.

experience larger tariff reductions if these industries are already more competitive on the world market. On the other hand, it may be that low productivity industries may lobby harder for protection. As such, it is difficult to predict the direction of the potential bias. As noted in Amiti and Konings (2007) it is generally difficult to find good instruments for tariffs, and in a firm-level fixed effects model is unclear whether there is in fact a serious endogeneity issue in the context of Indonesian manufacturing.

For the sake of completeness, however, we use a dynamic panel instrumental variable strategy to control for potential tariff endogeneity. In particular, we first consider equation (6) in differences:

$$\Delta a_{it} = \alpha_f \Delta f_{it} + \alpha_\tau \Delta \tau_t^k + \alpha_{f\tau} \Delta(f_{it}\tau_t^k) + \Delta Z_{it}\beta + \Delta\epsilon_{it} \tag{7}$$

where $\Delta z_{it} = z_{it} - z_{i,t-1}$ for variable z. Following Arellano and Bover (1995) we instrument the changes in industry k's tariff rate with past tariffs rates in levels. In the estimation of equation (7) we instrument tariffs along with their interactions with the lagged level in each variable.

Table 3 presents the results from estimating equation (7) when using instruments for tariff variables. The results suggest a similar pattern to that found in Table 2, and if anything, the differences before and during the crisis period may be even greater than previously estimated. Again, there is little evidence of a differential response to tariff change from foreign and domestic plants before the crisis. During 1997 and 1998, in contrast, a 10 percent decline in tariffs induced productivity improvements of 6.3 percent among domestic plants and 33 percent among foreign plants.

Collectively, the above results suggest a number of important results. First, while foreign

plants are substantially more productive than their the domestic counterparts, it is not clear that they respond more strongly to reductions in tariff protection during times of relative calm. This suggests that while average productivity growth may have been greater in foreign plants, it does not appear to be driven by tariff-induced, within-plant changes. However, differences in productivity growth may be driven by differences in the nature of entry and exit across foreign and domestic plants. If foreign and domestic plants are likely to choose to enter or leave high growth industries at different rates, the estimates may reflect these differences in the premia associated with foreign ownership. We explore this possibility next.

Second, foreign plants respond much more strongly to tariff changes during the financial crisis of 1997-1998. These results suggest that the presence of foreign ownership may have been instrumental in preventing aggregate productivity and production from falling even more drastically than it did during the crisis. One of the notable characteristics of this period was that domestic credit was particularly difficult to acquire.[30] Section 6.5 documents further evidence of debt financing differences across ownership classes in Indonesia and their ability to explain responses across foreign and domestic plants during the Asian crisis.

6.3 Plant Exit

In this section we examine the plant-level exit decisions across foreign and domestic plants in response to trade liberalization. On one hand, we might expect that foreign plants would be less likely to exit during a period of trade liberalization, since these plants are substantially more productive than their domestic counterparts and may have better access to credit markets. On the other hand, plants that are part of multinational corporations may face a higher opportunity cost of maintaining a plant within Indonesia. In particular, multinational corporations that had established foreign plants in order to avoid high tariffs, may now find it more profitable to produce outside of Indonesia and serve the Indonesian market through export sales.

Motivated by the decision rule (2) we first consider the following reduced-form empirical

[30] See Agung et al. (2001).

specification for a plant's decision to exit:

$$\chi_{it} = 1\{\lambda_a a_{i,t-1} + \lambda_k k_{i,t-1} + \lambda_f f_{i,t-1} + \lambda_\tau \tau_{it} + \lambda_{f\tau} f_{i,t-1}\tau_{it} + \phi Z_{it} + \lambda_t + \upsilon_{it} > 0\} \quad (8)$$

where λ_t is a year-specific constant and υ_{it} is a normally distributed error term. The first two coefficients in equation (8) control for plant-level productivity and capital stock, respectively. The third coefficient captures the impact of foreign ownership, while λ_τ and $\lambda_{f\tau}$ reflect the response of domestic and foreign plants to tariff changes. The Z_{it} matrix is a set of control variables including 5-digit industry dummies and year-island dummies.

The results from standard probit estimation are presented in Table 4. Columns (1) and (3) suggest that the probability of exiting is decreasing in productivity and capital stock, as predicted. While columns (2) to (4) indicate that foreign plants may be less likely to exit, column (5) suggests that once we control for other plant-characteristics there is little statistical difference between foreign and domestic plants.[31]

While the tariff variables appear to significantly encourage firms to exit the market in columns (4), (5), (6) and (8), they are not estimated to be any different across foreign and domestic plants. Moreover, the last four columns do not reveal any strong differences during the pre-crisis and crisis periods. Thus, to the extent that increased exit due to tariff change helps reallocate resources away from domestic firms and towards foreign firms, it appears that this is largely due to differences in productivity and capital stock across these groups of firms.[32]

The insignificance of the coefficient on the interaction between foreign ownership and tariffs is quite surprising and suggests that few foreign plants engaged in "tariff jumping" behaviour

[31] This is similar to the findings in Bernard and Sjöholm (2003) in Indonesia over an earlier time period. In their paper they find that, conditional on plant-level productivity, foreign plants demonstrate less duration in Indonesia. Our samples, however, are different in that they estimate the duration model on the entire population of plants before 1990, while our sample of plants only includes those with at least 20 employees from 1991 to 2000. Note that the if domestic plants shrink below the 20 employee threshold without exiting we will overestimate the probability of domestic exit.

[32] A potential concern with the results presented in Table 4 is that its validity depends on the distributional assumptions implied by the probit estimation. In particular, a poor fit of the plant-specific distribution may lead to biased coefficients. To further examine exit decisions in response to tariff change we re-estimate equation (8) using a linear probability model. While the linear probability model has the disadvantage that the predicted probabilities may lie outside of the 0-1 interval, it is valid under much weaker distributional assumptions on the plant-specific effects than the probit model. Since the results are almost identical to those presented in Table 4 even after controlling for plant-specific effects they are relegated to the Appendix.

Table 4: Plant-level Exit Decision, Probit Model

Dependent Variable: Exit Decision, χ_{it}									
	1991-2001					1991-1996		1997-1998	
Solow Residual	-0.012		-0.012	-0.013	-0.012	-0.016	-0.016	-0.005	-0.004
	(0.001)		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Capital Stock	-0.015		-0.015	-0.015	-0.014	-0.013	-0.012	-0.021	-0.020
	(0.0004)		(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Foreign Ownership (f)		-0.041	-0.014	-0.012	0.0004	-0.013	-0.002	-0.001	0.007
		(0.002)	(0.003)	(0.006)	(0.007)	(0.009)	(0.010)	(0.013)	(0.014)
Output Tariff (τ)				-0.065	-0.081	-0.070	-0.061	-0.186	-0.351
				(0.016)	(0.027)	(0.027)	(0.043)	(0.064)	(0.144)
$f \times \tau$				-0.020	-0.057	-0.033	-0.057	-0.100	-0.101
				(0.033)	(0.035)	(0.044)	(0.046)	(0.084)	(0.085)
5-Digit Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	No	No	Yes	No	Yes	No	Yes
No. of Obs.	175790	175790	175790	175790	175790	100155	100155	34782	34782

Notes: Standard errors are in parentheses. Marginal effects are reported. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

before trade liberalization. However, the results may be misleading in that foreign plants that use Indonesia as use Indonesia as an export platform may be much less likely to exit in the face of tariff reductions relative to those plants that had originally entered to sell largely to the domestic market. As such, we repeat the above experiment controlling for the export status of the foreign plants and its interaction with tariff changes. The results are presented in Table 5.

Consistent with the notion of tariff jumping, controlling for the export status of foreign plants tends to increase the predicted probability that a non-exporting plant will exit in response to tariff reductions. However, only during the crisis periods are these effects strongly significant. In fact, during the pre-crisis this distinction is rather weak, while it is only marginally significant when the probit model is estimated on the entire sample.

6.4 Plant Entry

While there is evidence of changes on relative exit rates across foreign and domestic plants, we might suspect that tariff declines may induce differential entry rates, particularly during the Asian crisis. In fact, foreign plants accounted for 7 percent of all new plants in 1990, 3 percent in 1996 and 20 percent in 1998. Here, we investigate whether trade liberalization induced relative

Table 5: Plant-level Exit Decision, Probit Model

Dependent Variable: Exit Decision, χ_{it}						
	1991-2001		1991-1996		1997-1998	
Solow Residual	-0.012	-0.012	-0.016	-0.016	-0.005	-0.004
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Capital Stock	-0.015	-0.014	-0.013	-0.012	-0.021	-0.020
	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.002)
Foreign Ownership (f)	-0.004	-0.003	0.001	-0.001	0.004	0.006
	(0.008)	(0.009)	(0.014)	(0.014)	(0.016)	(0.016)
$f \times$ Export Status	-0.015	0.014	-0.023	-0.001	-0.022	0.001
	(0.011)	(0.015)	(0.015)	(0.020)	(0.023)	(0.033)
Output Tariff (τ)	-0.065	-0.081	-0.070	-0.061	-0.186	-0.353
	(0.016)	(0.027)	(0.027)	(0.043)	(0.064)	(0.144)
$f \times \tau$	-0.090	-0.084	-0.104	-0.091	-0.221	-0.221
	(0.051)	(0.051)	(0.070)	(0.070)	(0.112)	(0.111)
$f \times$ Export Status $\times \tau$	0.126	0.016	0.123	0.049	0.420	0.379
	(0.067)	(0.070)	(0.089)	(0.092)	(0.209)	(0.219)
5-Digit Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	No	Yes	No	Yes
No. of Obs.	175790	175790	100155	100155	34782	34782

Notes: Standard errors are in parentheses. Marginal effects are reported. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

changes in entry across industries.

Unfortunately, the data do not allow us to see the entire structure of multinational corporations. As such, it is impossible to study plant-level entry decisions. Instead we aggregate the data to the industry level and examine whether trade liberalization induced changes in relative entry rates.

A concern with the degree of entry in a particular 5-digit industry is that it may depend not only on its own tariff but also on the tariff of closely related industries. If a tariff in industry k falls faster than the tariff in neighbouring industries we might expect that the entry rate in that particular industry may be slower (or faster) than industries that experience no change in tariffs. In this sense, tariffs may divert foreign entry rather than simply discourage or encourage foreign entry.

Define the following relative tariff index, τ_t^{Rk}, which captures the changes in the 5-digit tariffs in similar industries:

$$\tau_t^{Rk} = \sum_{k' \in K} v_t^{k'} \tau_t^{k'}$$

Table 6: Entry Cohorts

Dependent Variable: % of Entry Cohort with Foreign Ownership									
	All Foreign Firms			Greenfield FDI			Brownfield FDI		
Output Tariffs (τ)	0.064	0.175	0.272	0.028	0.046	0.070	0.035	0.129	0.203
	(0.088)	(0.146)	(0.154)	(0.067)	(0.111)	(0.118)	(0.069)	(0.115)	(0.121)
τ in Similar Industries		0.138	0.045		0.099	0.069		0.039	-0.024
		(0.156)	(0.166)		(0.119)	(0.127)		(0.123)	(0.131)
Exchange Rate	0.018	0.021	0.028	0.011	0.014	0.014	0.008	0.006	0.013
	(0.004)	(0.005)	(0.008)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input Tariffs Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Crisis Dummies	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
No. of Obs.	2197	1833	1833	2197	1833	1833	2197	1833	1833

Notes: Standard errors are in parentheses.

where K is the set of similar industries (not including industry k itself) [33] and $v_t^{k'}$ is industry k''s share of production in K. Using the tariff variables we consider the following linear regression:

$$\frac{N_{kt}^*}{N_{kt}} = \gamma_0 + \gamma_\tau \tau_t^k + \gamma_R \tau_t^{Rk} + \gamma_e e_t + Z_{it}\gamma_Z + \upsilon_{kt} \tag{9}$$

where N_{kt} and N_{kt}^* are the number of total and foreign entrants in year t, respectively, and e_t is the exchange rate.[34] The matrix Z_{it} is again a matrix of controls variables including input tariffs, input tariffs in neighbouring industries, year-specific effects and time-invariant industry specific effects.

We consider three different constructions of the dependent variable. We separately examine new foreign plants, typically referred to as "Greenfield FDI," in contrast to foreign takeovers of existing Indonesian firms, or "Brownfield FDI." Finally, we also consider them together. Table 6 presents the results from the estimation of (9) for each dependent variable. In columns (1), (4) and (7) we regress the entry only on the tariff variables, excluding the effects of tariff changes in neighbouring industries. In columns (2), (5) and (8) we repeat the experiment including the tariff variation from neighbouring industries. Last, we estimate equation (9) where we interact all variables with crisis and post-crisis dummy variables.

In no sample are any of the tariff coefficients remotely significant. Controlling for changes in input tariffs and input tariffs in similar industries are likewise insignificant. However, the

[33] We use groupings of industries in the same 4-digit industry.

[34] The exchange is the number of Indonesian rupiahs per US dollar as tabulated by the Penn World Tables.

exchange rate is always positive and strongly significant.[35] This suggests that depreciations of the Indonesian currency strongly encourage inward foreign investment, but trade policy has little effect. While reallocation of resources towards foreign plants may have substantially increased due to the degree of foreign entry during the Asian crisis, there is little evidence that tariff policy had any influence on differential entry rates.

6.5 Debt Financing and the Asian Crisis

Our results suggest that foreign-owned plants grew much more strongly during the Asian crisis than domestic plants, and demonstrated much more significant responses to changes in trade policy. This is in stark contrast to the pre-crisis period when foreign and domestic plants appear to have responded very similarly to changes in trade policy. A potential explanation for this difference is that foreign ownership may have lead to preferential access to credit markets for some plants, which in turn would may have allowed to them to continue to respond more rapidly to changes in economic environment. Exploring this explanation may be particularly important for understanding the role of foreign plants in the reallocation of resources during crises.

There are three issues that complicate this endeavour. First, we have limited information regarding the debt holdings of plants during the Asian crisis. Second, we cannot directly observe which plants are credit constrained and which have ready access to debt financing. Last, if debt financing is an important determinant of investment and productivity growth, the previous estimates of the Solow residual may be biased, particularly during the Asian crisis. We discuss each of these in turn.

The data contain detailed plant-level information on the value of total liabilities held at the beginning of 1996 and 1997.[36] They also include information on the total value of all new loans incurred during 1997 and whether plants received new loans during the previous 5 years (1992-1996). We construct the measure of total liabilities in 1998 as the sum of the total liabilities at the beginning of 1997 and all new loans. We do not have any information whether plants

[35] See Appendix for full tables.

[36] For many small plants the data total liabilities is missing. Following Blalock, Gertler and Levine (2008) we have set these values to zero. As noted below we repeat the experiment only including plants that hold amounts of debt to check our findings.

made payments to reduce their total debt burden during 1997. It is unlikely that debt owed to domestic creditors fell during this period since there was a sharp decline in credit during the Asian crisis, which would have made older debt relatively less expensive in comparison to refinancing. Moreover, given the sharp decline in the Indonesian exchange rate it is also unlikely that plants earning revenue in Indonesian rupiahs would have chosen to make large reductions in the liabilities denominated in foreign currencies.[37]

The second difficulty is that some plants with no debt may wish to access credit markets, but are unable due to the shrinking credit supply or other constraints.[38] However, as demonstrated in Arellano, Bai and Zhang (2009) plant-level productivity is typically positively correlated to the ratio of debt to total assets in emerging markets. In this case only plants with higher productivity can afford to access credit markets, and those with higher productivity also tend to borrow larger amounts of debt relative to total assets. Without a direct measure of credit constraints, we will assume that higher productivity plants use credit markets more intensively (in the sense that they have higher debt to capital ratios). Although the strength of the evidence below depends strongly upon these assumptions, we will relax the last assumption by also considering only the sample that held positive amounts of debt.

Last, to the extent that prior access to credit markets is important for investment and productivity growth, our previous estimates of the Solow residual may be biased, particularly during the Asian crisis. In fact, if foreign ownership serves as a proxy for credit market access we would expect that the difference in the coefficients across periods may have little to do with foreign ownership and may be largely explained by better access to credit markets and cheaper financing. In order to account for the potential bias we re-estimate the production function for all of the 3-digit industries using the plant's ratio of debt to capital stock in previous year and a dummy variable indicating whether the plant had accessed credit markets in the past five years to control for potential endogeneity and selection bias.[39]

After calculating the Solow residual as in equation (4) we re-estimate equation (6) includ-

[37]See Agung et al. (2001) and Ito and Sato (2006) for further details on credit supply and exchange changes during this period.

[38]See Bond, Tybout and Utar (2008) for a discussion of these issues in developing country context.

[39]Unfortunately, for 9 industries there are not enough observations to estimate the parameters of the production function using just two years. These observations are dropped from the sample.

Table 7: Debt Financing and Productivity, 1997-1998

Dependent Variable: Solow Residual (a_{it})						
	Full Sample			Positive Debt Holdings		
Foreign Ownership (f)	0.241	0.237	0.181	0.147	0.124	-0.026
	(0.052)	(0.052)	(0.053)	(0.136)	(0.135)	(0.136)
Debt/Capital (D/K)		0.000002	0.0001		-0.00001	0.0001
		(0.00005)	(0.00005)		(0.0001)	(0.0001)
$f \times D/K$		0.011	0.011		0.010	0.010
		(0.004)	(0.004)		(0.004)	(0.004)
Output Tariff (τ)	0.014	0.021	0.017	-0.352	-0.318	0.004
	(0.094)	(0.094)	(0.225)	(0.214)	(0.213)	(0.497)
$f \times \tau$	-1.821	-1.766	-1.179	-2.576	-2.334	-1.131
	(0.286)	(0.286)	(0.291)	(0.694)	(0.698)	(0.720)
$D/K \times \tau$		0.0001	-0.0001		0.0002	-0.00002
		(0.001)	(0.001)		(0.001)	(0.001)
$f \times D/K \times \tau$		-0.245	-0.233		-0.214	-0.207
		(0.093)	(0.092)		(0.100)	(0.099)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	No	No	Yes	No	No	Yes
No. of Obs.		33848			7408	

Notes: Standard errors are in parentheses. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

ing the plant's debt-capital ratio and its interactions with foreign ownership and tariffs as an additional explanatory variables. Letting D_{it}/K_{it} denote the plant's debt-capital ratio we can rewrite equation (6) as

$$\begin{aligned} \hat{a}_{it}^k &= \alpha_0 + \alpha_f f_{it} + \alpha_\tau \tau_t^k + \alpha_{f\tau} f_{it}\tau_t^k + \alpha_{dk}\frac{D_{it}}{K_{it}} + \alpha_{dkf}\frac{D_{it}}{K_{it}} f_{it} + \alpha_{dk\tau}\frac{D_{it}}{K_{it}}\tau_t^k + \alpha_{dkf\tau}\frac{D_{it}}{K_{it}} f_{it}\tau_t^k \\ &\quad + Z_{it}\beta + \zeta_i + \epsilon_{it} \end{aligned} \tag{10}$$

where the parameters α_{dk}, α_{dkf}, $\alpha_{dk\tau}$, and $\alpha_{dkf\tau}$ capture the effect of the debt-capital ratio, its interaction with foreign ownership, the impact of tariffs on debt holding plants, and the impact of tariffs on foreign debt holding plants. We expect the first two of the these coefficients to be greater than zero if heavily indebted plants are able to finance investment more readily in order take advantage of productivity enhancing opportunities. To the extent that plants are encouraged to make these investments through tariff reductions we expect that latter two coefficients to be less than zero.

Table 7 documents the results from the estimation of the equation (10). The first column excludes the debt variables as in equation (6). The estimated coefficients are similar to those

found in Table 2 suggesting that the exclusion of the variables did not largely bias our previous results. The second column demonstrates that debt-capital ratios appear to be significant only when interacted with the foreign status dummy. While foreign plants with higher debt-capital ratios tend to be more productive, the same is not true of domestic plants. While the coefficient on tariffs is insignificant for domestic plants, even when interacted with the debt-capital ratio, it is always negative and highly significant for foreign plants.

Similar to the results presented in Table 2, a 10 percent fall in tariffs is estimated to increase productivity by almost 18 percent among foreign plants that don't hold any debt. Multiplying the estimated coefficient on the foreign debt-capital ratio by the mean debt-capital ratio among foreign debt-holding plants, we compute that a 10 percent change in tariffs will increase productivity by an additional 5.5%. Allowing for other controls decreases the estimated coefficients slightly; the coefficients indicate that foreign plants respond to 10 percent fall in tariffs with a 12% increase in productivity, while the additional productivity effect of debt falls to 5.2%. Given that the parameters are entirely identified from within-plant variation, these results suggest that plants who increased their debt holdings over the 1997-1998 crisis were better able to invest to productivity enhancement.

An additional concern is that the relationship between the debt-capital ratio and productivity may be substantially different among those firms who hold debt and those who do not. In columns (4)-(6) we repeat the experiment, restricting the sample to only those plants with positive debt holdings over the Asian crisis. The results indicate that among debt holding plants, foreign plants do not appear to be particularly more productive *unless* they are also holding relatively large amounts of debt. While the tariff variables remain insignificant for domestic plants, they continue to be significant among foreign owned plants with the exception of the interaction between the foreign ownership dummy and tariffs in column (6). It is important to note, however, that foreign plants still demonstrate strong increases in productivity in response to tariff change, but they are also strongly correlated with their debt holdings.

Finally, we also examine the impact of debt holdings on plant-level exit decisions. We re-estimate equation (8) while including the debt-capital ratio and its interactions with foreign

Table 8: Debt Financing and Exit Decisions, Probit Model, 1997-1998

Dependent Variable: Exit Decision, χ_{it}						
	Full Sample			Positive Debt Holdings		
Solow Residual	-0.006	-0.006	-0.006	-0.011	-0.010	-0.009
	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)	(0.004)
Capital Stock	-0.021	-0.021	-0.020	-0.022	-0.020	-0.020
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Foreign Ownership (f)	0.009	0.011	0.017	0.015	0.022	0.026
	(0.015)	(0.016)	(0.017)	(0.032)	(0.039)	(0.041)
Debt/Capital (D/K)		-4.16e-05	-0.00004		-2.95e-5	-0.00003
		(0.0001)	(0.0001)		(3.59e-5)	(0.00004)
$f \times D/K$		-0.028	-0.025		-0.020	-0.019
		(0.031)	(0.030)		(0.023)	(0.022)
Output Tariff (τ)	-0.165	-0.139	-0.404	-0.044	0.032	0.094
	(0.068)	(0.069)	(0.151)	(0.115)	(0.115)	(0.247)
$f \times \tau$	-0.126	-0.136	-0.129	-0.133	-0.163	-0.199
	(0.089)	(0.090)	(0.091)	(0.193)	(0.202)	(0.207)
$D/K \times \tau$		0.0005	0.0005		0.0004	0.0004
		(0.0005)	(0.0005)		(0.0003)	(0.0004)
$f \times D/K \times \tau$		0.123	0.111		0.087	0.081
		(0.140)	(0.137)		(0.103)	(0.101)
5-Digit Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	Yes	No	No	Yes
No. of Obs.		34782			10509	

Notes: Standard errors are in parentheses. Marginal effects are reported. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

ownership and tariff changes as additional explanatory variation. The results are presented in Table 8.

The first three columns report the results from the probit model estimated on the entire sample, while the last three columns present the results from the sample with positive debt holdings. Across columns we see that the estimated productivity levels and capital stock generally continue to be significant predictors of the plant's exit decision, but in no case is the debt-capital ratio or its interactions significant.[40] These results do not necessarily indicate that debt holdings were not an important determinant of the plant's exit decision, but rather that without further information on the set of plants who are in fact credit constrained we are unable to identify the plants for whom the debt holdings are particularly burdensome.

[40]The Solow residual is insignificant in columns (3) and (6). However, given the short time period and number of additional explanatory variables in these regressions that are strongly correlated with productivity, this is not particularly surprising.

7 Conclusions

Using detailed plant-level information on manufacturing plants located in Indonesia this paper examines the role of foreign firms in determining aggregate productivity growth. We provide substantial evidence that the vast majority of aggregate growth in Indonesia during the 1991-2000 period can be attributed to foreign-owned plants. Moreover, the evidence suggests that, with the exception of the crisis period, almost all of the aggregate productivity growth can be attributed to increases in the market share of foreign owned plants rather than within-plant productivity growth. Although some recent papers have emphasized the impact of foreign ownership on technology transfer and within-plant productivity growth for all plants, we find little support for this hypothesis. In contrast, this paper argues that the largest effect foreign ownership has on the aggregate productivity acts through the resource allocation channel, which has received relatively little attention.

This paper shows that while foreign ownership improves plant-level productivity, for the most part foreign firms do not appear to grow at faster rates than comparable domestic firms in response to trade liberalization. Similarly, trade policy does not appear to have a differential effect on entry or exit rates across foreign and domestic plants once we have controlled for plant-specific productivity. In sum, these results suggest that while trade policy may have reallocated resources towards more productive plants, the growth in the contribution from foreign plants in aggregate productivity is not driven by changes in trade policy.

An important exception is the period during the Asian financial crisis when foreign firms demonstrated much stronger productivity growth than their domestic counterparts. This result would suggest that encouraging foreign ownership may help to mitigate productivity declines during times of crisis in a developing country. In particular, we specifically examine the impact of debt holdings on productivity growth during the Asian crisis and find that foreign plants that hold larger amounts of debt during the Asian crisis grow faster than those who held little or no debt. These results further suggest that foreign plants play a potentially important role in overcoming constraints that prevent plants from accessing credit markets.

References

[1] Agung J, Kusmiarso B, Pramono B, Hutapea E, Prasmuko A, Prastowo N. Credit Crunch In Indonesia In the Aftermath of the Crisis: Facts, Causes and Policy Implications. Directorate of Economic Research and Monetary Policy. 2001. Bank Indonesia.

[2] Amiti M., Davis D. Trade, Firms, and Wages: Theory and Evidence. NBER Working Papers 14106. 2008.

[3] Amiti M., Konings J. Trade liberalization, intermediate inputs and productivity: Evidence from Indonesia. American Economic Review. 2007. 97(5); 1611-1638.

[4] Arellano C., Bai Y., Zhang J. Firm Dynamics and Financial Development. 2009. mimeo.

[5] Arellano M., Bover, O. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics. 1995. 68(1); 29-51.

[6] Arnold J.A., Javorcik B.S. Gifted Kids or Pushy Parents? Foreign Direct Investment and Plant Productivity in Indonesia. Journal of International Economics. 2009. Forthcoming.

[7] Attanasio O, Goldberg P.K., Pavcnik N. 2004. Trade Reforms and Income Inequality in Colombia. Journal of Development Economics. 2004. 74; 331-366.

[8] Aw B.Y., Chung S., Roberts M.J. Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China). World Bank Economic Review. 2000. 14; 65-90.

[9] Bernard A.B., Eaton J., Jensen J.B., Kortum S. Plants and Productivity in International Trade. American Economic Review. 2003. 93(4); 1268-1290.

[10] Bernard A.B., Jensen J.B. Exceptional Exporter Performance: Cause, Effect, and or Both? Journal of International Economics. 1999. 47; 1-25.

[11] Bernard A.B., Sjöholm F. Foreign Owners and Plant Survival. NBER Working Paper 10039. 2003.

[12] Blalock G., Gertler P.J. Learning from exporting revisited in a less developed setting. Journal of Development Economics. 2004. 75; 397-416.

[13] Blalock G., Gertler P.J. Welfare gains from Foreign Direct Investment through technology transfer to local suppliers. Journal of International Economics. 2008. 74; 402-421.

[14] Blalock G., Gertler P.J., Levine D.I. Financial constraints on investment in an emerging market crisis. Journal of Monetary Economics. 2008. 55; 568-591.

[15] Bond E., Tybout J.R., Utar H. Credit Rationing, Macro Volatility, and Industrial Evolution in Developing Countries. 2008. mimeo.

[16] Cooley T.F., Quadrini V. Financial Markets and Firm Dynamics. American Economic Review. 2001. 91(5); 1286-1310.

[17] De Loecker, J. Do Exports Generate Higher Productivity? Evidence from Slovenia. Journal of International Economics. 2007. 73; 69-98.

[18] Ito T., Sato K. Exchange Rate Changes and Inflation in Post-Crisis Asian Economies: VAR Analysis of the Exchange Rate Pass-through. NBER Working Paper 12395. 2006.

[19] Helpman E., Melitz M.J., Yeaple S.R. Export versus FDI with Heterogeneous Firms. American Economic Review. 2004. 94; 300-316.

[20] Javorcik, B.S. Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. American Economic Review. 2004. 94(3); 605-627.

[21] Kasahara H., Rodrigue J. Does the Use of Imported Intermediates Increase Productivity? Plant-Level Evidence. Journal of Development Economics. 2008. 87(1); 106-118.

[22] McGrattan E.R., Prescott E.C. Openness, Technology Capital, and Development. NBER Working Paper 13515. 2007.

[23] Melitz M.J. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. Econometrica. 2003. 71(6); 1695-1725.

[24] Olley S.G., Pakes A. The Dynamics of Productivity in the Telecommunications Equipment Industry. Econometrica. 1996. 65(1); 245-276.

[25] Pavcnik N. Trade Liberalization, Exit, and Productivity Improvements: Evidence From Chilean Plants. Review of Economic Studies. 2002. 69(1); 245-276.

[26] Ramondo N. The Effects of Foreign Plants on Industry Productivity: Evidence From Chile. Scandanavian Journal of Economics. 2009. Forthcoming.

[27] Ramondo N., Rodríguez-Clare A. Trade, Multinational Production, and the Gains from Openness. 2009. mimeo.

[28] Roberts M.J., Tybout J.R. The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs. American Economic Review. 1997. 92(5); 545-564.

[29] Trefler, D. The Long and Short of the Canada-U.S. Free Trade Agreement. American Economic Review. 2004. 94(4); 870-895.

[30] Van Biesebroeck, J. Exporting Raises Productivity in Sub-Saharan African Manufacturing Firms. Journal of International Economics. 2004. 67(2); 373-391.

Supplemental Appendix for Foreign Firms, Trade Liberalization and Resource Allocation

Joel Rodrigue
Department of Economics
Vanderbilt University
joel.b.rodrigue@vanderbilt.edu

A Data Construction

A.1 Product class, location and age

The main product class of each establishment is identified by 5-digit ISIC codes published by the United Nations Industrial Development Organization (UNIDO). The data include establishment age and location by province and district. In this paper we exploit the location data to create an indicator variable that distinguishes the island of the plant's location.

A.2 Ownership

Each plant reports the establishment's percentage of foreign equity. Establishments with more than 10% foreign equity were defined as foreign.

A.3 Capital

Each establishment reports the book and current replacement value of land, buildings, machinery and equipment, vehicles and other assets. The total value of investment in each category is also reported annually.

A.4 Labour and wages

The total number of paid and unpaid workers are reported each year. Similarly, the total number of production and non-production workers are reported annually, with worker gender (1995-1997) and education (1996-1997) data reported less frequently. Total wages can be disaggregated into cash payments and in-kind payments for normal wages, overtime, gifts, bonuses and other payments.

A.5 Materials and energy

The value of total consumed materials and the value of total imported materials are reported annually. The surveys also collect information on the quantity and price of consumed gasoline and lubricants and the amount of purchased and/or self-generated electricity.

A.6 Revenue

The nominal rupiah value of total and export revenues are recorded annually.

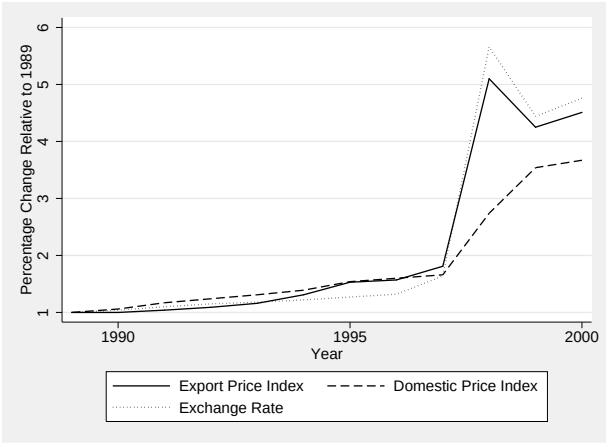

Figure A.1: Export and Domestic Price Indices, 1989-2000, Relative to 1989 Level

A.7 Price Deflators

Revenues, materials and capital are deflated to express values in real terms. The wholesale price indices are constructed by the Indonesian Statistical Agency, *Budan Pusat Statistik* (BPS), and cover prices for agriculture, manufacturing, mining and quarrying, oil and gas, imports, and exports. In sum, wholesale prices are published for 327 commodities, 192 of which are manufactured commodities. Domestic revenues and domestic materials are deflated using the wholesale price index for the nearest corresponding manufactured commodity. Imported inputs are deflated using the wholesale price index for the nearest corresponding imported commodity. Energy is deflated using Indonesian petroleum prices.

A.7.1 Capital Deflators

Fixed assets are deflated using the wholesale price index for construction, imported electrical and non-electrical equipment and imported transportation equipment. To construct the capital stock deflator we weight each price index by the average reported shares of buildings and land, machinery and equipment and fixed vehicle assets.

A.7.2 Export Revenues

Before the Asian crisis domestic and export prices track each other very closely. As shown in Figure A.1 during the Asian crisis domestic and export prices diverge substantially. Using domestic price deflators would lead to a misleading real value of total export sales during this period. For most industries, it is possible to deflate export sales by the nearest corresponding export commodity; however, for a number of industries this data does not exist before 1998.

In all industries where the data are available it is clear that when the exchange rate is stable, export prices tend to follow domestic prices very closely. During the Asian crisis, however, export prices depart from domestic prices and move very closely with the exchange rate. As such, we fit a simple model of export prices determination as a weighted linear expression of corresponding domestic prices and the exchange rate. The weights are determined by regressing a model of export prices on domestic prices and the exchange rate for industries where export

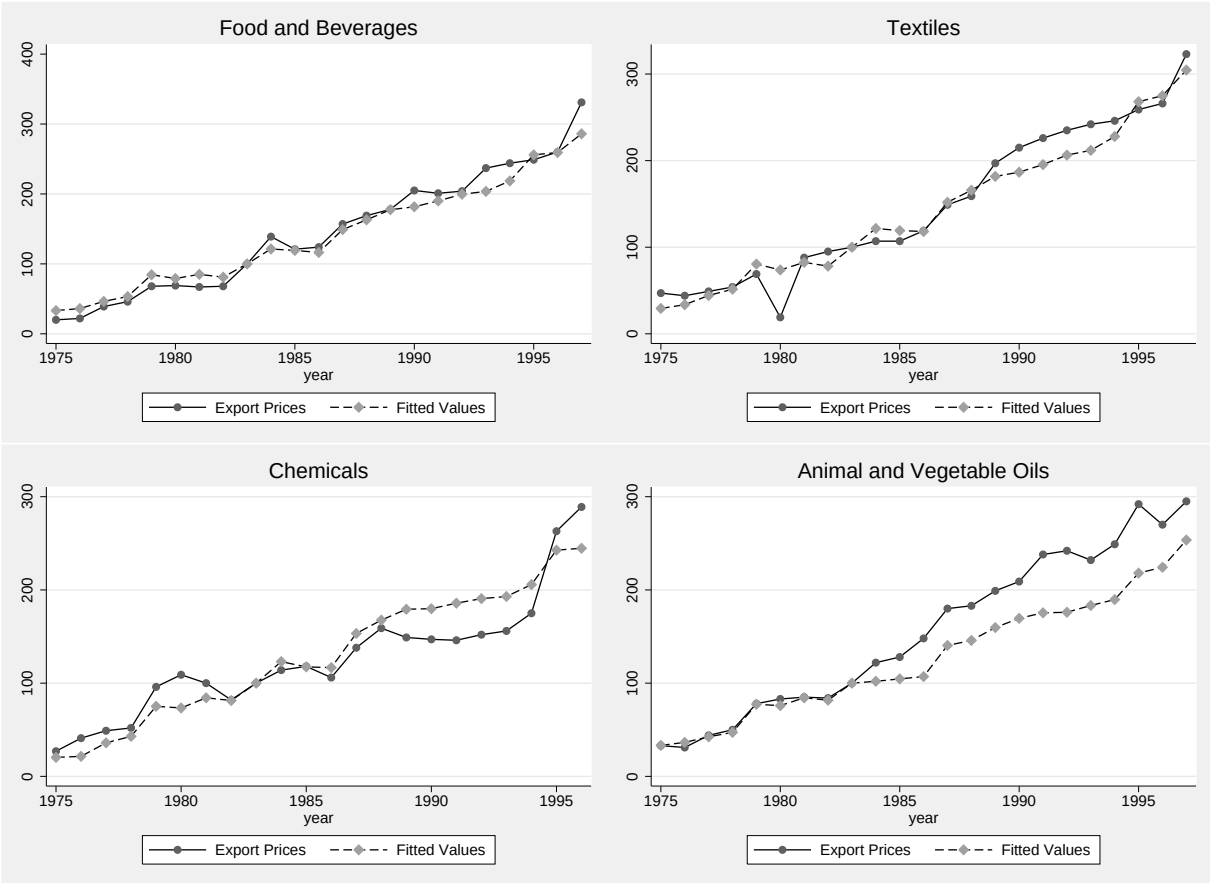

Figure A.2: Actual vs Predicted Export Prices, 1975-1997

prices are available. In every case, the simple linear model predicts the observed export prices very closely. A sample of results are presented in Figure A.2. As such, we use the predicted export price for all industries where it is not available. It is important to note that fundamentally this only changes the data in one year for a small number of firms. After 1997 export price data is available for all plants, while before 1997 it is available for most plants. However, before 1997 export prices are known to track domestic prices very closely and this is what is typically used to deflate export revenues. Only in 1997 is there missing data for a small number of industries and large divergence between export and domestic prices.

B Tariffs in Indonesia

This section describes the variation in output and input tariffs in the Indonesian manufacturing sector over the 1991-2000 period.

Table B.1: Input and Output Tariffs

Industry	Tariff Type	1991	1993	1995	1997	1999	2000
31 Food	Output	20.84	20.50	20.62	19.19	15.95	15.94
	Input	13.86	13.60	9.83	8.68	7.12	6.95
32 Textiles	Output	27.35	26.65	20.19	16.53	12.68	9.43
	Input	17.59	17.38	13.25	10.76	8.87	6.27
33 Wood	Output	24.20	24.10	17.95	12.32	9.43	6.91
	Input	10.24	10.09	6.52	4.32	3.57	2.90
34 Paper	Output	21.21	19.76	10.09	7.04	4.31	4.03
	Input	17.56	16.30	9.42	6.86	4.81	4.18
35 Chemicals	Output	15.60	14.93	12.05	10.11	8.31	6.62
	Input	11.14	11.05	9.00	7.57	6.26	5.17
36 Metal	Output	23.04	21.84	10.62	7.46	6.40	5.65
	Input	14.81	13.94	9.52	7.95	6.61	5.64
37 Machinery	Output	11.50	9.72	8.08	7.32	6.85	5.71
	Input	9.80	9.94	7.82	7.32	6.88	6.07
38 Electrical	Output	18.89	18.56	14.69	11.01	7.75	6.69
	Input	13.84	13.53	10.25	8.32	7.26	6.26
39 Other	Output	32.50	31.57	22.11	17.70	14.28	10.98
	Input	15.94	15.37	11.25	9.17	7.67	6.17
All	Output	20.88	20.29	15.58	12.51	9.76	8.38
	Input	13.71	13.40	9.92	8.24	6.91	5.93

C Summary Statistics

The section provides summary statistics for the plant-level variables discussed in the main text and used in the estimation routine.

D Olley-Pakes Methodology

A well known problem with the estimation of production functions is the correlation between unobserved productivity shocks and the hiring of inputs. The correlation between the error term and the observed variables yields inconsistent estimates when the production function is estimated by ordinary least squares. Sample selection also induces biased coefficients when low productivity firms endogenously choose to exit the market.

The Olley-Pakes estimation methodology uses the structure of the dynamic optimization problem to overcome both the selection and endogenous input choice problem. It assumes that the unobserved productivity shock a_{it} follows a first-order Markov process and that capital investment is a deterministic process. The optimal investment demand function depends only on two plant-specific state variables, the current capital stock and current productivity:

$$I_{it} = I(a_{it}, k_{it}, \Omega_t) = I_t(a_{it}, k_{it})$$

where Ω_t represents the economic state variables common to all firms.

As described in Olley and Pakes (1996) there exist a set of conditions such that if the investment function is monotonically increasing in productivity it is possible to invert the investment function and describe the unobservable productivity shock as a function of the observable capital and investment. Following Van Biesebroeck (2004), De Loecker (2008), Kasahara and Rodrigue

Table C.1: Summary Statistics

Variable	Observations	Mean	Standard deviation
Output tariff	175,984	0.166	0.111
Output tariff(t)-output tariff(t-1)	143,580	-0.019	0.047
Input tariff	175,927	0.104	0.061
Input tariff(t)-input tariff(t-1)	143,529	0.108	0.061
Log real output	191,058	7.926	2.099
ln(TFP) - full sample	190535	1.364	0.815
ln(TFP) - precrisis only[a]	114,838	1.382	0.829
ln(TFP) - crisis only[b]	34,891	1.159	0.812
Log value added	191,048	6.844	2.028
Log total employment	191,053	4.178	1.196
Log capital stock	191,053	7.080	2.099
Log capital/labour	191,053	2.901	1.460
Log total materials	190,790	7.120	2.291
Import share	190,790	0.093	0.244
Import status= 1 if import share> 0	191,790	0.202	0.401
Import status(t)-import status(t-1)	155,924	-0.004	0.221
Export share	191,058	4.296	17.986
Export status= 1 if export share> 0	191,058	0.147	0.354
Export status(t)-export status(t-1)	155,924	0.003	0.319
Foreign share	191,058	4.296	17.986
Foreign status= 1 if foreign share¿0.1	191,058	0.059	0.236
Foreign status(t)-foreign status(t-1)	155,924	0.002	0.110
Crisis dummy= 1 if year=1997 or 1998	191,058	0.197	0.398
Herfindahl index at 4-digit ISIC level	191,058	0.072	0.105

Notes: In each case ln(TFP) is calculated as in Amiti and Konings (2007). (a) The production function coefficients and Solow residual were estimated only using the pre-crisis data, 1990-1996. (b) The production function coefficients and Solow residual were estimated only using the crisis data, 1997-1998. Debt financing and previous loan experience data were included in the estimation routine.

(2008) and Amiti and Konings (2008) we modify the Olley and Pakes (1996) methodology by treating foreign ownership as a state variable. We also allow export and import status to be a state variable as well. We assume that a foreign firm decides to purchase an Indonesian firm in period $t-1$. Similarly, we assume that import and export decisions for period t are made in period $t-1$ so that the investment demand function becomes a function of five variables

$$I_{it} = i_t(a_{it}, k_{it}, f_{it}, x_{it}, p_{it})$$

where we define f_{it}, x_{it} and p_{it} to represent foreign ownership status, export status and import status, respectively.[41] Moreover, in order to account for the Asian crisis and the recovery period afterwards we allow the investment function to depend on three sub-periods, 1990-1996, 1997-1998, and 1999-2000. In this setting we invert the investment function to write the unobservable productivity as an unknown function of the capital stock, investment, foreign ownership, export status and import status:

$$a_{it} = h_t(I_{it}, k_{it}, f_{it}, m_{it}, x_{it}). \tag{D1}$$

Inserting (D1) into equation (3) we can recover consistent estimates of the variable input

[41] This implies that there are also deterministic functions that describe export and import decisions along with a rule that describes which firms receive foreign direct investment.

coefficients using a non-parametric estimate of $h_t(\cdot)$:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + h_t(I_{it}, k_{it}, f_{it}, p_{it}, x_{it}) + \varepsilon_{it} \tag{D2}$$

In the first step, we obtain consistent estimates of β_l and β_m. We use a fourth order polynomial series estimator in investment, capital, export status, import status and foreign ownership before, during and after the Asian crisis to control for productivity and capital in the first step.

In the second step we estimate the probability that the firm exits the sample in the next period in order to control for sample selection. The same fourth order polynomial above is used here. Last, the coefficient on physical capital is estimated using non-linear least squares, while controlling for the survival probability.

E Production Function Coefficients

This section provides the estimates of the production function coefficients when estimated by OLS and the Olley-Pakes methodology. Estimates for the entire period and the crisis period (using debt variables) are included below.

Table E.1: Estimated Coefficients of the Production Function, 1991-2000

Industry	Labour		Materials		Capital	
	OLS	OP	OLS	OP	OLS	OP
311 Food Products	0.247	0.222	0.770	0.767	0.091	0.058
312 Food Products, new	0.325	0.274	0.500	0.488	0.252	0.104
313 Beverages	0.811	0.697	0.394	0.375	0.214	0.285
314 Tobacco	0.156	0.119	0.906	0.896	0.049	0.045
321 Textiles	0.209	0.197	0.777	0.772	0.074	0.052
322 Clothing	0.168	0.164	0.820	0.840	0.059	0.051
323 Leather goods, nes	0.279	0.294	0.724	0.709	0.075	0.038
324 Leather footwear	0.307	0.297	0.636	0.628	0.073	0.059
331 Wood and cork, except furniture	0.286	0.266	0.683	0.675	0.082	0.072
332 Furniture	0.269	0.257	0.687	0.675	0.093	0.081
341 Paper and paper products	0.246	0.208	0.720	0.699	0.105	0.089
342 Printing, publishing and allied industries	0.422	0.313	0.630	0.661	0.056	0.110
351 Industrial chemicals	0.302	0.284	0.608	0.560	0.174	0.036
352 Other chemical products	0.331	0.336	0.658	0.638	0.107	0.080
355 Rubber products	0.213	0.206	0.734	0.715	0.063	0.044
356 Plastic Products, nes	0.206	0.189	0.746	0.748	0.088	0.118
361 Pottery, china, and earthware	0.325	0.330	0.612	0.586	0.129	0.057
362 Glass and glass products	0.462	0.404	0.665	0.605	0.033	0.004
363 Cement	0.470	0.362	0.671	0.661	0.056	0.103
364 Clay Products	0.516	0.486	0.426	0.411	0.165	0.167
369 Other non-metallic mineral products	0.378	0.326	0.566	0.557	0.184	0.108
371 Iron and steel industries	0.338	0.247	0.719	0.725	0.062	0.072
372 Non-ferrous basic metal industries	0.259	0.298	0.709	0.652	0.222	0.192
381 Fabricated metal products, except machinery	0.253	0.247	0.708	0.692	0.096	0.079
382 Non-electrical machinery	0.232	0.230	0.726	0.723	0.127	0.158
383 Electrical machinery	0.248	0.248	0.696	0.687	0.089	0.111
384 Transport equipment	0.312	0.286	0.696	0.702	0.086	0.084
385 Professional, scientific and controlling equipment	0.387	0.390	0.620	0.606	0.107	0.107
390 Miscellaneous manufacturing	0.297	0.290	0.627	0.609	0.119	0.091

Table E.2: Estimated Coefficients of the Production Function, 1997-1998, using debt variables

Industry	Labour		Materials		Capital	
	OLS	OP	OLS	OP	OLS	OP
311 Food Products	0.226	0.152	0.766	0.755	0.109	0.120
312 Food Products, new	0.372	0.258	0.501	0.444	0.237	0.314
314 Tobacco	0.128	0.066	0.925	0.915	0.058	0.102
321 Textiles	0.235	0.203	0.752	0.743	0.074	0.194
322 Clothing	0.225	0.256	0.765	0.778	0.084	0.124
324 Leather footwear	0.330	0.405	0.618	0.567	0.101	0.129
331 Wood and cork, except furniture	0.302	0.268	0.689	0.665	0.083	0.091
332 Furniture	0.285	0.270	0.676	0.624	0.101	0.123
341 Paper and paper products	0.199	0.161	0.723	0.725	0.127	2.16e-10
342 Printing, publishing and allied industries	0.469	0.303	0.579	0.617	0.095	0.218
351 Industrial chemicals	0.272	0.305	0.613	0.578	0.179	0.062
352 Other chemical products	0.296	0.308	0.659	0.615	0.108	0.078
355 Rubber products	0.185	0.235	0.761	0.727	0.070	0.112
356 Plastic Products, nes	0.209	0.214	0.724	0.696	0.095	0.091
363 Cement	0.480	0.379	0.680	0.670	0.047	0.071
364 Clay Products	0.476	0.414	0.424	0.367	0.202	0.156
381 Fabricated metal products, except machinery	0.284	0.229	0.696	0.659	0.094	0.119
383 Electrical machinery	0.280	0.298	0.689	0.666	0.086	0.062
384 Transport equipment	0.312	0.258	0.665	0.731	0.099	0.123
390 Miscellaneous manufacturing	0.314	0.397	0.613	0.542	0.125	0.207

F Industry Concentration and Aggregate Productivity

This section demonstrates how industry concentration may affect the measurement of resource reallocation across industries. Consider two equally sized industries, A and B, where average productivity is equal across each industry, $\bar{a}_t^A = \bar{a}_t^B = \bar{a}_t$, but average market size in industry A is twice the average market size in industry B, $\bar{s}_{it}^A = 2\bar{s}_{it}^B$. If we were to perform the aggregate productivity breakdown outlined in Section 5 for each industry we would find

$$\begin{aligned} A_t^A &= \bar{a}_t + \sum_{i\in A}(s_{it} - \bar{s}_t^A)(a_{it} - \bar{a}_t) = \bar{a}_t + \sum_{i\in A}(s_{it} - 2\bar{s}_t^B)(a_{it} - \bar{a}_t) \\ A_t^B &= \bar{a}_t + \sum_{i\in B}(s_{it} - \bar{s}_t^B)(a_{it} - \bar{a}_t) \end{aligned}$$

If instead we were to combine the two industries into the same aggregate productivity breakdown we would compute

$$\begin{aligned} A_t &= \bar{a}_t + \sum_{i}(s_{it} - \frac{3}{2}\bar{s}_t^B)(a_{it} - \bar{a}_t) \\ &= \bar{a}_t + \sum_{i\in A}(s_{it} - \frac{3}{2}\bar{s}_t^B)(a_{it} - \bar{a}_t) + \sum_{i\in B}(s_{it} - \frac{3}{2}\bar{s}_t^B)(a_{it} - \bar{a}_t) \end{aligned}$$

where the last two terms represent the contribution to resource reallocation from each industry. In this case the contribution from industry A is measured to be too big, while the contribution from industry B is too small. The same logic holds in reverse.

G Resource Reallocation

This section provides figures for the aggregate productivity breakdown when manufacturing is treated as a single industry. Figures (G1)-(G2) are analogous to Figures (2)-(5) in the text.

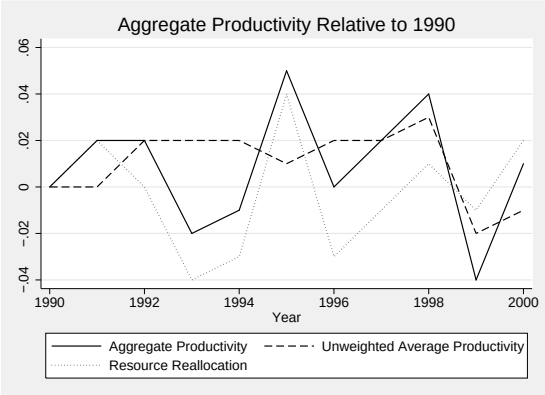

Figure G.1: Productivity Decomposition (All of Manufacturing)

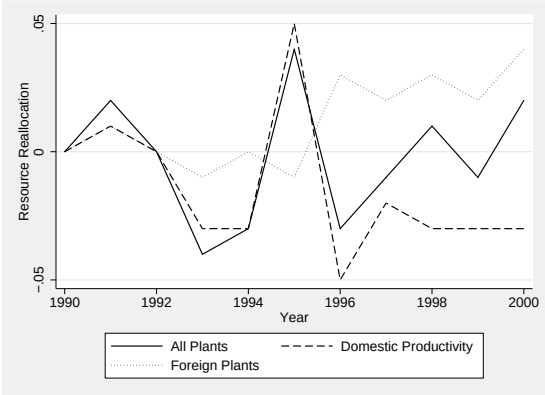

Figure G.2: Realloaction Decomposition (All of Manufacturing)

Figure G3 presents the resource allocation decomposition for large firms at the 5-digit industry level.

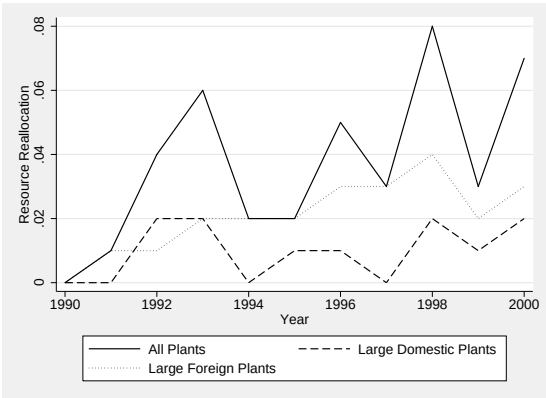

Figure G.3: Realloaction Decomposition, Large Plants (5-digit)

H Alternative Measures of Productivity

This section provides further estimates of the response of foreign productivity to tariff change using alternative measures of productivity.

Table H.1: Plant-level Productivity Differences

Dependent Variable: Labour Productivity								
	1991-2001				1991-1996		1997-1998	
Foreign Ownership (f)	0.313		0.461	0.438	0.389	0.338	0.373	0.318
	(0.017)		(0.022)	(0.022)	(0.036)	(0.036)	(0.070)	(0.070)
Output Tariff (τ)		-0.256	-0.212	-0.222	-0.144	-0.224	-0.512	-0.072
		(0.033)	(0.033)	(0.064)	(0.054)	(0.097)	(0.122)	(0.276)
$f \times \tau$			-0.938	-0.875	-0.441	-0.302	-1.866	-1.195
			(0.089)	(0.092)	(0.133)	(0.136)	(0.387)	(0.393)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	No	Yes	No	Yes	No	Yes
No. of Obs.	172186	172186	172186	172186	95111	95111	33848	33848

Notes: Standard errors are in parentheses. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

I Robustness

This section provides full tables from the main text and additional checks on the main results.

Table H.2: Plant-level Productivity Differences

Dependent Variable: Value Added Per Worker								
	1991-2001				1991-1996		1997-1998	
Foreign Ownership (f)	0.253		0.492	0.460	0.216	0.198	0.591	0.547
	(0.019)		(0.024)	(0.025)	(0.040)	(0.040)	(0.083)	(0.084)
Output Tariff (τ)		-0.218	-0.147	0.043	-0.057	-0.352	0.036	0.206
		(0.037)	(0.037)	(0.071)	(0.060)	(0.108)	(0.145)	(0.329)
$f \times \tau$			-1.521	-1.389	-0.194	-0.172	-3.237	-2.789
			(0.099)	(0.102)	(0.148)	(0.151)	(0.458)	(0.469)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	No	Yes	No	Yes	No	Yes
No. of Obs.	172186	172186	172186	172186	95111	95111	33848	33848

Notes: Standard errors are in parentheses. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

Table H.3: Plant-level Productivity Differences

Dependent Variable: Domestic Sales								
	1991-2001				1991-1996		1997-1998	
Foreign Ownership (f)	0.375		0.764	0.735	0.388	0.491	0.740	0.594
	(0.022)		(0.029)	(0.028)	(0.047)	(0.046)	(0.087)	(0.080)
Output Tariff (τ)		-0.346	-0.242	0.007	-0.157	-0.186	-0.474	-0.033
		(0.041)	(0.041)	(0.076)	(0.066)	(0.116)	(0.145)	(0.310)
$f \times \tau$			-2.579	-1.833	-0.443	-0.522	-3.959	-2.128
			(0.120)	(0.118)	(0.180)	(0.177)	(0.484)	(0.451)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	No	Yes	No	Yes	No	Yes
No. of Obs.	172186	172186	172186	172186	95111	95111	33848	33848

Notes: Standard errors are in parentheses. Other controls include a Herfindahl concentration index, export status, import status, the ratio of non-production to production workers and input tariffs. All control variables are also interacted with output tariffs with the exceptions of import status and input tariffs which are interacted with each other.

Table I.1: Plant-level Exit Decision, Probit Model, Full Table

Dependent Variable: Exit Decision, χ_{it}									
	1991-2001					1991-1996		1997-1998	
Solow Residual	-0.012		-0.012	-0.013	-0.012	-0.016	-0.016	-0.005	-0.004
	(0.001)		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Capital Stock	-0.015		-0.015	-0.015	-0.014	-0.013	-0.012	-0.021	-0.020
	(0.0004)		(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Foreign Ownership (f)		-0.041	-0.014	-0.012	0.0004	-0.013	-0.002	-0.001	0.007
		(0.002)	(0.003)	(0.006)	(0.007)	(0.009)	(0.010)	(0.013)	(0.014)
Output Tariff (τ)				-0.065	-0.081	-0.070	-0.061	-0.186	-0.351
				(0.016)	(0.027)	(0.027)	(0.043)	(0.064)	(0.144)
$f \times \tau$				-0.020	-0.057	-0.033	-0.057	-0.100	-0.101
				(0.033)	(0.035)	(0.044)	(0.046)	(0.084)	(0.085)
Herfindahl Index					-0.002		-0.003		0.024
					(0.002)		(0.004)		(0.008)
Herfindahl Index $\times \tau$					0.008		0.011		-0.085
					(0.008)		(0.012)		(0.042)
Export Status					-0.024		-0.022		-0.019
					(0.004)		(0.005)		(0.009)
Export Status $\times \tau$					0.100		0.074		0.047
					(0.019)		(0.024)		(0.070)
Input Tariffs (τ^m)					0.166		0.241		-0.299
					(0.036)		(0.074)		(0.210)
Import Status					-0.022		-0.020		-0.031
					(0.004)		(0.006)		(0.009)
Import Status $\times \tau^m$					0.329		0.051		0.223
					(0.058)		(0.040)		(0.121)
Skill Intensity					-0.030		0.016		0.033
					(0.015)		(0.012)		(0.016)
Skill Intensity $\times \tau$					-0.033		-0.067		-0.247
					(0.044)		(0.059)		(0.122)
5-Digit Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	175790	175790	175790	175790	175790	100155	100155	34782	34782

Notes: Standard errors are in parentheses. Marginal effects are reported.

Table I.2: Plant-level Exit Decision: Linear Probability Model

Dependent Variable: Exit Decision, χ_{it}									
	1991-2001					1991-1996		1997-1998	
Solow Residual (a_{it})	-0.006		-0.006	-0.006	-0.006	-0.006	-0.006	-0.004	-0.003
	(0.001)		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Capital Stock	-0.004		-0.004	-0.004	-0.005	-0.003	-0.003	-0.0004	-0.001
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Foreign Ownership (f)		-0.009	-0.006	-0.028	-0.015	-0.043	-0.029	-0.042	-0.027
		(0.006)	(0.006)	(0.007)	(0.008)	(0.014)	(0.014)	(0.018)	(0.019)
Output Tariff (τ)				-0.065	0.017	-0.062	0.033	-0.075	-0.117
				(0.011)	(0.022)	(0.021)	(0.039)	(0.032)	(0.074)
$f \times \tau$				0.139	0.058	0.111	0.052	0.430	0.295
				(0.030)	(0.031)	(0.053)	(0.054)	(0.102)	(0.105)
Herfindahl Index					-0.003		-0.001		0.006
					(0.002)		(0.003)		(0.004)
Herfindahl Index $\times \tau$					0.043		0.046		-0.011
					(0.006)		(0.011)		(0.022)
Export Status					-0.012		-0.022		0.023
					(0.004)		(0.007)		(0.010)
Export Status $\times \tau$					0.083		0.050		-0.039
					(0.018)		(0.027)		(0.061)
Input Tariffs (τ^m)					-0.006		0.142		-0.179
					(0.026)		(0.054)		(0.104)
Import Status					-0.030		-0.042		-0.052
					(0.005)		(0.009)		(0.014)
Import Status $\times \tau^m$					0.255		0.329		0.621
					(0.035)		(0.058)		(0.145)
Skill Intensity					-0.028		-0.030		-0.029
					(0.009)		(0.015)		(0.019)
Skill Intensity $\times \tau$					0.112		0.049		0.354
					(0.042)		(0.070)		(0.131)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	172186	172186	172186	172186	172186	95111	95111	33848	33848

Notes: Standard errors are in parentheses.

Table I.3: Debt Financing and Exit Decisions, Probit Model, 1997-1998, Full Table

Dependent Variable: Exit Decision, χ_{it}						
	Full Sample			Positive Debt Holdings		
Solow Residual	-0.006	-0.006	-0.006	-0.011	-0.010	-0.009
	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)	(0.004)
Capital Stock	-0.021	-0.021	-0.020	-0.022	-0.020	-0.020
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Foreign Ownership (f)	0.009	0.011	0.017	0.015	0.022	0.026
	(0.015)	(0.016)	(0.017)	(0.032)	(0.039)	(0.041)
Debt/Capital (d/k)		-4.16e-05	-0.00004		-2.95e-5	-0.00003
		(0.0001)	(0.0001)		(3.59e-5)	(0.00004)
$f \times d/k$		-0.028	-0.025		-0.020	-0.019
		(0.031)	(0.030)		(0.023)	(0.022)
Output Tariff (τ)	-0.165	-0.139	-0.404	-0.044	0.032	0.094
	(0.068)	(0.069)	(0.151)	(0.115)	(0.115)	(0.247)
$f \times \tau$	-0.126	-0.136	-0.129	-0.133	-0.163	-0.199
	(0.089)	(0.090)	(0.091)	(0.193)	(0.202)	(0.207)
$d/k \times \tau$		0.0005	0.0005		0.0004	0.0004
		(0.0005)	(0.0005)		(0.0003)	(0.0004)
$f \times d/k \times \tau$		0.123	0.111		0.087	0.081
		(0.140)	(0.137)		(0.103)	(0.101)
Herfindahl Index			0.027			0.019
			(0.008)			(0.013)
Herfindahl Index $\times \tau$			-0.125			-0.021
			(0.044)			(0.071)
Export Status			-0.011			0.021
			(0.011)			(0.025)
Export Status $\times \tau$			-0.002			-0.169
			(0.075)			(0.121)
Input Tariffs (τ^m)			-0.423			-0.317
			(0.215)			(0.385)
Import Status			-0.029			-0.037
			(0.010)			(0.014)
Import Status $\times \tau^m$			0.207			0.525
			(0.126)			(0.227)
Skill Intensity			0.036			0.035
			(0.018)			(0.032)
Skill Intensity $\times \tau$			-0.253			-0.306
			(0.142)			(0.260)
5-Digit Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	Yes	No	No	Yes
No. of Obs.		34782			10509	

Notes: Standard errors are in parentheses. Marginal effects are reported.

Table I.4: Plant-level Productivity Differences, Full Table

Dependent Variable: Solow Residual												
	1991-2000				1991-1996				1997-1998			
Foreign Ownership (f)	0.095	0.098	0.095	0.112	0.112	0.080	0.111	0.073	0.213	0.159	0.213	0.165
	(0.015)	(0.015)	(0.015)	(0.015)	(0.025)	(0.025)	(0.025)	(0.026)	(0.048)	(0.049)	(0.049)	(0.051)
Output Tariff (τ)	0.043	-0.037	-0.049	-0.047	-0.009	-0.074	-0.163	-0.032	0.768	0.151	-0.008	0.191
	(0.039)	(0.026)	(0.026)	(0.044)	(0.062)	(0.039)	(0.042)	(0.069)	(0.182)	(0.102)	(0.096)	(0.201)
$f \times \tau$	-0.204	-0.177	-0.207	-0.206	-0.148	-0.025	-0.143	0.009	-1.580	-1.038	-1.609	-1.039
	(0.060)	(0.061)	(0.060)	(0.063)	(0.093)	(0.094)	(0.093)	(0.097)	(0.268)	(0.274)	(0.269)	(0.287)
Herfindahl Index	0.005			0.016	-0.008			0.007	-0.003			0.042
	(0.003)			(0.003)	(0.073)			(0.006)	(0.010)			(0.011)
Herfindahl Index $\times \tau$	0.034			0.007	0.073			0.025	0.231			0.018
	(0.012)			(0.013)	(0.019)			(0.020)	(0.055)			(0.060)
Export Status		-0.110		-0.118		0.096		0.082		-0.050		-0.060
		(0.007)		(0.008)		(0.012)		(0.012)		(0.026)		(0.027)
Export Status $\times \tau$		0.154		0.188		-0.400		-0.351		-0.934		-0.855
		(0.034)		(0.036)		(0.048)		(0.049)		(0.159)		(0.168)
Input Tariffs (τ^m)		-0.092		-0.082		-0.459		-0.482		-0.055		-0.601
		(0.050)		(0.052)		(0.095)		(0.097)		(0.265)		(0.285)
Import Status		0.044		0.040		0.013		0.010		0.067		0.053
		(0.009)		(0.010)		(0.016)		(0.016)		(0.037)		(0.039)
Import Status $\times \tau^m$		-0.139		-0.107		0.054		0.092		-0.368		-0.212
		(0.069)		(0.071)		(0.102)		(0.104)		(0.378)		(0.397)
Skill Intensity			0.031	0.040			0.044	0.075			-0.057	-0.039
			(0.017)	(0.017)			(0.027)	(0.028)			(0.049)	(0.051)
Skill Intensity $\times \tau$			0.056	-0.021			-0.115	-0.253			0.705	0.257
			(0.084)	(0.086)			(0.121)	(0.124)			(0.342)	(0.358)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	172186	172186	172186	172186	95111	95111	95111	95111	33848	33848	33848	33848

Notes: Standard errors are in parentheses.

Table I.5: Debt Financing and Productivity, 1997-1998, Full Table

Dependent Variable: Solow Residual (a_{it})						
	Full Sample			Positive Debt Holdings		
Foreign Ownership (f)	0.241	0.237	0.181	0.147	0.124	-0.026
	(0.052)	(0.052)	(0.053)	(0.136)	(0.135)	(0.136)
Debt/Capital (d/k)		0.000002	0.0001		-0.00001	0.0001
		(0.00005)	(0.00005)		(0.0001)	(0.0001)
$f \times d/k$		0.011	0.011		0.010	0.010
		(0.004)	(0.004)		(0.004)	(0.004)
Output Tariff (τ)	0.014	0.021	0.017	-0.352	-0.318	0.004
	(0.094)	(0.094)	(0.225)	(0.214)	(0.213)	(0.497)
$f \times \tau$	-1.821	-1.766	-1.179	-2.576	-2.334	-1.131
	(0.286)	(0.286)	(0.291)	(0.694)	(0.698)	(0.720)
$d/k \times \tau$		0.0001	-0.0001		0.0002	-0.00002
		(0.001)	(0.001)		(0.001)	(0.001)
$f \times d/k \times \tau$		-0.245	-0.233		-0.214	-0.207
		(0.093)	(0.092)		(0.100)	(0.099)
Herfindahl Index			-0.003			-0.016
			(0.011)			(0.025)
Herfindahl Index $\times \tau$			-0.044			0.069
			(0.064)			(0.139)
Export Status			-0.057			-0.116
			(0.029)			(0.059)
Export Status $\times \tau$			-1.033			-1.086
			(0.181)			(0.367)
Input Tariffs (τ^m)			-0.871			-1.085
			(0.283)			(0.619)
Import Status			0.068			0.176
			(0.039)			(0.089)
Import Status $\times \tau^m$			-0.375			-0.788
			(0.397)			(0.953)
Skill Intensity			-0.139			-0.222
			(0.052)			(0.126)
Skill Intensity $\times \tau$			1.057			1.577
			(0.384)			(0.909)
Year-Island Effects	Yes	Yes	Yes	Yes	Yes	Yes
Plant-Specific Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	No	No	Yes	No	No	Yes
No. of Obs.		33848			7408	

Notes: Standard errors are in parentheses.

Table I.6: Entry Cohorts

Dependent Variable: % of Entry Cohort with Foreign Ownership									
	All Foreign Firms			Greenfield FDI			Brownfield FDI		
Output Tariffs (τ)	0.064	0.175	0.272	0.028	0.046	0.070	0.035	0.129	0.203
	(0.088)	(0.146)	(0.154)	(0.067)	(0.111)	(0.118)	(0.069)	(0.115)	(0.121)
τ in Similar Industries		0.138	0.045		0.099	0.069		0.039	-0.024
		(0.156)	(0.166)		(0.119)	(0.127)		(0.123)	(0.131)
Input Tariff (τ^m)	0.216	-0.205	-0.466	0.283	-0.139	-0.255	-0.068	-0.067	-0.211
	(0.282)	(0.333)	(0.366)	(0.216)	(0.254)	(0.280)	(0.222)	(0.262)	(0.288)
(τ^m) in Similar Industries		0.157	0.175		0.491	0.498		-0.334	-0.324
		(0.376)	(0.390)		(0.287)	(0.299)		(0.296)	(0.307)
Exchange Rate	0.018	0.021	0.028	0.011	0.014	0.014	0.008	0.006	0.013
	(0.004)	(0.005)	(0.008)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input Tariffs Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Crisis Dummies	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
No. of Obs.	2197	1833	1833	2197	1833	1833	2197	1833	1833

Notes: Standard errors are in parentheses.