

# Growing into Export Markets: The Impact of Exporting on Firm-Level Investment in Indonesia

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## Abstract

This paper documents the impact of exporting on capital accumulation across heterogeneous manufacturing firms in Indonesia. We find that entering export markets significantly increases investment behavior during the year of initial entry and for as much as three years after entry. Our results imply that the investment rate among new exporters is 37 percent higher than non-exporters in the year of entry and 14-26 percent higher in the three years after entry. Using detailed data on firm ownership, we further show that foreign-owned affiliates invest at systematically higher rates upon entry into export markets. Our estimates indicate that domestically-owned exporters are potentially credit constrained and suggest that improving credit market access may increase the investment rate among domestic exporters by as much as 40 percent in the year of entry.

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Since the 1960s numerous East Asian countries have witnessed unprecedented economic growth rates. Not surprisingly, international success in a variety of manufactured goods markets has lead numerous researchers to study the determinants of export growth among East Asian manufacturers and the consequent impact of exporting on manufacturing efficiency. This paper contributes to this literature by studying the link between exporting and investment in physical capital. An emerging line of research strongly argues that new exporters are often restricted by a lack of physical and working capital and, because of this, make systematically smaller entries into export markets. We find that exporting increases the investment rate among new exporters by 3.9 percentage points in the year of entry and that this increase remains 2 to 3 percentage points higher for at least 3 years after first entry into export markets. This represents 14-37 percent increase in the total investment in physical capital of the average exporting firm.

Our analysis, covering the period between 1990-2000, is based on detailed firm-level data from the Census of Indonesian Manufacturing Plants. We document that our primary results are robust across different samples, types of capital, firm-size and ownership. In each case we find that new exporters are strongly increasing their capital holdings upon entry into export markets. Our most striking results pertain to the differences across similar firms with different types of ownership. We exploit observed differences in firm ownership to capture idiosyncratic variation in access to foreign credit markets. We find that foreign firms increase the capital holdings by much larger amounts and over a much shorter time period relative to domestic firms. In the year of initial entry, we find that exporting increases investment 76 percent faster among foreign firms, relative to domestic firms. However, while domestic exporters continue to invest at a higher rate than comparable non-exporting domestic firms over the three years after initial entry, we only observe significant differences between foreign exporters and comparable foreign non-exporters in the year of initial entry.

A large number of recent papers indicate that exporting and investment are highly complementary activities. Pratap and Urrutia (2004) develop a quantitative model of the impact of the 1994 Tequila crisis on firm, export and investment dynamics. They find that exporting is found to strongly increase aggregate investment. Rho and Rodrigue (2012) and Ahn and

McQuoid (2012) argue that there exists strong empirical evidence that many new exporters are subject to increasing marginal costs, largely arising from a lack of physical capital upon entry. Further, Riano (2011) and Rho and Rodrigue (2012) demonstrate that this feature is important for capturing firm-level investment behavior, survival and revenue growth in dynamic models of exporting and investment. A number of studies have demonstrated that allowing for a fixed input, such as physical capital, has an important role in heterogeneous firm models of international trade (Soderbery, 2010; Nguyen and Schaur, 2011; and Blum, Claro and Horstmann, 2011; Vannoorenberghe, 2012). They find that the assumption of a fixed production input (such as capital) or fixed short-run capacity allows their models to rationalize the correlation of domestic and export sales and/or the volatility of sales among exporting firms. They do not document, however, the extent to which these market trade-offs encourage firms to expand capital holdings as they grow into export markets or the length of time required to accomplish these changes.

Our study differs from the existing literature in three important respects. First, we study changes at the firm level during and after entry into export markets. This allows us to characterize how firms build up capital holdings over time in response to exporting. Second, our study has an explicit focus on the impact of exporting on firm-level investment. While preceding research has convincingly argued that working capital (e.g. Manova and Yu, 2014) is a key determinant of export outcomes, very few studies have the extent to which exporting affects the incentive to invest as they grow into export markets. We provide complementary evidence which suggests that as firms enter into export markets, their investment behaviour reflects key changes in the demand for existing capital. Third, our firm-level data allows us to characterize the difference in investment behaviour across foreign and domestic firms upon entry into export markets. While existing evidence indicates that foreign firms, with better access to credit markets, have much better export performance (as in Manova, Wei and Zhang (2014) for example), we provide evidence of changes *within* firms which are consistent with the interpretation that new exporters are often credit constrained.

It is well known that across countries exporting firms are typically among the largest and most productive firms in a given industry and, not surprisingly, more likely to invest.<sup>1</sup> In this

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<sup>1</sup>Early contributions include those from Aw and Hwang (1995), Bernard and Jensen (1995, 1999), Tybout and

context disentangling correlation and causality is of utmost importance for policymakers, but also poses numerous challenges for researchers. To address this issue we use propensity score matching to assess the effect of exporting on investment. Matching methods allow us to create the missing counterfactual of an exporting firm had it not entered export markets. We then combine propensity score matching with a difference-in-difference approach. The impact of exporting is inferred from the average divergence in the investment paths between each new exporter and its matched control firm. Our approach directly addresses concerns with reverse causality and omitted variable biases.

Although few papers have studied capital accumulation and exporting, a number of recent related papers have emphasized the importance of financial frictions in determining export outcomes across firms, industries and countries. Manova (2013), Aisen et al. (2011), Ahn and McQuoid (2012), Manova, Wei and Zhang (2014), Kohn, Leibovici and Szkup (2012) and Manova and Yu (2014) all suggest that the presence of firm-level financial frictions affect export decisions and growth. Naturally, financial frictions will also affect investment. A large number of papers argue that multinational corporations are able to relax financial constraints for affiliates located in developing countries. For example, Blalock, Gertler and Levine (2008) use observable differences in ownership structure to demonstrate that foreign owned firms in Indonesia, *certeris paribus*, invested at a higher rate than domestic firms as the domestic credit market tightened during the Asian crisis.<sup>2</sup> They argue that a key reason for the observed difference in the investment rate arises naturally since foreign owned firms are likely to have much better access to foreign credit markets. As noted in Bond, Tybout and Utar (2014), small firms in developing countries are likely to have to finance investment from internal saving. If financial frictions impede export-associated investment we might expect to observe sizable differences in

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Westbrook (1995), Clerides, Lach and Tybout (1998) and Aw, Chung and Roberts (2000) among others. Bustos (2011) and Lileeva and Trefler (2011) suggest that new exporters have a strong incentive to invest as they enter export markets though neither paper quantifies the extent firm-level capital holdings evolve with entry into export markets. Manova and Yu (2014) indicate that firm-level differences in capital structure strongly influence the mode of firm-level exporting. We add to this literature by quantifying the extent to which exporting *affects the rate* of within-firm capital growth and subsequent firm-level investment decisions and outcomes.

<sup>2</sup>Other supporting evidence includes Antràs, Desai and Foley (2009) and Carluccio and Fally (2012) who document the activities of US and French MNCs, respectively. Similarly, Bustos (2007) shows that Argentine firms in sectors more reliant on external finance are more likely to be foreign owned and funded. Huang et al. (2008), Héricourt and Poncet (2009) and Girma, Gong and Görg (2008) document that FDI helps private domestic firms in China overcome credit constraints and accelerate innovation activities.

our context across ownership, time and lending regimes in Indonesia.

This paper provides complementary evidence to these findings. In particular, we document that while domestic firms grow capital holdings slowly over time, foreign firms tend to invest heavily in the first year of exporting. In the presence of fixed (non-convex) investment costs we expect that investment will tend to be lumpy. As such, we would expect that unconstrained firms would choose to optimally adjust their capital holdings by a relatively large amount in a small number of years, while credit-constrained firms are more likely to have to self-finance investment over time. Given the prominent role that export promotion has in the growth strategy of many developing countries, our results shed light on the impact of financial reform on export growth.

The next section provides a model of investment and exporting to motivate our empirical approach. Section two describes our empirical strategy and section three describes the Indonesian manufacturing sector and the data used to study firm-level investment and export behavior. The fourth section presents our empirical model, while section five presents both our main results and robustness checks. Section six investigates whether differential investment patterns across foreign and domestic exporters is consistent with the hypothesis that new domestic firms are credit constrained. The last section concludes.

## 1 A Simple Model of Investment and Exporting

To facilitate our empirical analysis we present a simple model of investment and exporting. Consider a set of horizontally differentiated manufacturing firms in a developing country which each produce one variety which can be sold at home in the domestic market or abroad through export sales. Each firm produces according to a Cobb-Douglas production function  $q_{jt} = e^{\omega_{jt}} k_{jt}^{\alpha_k} l_{jt}^{\alpha_l}$  where  $q$  is the firm's total production,  $\omega$  is firm-specific productivity and  $k$  and  $l$  are firm  $j$ 's current holdings of capital and variable inputs, respectively. We assume that variable inputs can be freely adjusted each period, but investment in physical capital only becomes productive the year after the initial investment. We can write firm  $j$ 's short-run marginal cost function as:

$$\ln mc_{jt} = -\ln \alpha_l - \frac{\alpha_k}{\alpha_l} \ln k_{jt} - \frac{1}{\alpha_l} \omega_{jt} + \ln w_t + \frac{1 - \alpha_l}{\alpha_l} \ln q_{jt}^* \quad (1)$$

where  $w_t$  is a set of relevant input prices and  $q_{jt}^*$  is the target, profit-maximizing level of output. Equation (??) implies that firms with larger capital stocks incur lower marginal costs, *ceteris paribus*. As such, more capital-intensive firms will be more likely to export.

Productivity evolves according to the Markov process,  $\omega_{jt} = f(\omega_{jt-1}) + \epsilon_{jt}$  where  $\epsilon_{jt}$  is an *iid* productivity shock. Likewise, the firm-level capital stock evolves over time,  $k_{jt} = (1 - \delta)k_{jt-1} + i_{jt-1}$ , where  $i_{jt-1}$  is the firm's total investment in physical capital in period  $t - 1$  and  $\delta$  is the per-period depreciation rate on physical capital.

Firms incur further costs when they choose to invest or export. We write the firm's investment cost function,  $C(i_{jt}, k_{jt}, \xi_j)$ , as

$$C(i_{jt}, k_{jt}, \xi_j) = c(i_{jt}, k_{jt}, \xi_j) + F_{jt}^{\xi_j} 1[i_{jt} > 0] \quad (2)$$

where  $\xi_j$  is an indicator variable capturing whether the firm is owned by foreign ( $\xi_j = 1$ ) or domestic ( $\xi_j = 0$ ) investors.<sup>3</sup> We maintain standard assumptions on the nature of convex investment costs,  $c(0, k_{jt}, \xi_{jt}) = 0$ ,  $c_1 = \frac{\partial C}{\partial i_{jt}} > 0$ ,  $c_2 = \frac{\partial C}{\partial k_{jt}} < 0$ ,  $c_{11} = \frac{\partial^2 C}{\partial i_{jt}^2} > 0$ ,  $c_{22} = \frac{\partial^2 C}{\partial k_{jt}^2} > 0$ . We also assume that firms have to pay a fixed investment cost  $F_{jt}$  in order to invest<sup>4</sup> where  $F_{jt}$  is independently drawn from the distribution  $G_\xi^I$  for each firm in each year. This assumption allows otherwise identical firms to make different investment decisions, as is commonly observed in the data. However, we further allow foreign firms, which are commonly associated with better access to foreign credit (see Blalock, Gertler and Levine (2008) and Manova, Wei and Zhang (2014)) to systematically have lower convex,  $c_3 = \frac{\partial C}{\partial \xi_j} < 0$ , and non-convex investment costs,  $E[F|\xi_j = 1] - E[F|\xi_j = 0] < 0$ .

Similarly, we allow that entering foreign markets may require additional fixed entry costs,  $C_X(d_{jt}, d_{jt-1}, \xi_j)$ , which may depend on the firm's export history:

$$C_X(d_{jt}, d_{jt-1}, \xi_j) = F_{Xjt}^{\xi_j} d_{jt} d_{jt-1} + S_{Xjt}^{\xi_j} d_{jt} (1 - d_{jt-1}) \quad (3)$$

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<sup>3</sup>We abstract from changes in ownership status since we observe relatively few ownership changes over time in our sample data.

<sup>4</sup>Both convex and non-convex parameters have been found to be important for capturing firm-level investment dynamics in the US (Cooper and Haltiwanger, 2006) and Indonesia (Rho and Rodrigue, 2012).

where  $d_{jt}$  takes a value of 1 if firm  $j$  exports in year  $t$  and is zero otherwise. As with fixed investment costs we assume that the export entry costs  $F_{Xjt}^{\xi_j}$  and  $S_{Xjt}^{\xi_j}$  are independently drawn from the distributions  $G_F^{\xi}$  and  $G_S^{\xi}$ , respectively. We write sunk and fixed export costs as a function of ownership to emphasize that foreign ownership will also likely affect the costs of entry into export markets. If the initial entry into export markets is more costly than subsequent entries into export markets we expect that  $E[S_{Xjt}^{\xi_j=1}] > E[F_{Xjt}^{\xi_j=0}]$ .

We assume that both domestic and foreign markets are monopolistically competitive, but segmented from each other. The maximized profit function for firm  $j$  at time  $t$  (before investment costs) is:  $\pi_{jt} = \pi_t(k_{it}, \omega_{jt}, d_{jt}, d_{jt-1}, A, A^*)$  where  $A$  and  $A^*$  capture market-specific demand shifters (e.g. size, income) in domestic and foreign markets, respectively.<sup>5</sup> Given the firm's state  $s_{jt} = (k_{it}, \omega_{jt}, d_{j,t-1}, \xi_j, A, A^*)$ , we can write the firm's recursive problem as

$$V_{jt}(s_{jt}) = \max_{d_{jt}, i_{jt}} \pi_{jt}(s_{jt}, d_{jt}) - C(i_{jt}, k_{jt}, \xi_j) - C_X(d_{jt}, d_{jt-1}, \xi_j) + \beta E_t V_{jt+1}(s_{jt+1}) \quad (4)$$

where  $E_t V_{jt+1}(s_{jt+1}) = \int_{\omega'} V_{jt+1}(s') dF(\omega' | \omega_{jt})$ . If the firm does not choose to invest ( $i_{jt} = 0$ ), the firm's capital stock will fall and the firm's marginal costs of production, for the same level of output, will rise next period. Conversely, if the firm invests enough to increase its capital stock in period  $t + 1$  the firm's marginal costs will fall. The first-order condition for the investment decisions for either exporters and non-exporters can be written as

$$c_1(i_{jt}, k_{jt}, \xi_j) = \beta E_t \frac{\partial V_{jt+1}(s_{jt+1})}{\partial i_{jt}} \quad (5)$$

The left side of (5) is the marginal cost of adjustment and is independent of the firm's export decision or history. The right side is the expected marginal gain and includes the effects on both the intensive (the amount of investment) and extensive margins (whether to invest or not).

The net benefit to exporting, conditional on the firm's investment decision, can be described

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<sup>5</sup>We abstract from the firm's decision to enter multiple export markets because our data do not reveal the number of export markets entered by any particular firm.

by the value functions. We write the marginal benefit from exporting,  $MBE$ , for any firm as:

$$\begin{aligned}
 MBE_{jt} = & \underbrace{\pi_{jt}(s_{jt}, d_{jt} = 1) - \pi_{jt}(s_{jt}, d_{jt} = 0) - C_X(d_{jt}, d_{jt-1}, \xi_j)}_{\text{Initial Gain/Loss}} \\
 & + \underbrace{\beta E_t[V_{jt+1}(s_{jt+1}, d_{jt} = 1) - V_{jt+1}(s_{jt+1}, d_{jt} = 0)]}_{\text{Future Gain/Loss}}
 \end{aligned} \tag{6}$$

The marginal benefit to exporting captures both the current profits from exporting and the expected future gains from exporting. It is clear from equation (??) that current investment choices will vary firm-level differences in productivity, capital holdings and ownership and, as such, we will need to control for these firm attributes in our empirical exercise. For any given firm the initial gain captures the difference in operating profits associated with exporting and any direct export entry costs. The expected marginal gain from investment depends upon the firm's export decision. If entering export markets lowers the costs of future exporting, through sunk export costs for example, firms will be more likely to export in future years. In our model this raises the marginal value of capital and in turn encourages greater investment. Further, if the cost of investment is lower for foreign firms then we expect that these firms will in turn respond by stronger investment when entering export markets. Note that this does not imply that all investment for exporting will occur in the year of entry or afterwards; non-exporting firms may invest in the current period with the prospect of future exporting.

## 1.1 Model Predictions

Our model, though simple, presents a number of key, testable predictions. We enumerate three key predictions which we proceed to examine in our empirical model:

1. Exporting firms will increase investment upon entry into export markets.
2. The adjustment of capital stock to exporting occurs over time, particularly among firms with poor access to credit markets.
3. In presence of non-convex investment costs, new foreign exporters will expand faster into export markets relative to comparable, credit-constrained domestic exporters.



We proceed by first examining whether exporting has an impact on firm-level investment among new Indonesian exporters over time. We then investigate the role of foreign ownership on export-related investment behavior.<sup>6</sup>

## 2 Empirical Strategy

The aim of our empirical strategy is to identify the causal impact of exporting on investment. As such, a primary concern is endogeneity of the decision to export on the estimated impact on investment. As a first step we eliminate all firms which export during 1990 to focus on the sample of initial non-exporters. Letting  $d = 1$  for a new exporter and 0 otherwise, the measured impact of exporting on the physical investment rate can be defined as

$$E[r_t(d = 1) - r_t(d = 0)|d = 1] = E[r_t(d = 1)|d = 1] - E[r_t(d = 0)|d = 1] \quad (7)$$

where  $r_t = \frac{i_t}{k_t}$ ,  $i_t$  captures the current investment rate and  $k_t$  is the firm's stock of capital in year  $t$ .<sup>7</sup> Our strategy is to then use a difference-in-difference technique to compare the performance of new exporters with that of similar firms who choose not to export. The right-hand side of equation (7) captures the difference between the performance paths of firms which started exporting (the first term) and the performance paths of the same firms should they not have started exporting (the second term). Clearly, we observe each firm as an exporter or non-exporter in any year and never both, so that the second outcome is an unobserved counterfactual. It has been shown that as long as relevant differences between two firms can be captured by the observable (pre-treatment) variables, matching methods yield an unbiased estimate of the treatment impact (Dehejia and Wahba, 2002). The key underlying assumption is that conditional on the observable characteristics that are relevant for the export decision,  $X$ , potential outcomes for exporting (treated) and non-exporting (untreated) are orthogonal to treatment status,  $(r_t(d = 1), r_t(d = 0)) \perp d|X$ . The implication is that our matched pairs

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<sup>6</sup>Further discussion of our model and a brief examination of the investment policy functions across exporting and non-exporting firms as in Strebulaev and Whited (2012) can be found in the Supplemental Appendix.

<sup>7</sup>In the model we abstract from the possibility of capital sales and, as such,  $r_t$  captures the gross investment rate. However, here we adjust total new investment by subtracting capital sales in the few instances where firms are selling off existing capital stock to capture the firm-level increase in capital holdings.

exhibit similar performance under the same circumstances

$$\begin{aligned}
E[r_t(d=1) - r_t(d=0)|d=1] &= \left[ E[r_t(d=1)|X, d=1] - E[r_t(d=0)|X, d=0] \right] \\
&- \left[ E[r_t(d=0)|X, d=1] - E[r_t(d=0)|X, d=0] \right] \\
&= \left[ E[r_t(d=1)|X, d=1] - E[r_t(d=0)|X, d=0] \right] \quad (8)
\end{aligned}$$

The first difference in equation (??) captures the causal effect of exporting on physical investment. The second difference captures the selection bias. The key assumption in our method is that this term is assumed to be zero conditional on  $X$ . It represents the difference between the exporting firms, should they not have exported, and those that did not export, in the same state.

In our setting, we use the predicted probability of entry into export markets as the propensity score and compare the performance of firms matched on this basis. This technique is particularly attractive in this context as there are a large number of observable variables with significant predictive power for determining whether a firm will enter into export markets. As noted by Rosenbaum and Rubin (1983) propensity score matching provides a natural weighting scheme that yields unbiased estimates of the treatment impact. Blundell and Costa Dias (2000) highlight the benefits of combining propensity score matching with difference-in-difference methods for controlling observable and unobservable differences between treatment and control units. They emphasize that matching accounts for differences in observable characteristics while difference-in-differences methods allows for an “unobserved determinant of participation as long as it can be represented by separable individual and/or time-specific components of the error term.” In our case, examples would include a particular firm entering export markets because of its knowledge of export markets or the superior performance of the firm manager.

### 3 Data

The primary source of data is the Indonesian manufacturing census between 1990 and 2000. Collected 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. Although

our data is collected at the plant-level, Blalock, Gertler and Levine (2008) report that 95% of the plants in the Indonesian manufacturing census are separate organizational entities and, as such, we will use the terms plant and firm interchangeably in this context. The data record plant-level information covering industrial classification, revenues, intermediate inputs, exports, and foreign ownership. Data on revenues and inputs are deflated with wholesale price indices. As described in the appendix we use this information to construct a firm-level measure total factor productivity following Caves et al. (1982).<sup>8</sup> In every year except 1996, the data also include detailed annual observations of the estimated value of fixed capital, new investment and capital sales across five types of capital: land, buildings, vehicles, machinery and equipment, and other capital not classified elsewhere. The capital stock and investment series are created by aggregating data across types. We deflate capital using a wholesale price indices for construction, imported electrical and non-electrical equipment and imported transportation equipment. In 1990, there are 13,641 manufacturing plants that contain a full set of information, while by 2000 the data covers 18,211 plants.<sup>9</sup>

### 3.1 Investment and Export Moments

Key features of the investment and export sales data are summarized in Table 1. While only 25 percent of non-exporters are actively investing in new capital, 46 percent of new exporters are increasing their capital stock. While only 13 percent of firms export, among exporters, export sales represent nearly 64% of total sales.<sup>10</sup> As such, perhaps it is not as surprising that the investment rate among new exporters is nearly double that among non-exporters. The last of Table 1 row restricts our attention to firms that are both investing and exporting in the same year. We find that the correlation between log export sales and log investment is strongly

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<sup>8</sup>Price deflators are constructed as closely as possible to Blalock and Gertler (2004) and include separate deflators (1) output and domestic intermediates, (2) energy, (3) imported intermediates and (4) export sales.

<sup>9</sup>We omit firms for which there is missing investment and capital information. 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 discussion of the capital measure and a further comparison with other studies can be found in the Supplemental Appendix.

<sup>10</sup>As noted in Lu (2010), high export intensities are common both in China and Indonesia. Likewise, high export intensities among exporters are a well-established feature of Indonesian exporting given a strong degree institutional support for exporters in Indonesia since the early 1980s, such as export promotion zones (Madani, 1999). Naturally, to the extent that these policies influence the nature of firm entry into export markets, they will also affect the responsiveness of the physical investment.

positive.

While Table 1 suggests that exporting is positively associated with investment, it is not clear that these differences are statistically significant. As such, we consider a simple regression of the firm's investment rate,  $r_{jt} = i_{jt}/k_{jt}$ , on its export status,<sup>11</sup>

$$r_{jt} = \beta_0 + \beta_x x_{jt} + \epsilon_{jt} \tag{9}$$

where  $x_{jt} \in \{0, 1\}$  is a binary variable which takes a value of one if the firm exports in year  $t$  and  $\epsilon_{jt}$  is an error term. Table 2 documents OLS estimates of coefficients from equation (9). In each case we include province, year and industry (ISIC 4-digit) dummies. We find that the investment rate among exporters is 5.7 percentage points higher than that among non-exporting firms. While this appears to be a moderate increase in the investment rate, it represents a drastic difference in investment behavior. The average investment rate among exporting firms is only 10.7 percent. As such, the export premium for exporters, 0.057, represents over half of new investment among new exporters during the year of entry. Rows (2)-(8) repeat the experiment for different dimensions of our data. Specifically, we separately examine the investment in machinery alone, investment among domestic and foreign firms, investment before and after the Asian crisis, and among small and large firms. In each case, the investment rate among new exporters ranges between 5 and 6 percentage points greater than that among non-exporters.

Although these initial results are striking, there are a number of alternative explanations for the statistically significant relationship between exporting and investment. For instance, our estimates likely reflect unobserved differences across firms. As our model suggests more productive firms are likely to invest at a higher rate. In the second panel we re-estimate equation (9) with firm-level fixed effects. To the extent that key firm-level differences, such as productivity, are persistent over time, we expect that the firm-level fixed effects will at least partially control for these factors. Across all rows the export premia coefficients are now estimated to be

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<sup>11</sup>Alternatively, we considered the log of new investment as our dependent variable. While it yielded similar results, its use required dropping many firms in our sample because the firm chose not to invest or was reducing its capital holdings. Moreover, we would be unable to perform analysis over time since only a portion of our sample invests continuously over time.

substantially smaller, though in most cases strongly significant. In the full sample, we find that exporters invest 1.2 percentage points faster than non-exporters which represents 11 percent of overall investment among new exporters. Remarkably, when we study foreign firms alone, we observe very little change in the export premium. This suggests that foreign firms may display systematically different investment behaviour to domestic firms, particularly in the fashion that they choose to enter export markets. In contrast, the impact of exporting is insignificantly different from zero in the pre-crisis period or when we examine investment in machinery alone.

## 4 An Empirical Model of Exporting and Investment

To implement propensity score matching we need an empirical model of export entry. We estimate a probit model of the binary decision to enter export markets. In general, the logarithm of observable plant-level characteristics are lagged one year and pertain to the pre-entry period. We believe that observable characteristics are a reasonable starting point since firm-level capabilities in terms of productivity, age, capital stock, skill-intensity or foreign ownership are likely to influence the extent to which firms are able and willing to enter export markets.

The results are presented in Table 3. We observe that the exporting firms differ strongly from non-exporters. In particular, firms with greater TFP are more likely to enter export markets; the coefficient on TFP is significant at standard levels. Further, younger firms, foreign-owned firms, and firms with greater capital holdings are more likely to export.<sup>12</sup> Both average firm-level wages and skill-intensity, measured as the ratio of non-production to production workers, enter negatively in the first stage probit. These findings are consistent with the fact that Indonesia has a comparative advantage in labour-intensive, low skill products. Finally, we have also included the lagged net investment rate to ensure that matches assigned on the basis of propensity score will be homogeneous with respect to prior investment behavior. This variable controls for plants which begin accumulating capital in anticipation of future entry into export markets. Moreover, to the extent that previous investment behaviour is indicative to differences in firm-level access

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<sup>12</sup>The coefficients in Table 3 suggest that for very high levels of productivity or capital we may expect that further productivity or capital increases would cause the probability of exporting to fall. We have investigated this hypothesis and find that for the distribution of productivity or capital in our data we always find that the probability of exporting is always increasing in productivity or capital stock among the set of firms in our sample.

to credit markets we want to be able to match firms closely along this dimension.

The predicted probability of exporting resulting from the model in Table 3 acts as the metric for our matching procedure. We use one-to-one nearest neighbor matching<sup>13</sup> and restrict that any two matched firms must be chosen from the same year and industry. To evaluate our matching procedure we compare the difference between the treated and control group in terms of each of the above variables and compute *t*-statistics for each of the reported variables across 8 bands of the propensity score. In no case do we find statistically significant differences.<sup>14</sup> In the full sample, our matched pairs of firms are less than one percentage point apart in terms of propensity score. Given the similarity of treatment and control firms, we have strong confidence in the resulting comparisons.<sup>15</sup> Finally, in no specification do we ever find statistically significant differences in the investment rates across treated and control firms in the pre-entry year.

## 5 Results

Table 4 reports the difference-in-difference results on the full sample of matched firms. Although both treatment and control groups begin with similar investment rates, they diverge quickly. In particular, exporting firms maintain high investment rates during the entry period while investment rates among the non-exporting control group decline sharply. This pattern reflects the lumpiness of investment. New exporters are likely to be firms which are investing heavily before entry. However, among exporters it will often take several years to expand into export markets; in developing countries where access to credit is relatively tight we might expect that capital accumulation is stretched out over time since many firms have to finance capital expenditures internally. As such, it is not surprising that investment rates remain high among the treated group in all 3 years after initial entry. While it is expected the matched control firms demonstrate similar investment behavior in the pre-entry period, we further observe sharp declines in their investment rates in subsequent years. Among non-exporting firms which are not

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<sup>13</sup>We have repeated our experiment using alternative matching strategies such as increasing the number of control matches (10), local linear regression matching, spline matching and full Mahalanobis matching. Since the main results are very similar across matching strategies we do not present further results below.

<sup>14</sup>This exercise is often referred to as the balancing hypothesis (see Dehejia and Wahba, 2002). The results of this exercise are presented in the Supplemental Appendix.

<sup>15</sup>Recall, that the propensity score measure is bounded by 0 and 100.

actively expanding into export markets, investment is likely to capture the normal replacement of depreciated capital.

The average treatment effect on the treated (ATT) suggests that average investment rate spikes up by 4 percentage points in the year of entry, remains 1-3 percentage points higher for three years after entry. These are all significant at conventional levels and represent large increases in investment behavior.<sup>16</sup> To get a sense of the relative change in investment behavior, we calculate the relative export effect as the ratio of the average treatment effect on the treated to mean investment rate among the treated firms. Relative to the average investment rate among treated firms, the average treatment effect on the treated firms suggests that exporting accounts for 15 to 37 percent of total investment between the year of entry and three years afterwards.<sup>17</sup>

## 5.1 Robustness Checks

Our main sample combines the results across all types of ownership structure, firm-size and time periods. We examine these sources of potential differences in a wide set of robustness checks. The average treatments effects on the treated from each experiment, along with the associated statistical significance, are reported in Table 6. For brevity, we omit the the bootstrapped standard errors, the percentage of investment accounted for by the treatment effects and the difference in propensity scores across treatment and control groups. The interested reader can find a full set of results for each experiment documented in our Supplemental Appendix.

### 5.1.1 Large vs. Small Firms

In this section we investigate differences across firm size. On one hand, small firms may have a greater need to increase capacity as they enter export markets. On the other hand, large firms may be able to secure cheaper financing and, as such, expand more rapidly into export markets.

We define a large firm as any firm which has at least as much capital as the median firm in the

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<sup>16</sup>Bootstrap confidence intervals suggest that the impact of exporting on investment is always strongly significant at the 5 percent level. See the Supplemental Appendix for further discussion.

<sup>17</sup>The reader will notice that the number of matched pairs varies over time. This occurs for two reasons. First, the survey does not collect investment information in 1996. This differentially affects the number of matches which are missing information in any two years; that is, the number of firms missing information for year  $t = -1$  is different than that in year  $t = 0$  and so on. Second, some firms endogenously exit our sample. We address this issue in Section 5.1.

same industry one year prior to entry into export markets.<sup>18</sup> We find that both small and large firms increase investment upon entry into export markets, though the expansion among small firms is moderately larger and is statistically significant in both the year of entry and the first year after entry. This suggests that (a) smaller firms may have stronger incentives to increase capacity upon entry into export markets, (b) large firms are likely to be able to fully adjust to exporting after one year.

### 5.1.2 Foreign vs. Domestic Firms

Here we investigate whether there are systematic differences in the investment behavior of foreign and domestic firms upon entry into export markets. We need to be careful in our definition of what constitutes a foreign firm. As noted above, we first consider any firm where at least 10 percent of firm equity is owned by foreign investors to be foreign owned. Second, in order not to misinterpret the impact of becoming foreign with that from exporting, we define a new foreign exporter as a firm which has been held by foreign investors for at least one year prior to starting to export.<sup>19</sup> We likewise capture our domestic sample in a similar fashion; we define a new domestic exporter as a firm which has been held by domestic owners for at least one year prior to entry into export markets. Finally, note that foreign firms are matched to similar foreign non-exporting firms, while domestic firms are matched to similar domestic non-exporting firms. In this fashion, we are comparing firms which operate with similar access to credit markets.

The estimated average treatment effects on the treated are strongly significant among foreign firms in the year of entry. In the year of entry, the ATT implies a 5.8 percentage point increase in the investment rate among foreign exporters. When we compare the ATT in the year of entry relative to the average investment rate among foreign exporters we find that it explains 42% of total firm-level investment. However, during the following years the ATTs are very small, often negative and never significantly different from zero. This pattern suggests a degree of lumpiness

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<sup>18</sup>We choose to use capital stock as our metric for firm size since existing capital is most closely linked to a firm's ability to secure further financing. We check the robustness of our results with respect to employment. See the Supplemental Appendix for full results.

<sup>19</sup>Arnold and Javorcik (2009) show that firms that receive foreign direct investment tend to experience productivity increases in Indonesia. We choose this definition of foreign firms so that our findings cannot be attributed to MNCs choosing to purchase Indonesian firms with larger capital holdings, better access to credit markets or superior export potential.



in investment consistent with non-convex adjustment costs among foreign firms.

Domestic firms contrast sharply to their foreign counterparts. First, we begin to observe significant differences between treated and control firms in the year of initial entry and these continue during the three years after entry. This result is consistent with the idea that domestic firms may be constrained by financial frictions and, as such, can only adjust capital holdings slowly over time. We find that the investment rate among domestic exporters is 3.3 percentage points higher in the year of entry and 2.0-2.8 percentage points higher in the years following entry. Collectively, these explain approximately 23-34% of overall investment in each year. While our results are suggestive of financial frictions affecting firm-level entry into export markets, they require some caution. In particular, the control firms are likely to differ across subsamples and, as such, it would be incorrect to draw conclusions by comparing the estimated differences between treated and control groups across experiments.<sup>20</sup> Nonetheless, these findings motivate further inquiry into the impact of foreign ownership and financial frictions on firm-level export and investment behavior.

### 5.1.3 Asian Crisis

Our sample covers the 1997-1998 Asian financial crisis. There are two features of the Asian crisis which are of particular interest in our study. First, the onset of the financial crisis caused a sharp contraction in Indonesian GDP. This, in turn, affected the return to exporting relative to producing for domestic consumption. Second, the Asian crisis was reported to have further restricted access to credit during the crisis years (Ito and Sato, 2006).<sup>21</sup>

We investigate this possibility by repeating our exercise before the Asian crisis period (1990-1995) and on the period during and after the Asian crisis (1997-2000).<sup>22</sup> During the crisis period

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<sup>20</sup>For example, the results may indicate differences in demand which vary systematically across foreign and domestic firms.

<sup>21</sup>To the extent that the Asian crisis may have affected firm-level exporting and investment rates, we may expect that our estimates may be biased. On one hand, tighter investment regulation is likely to reduce investment and discourage large entries into export markets. As such, we might expect that our estimates in the full sample could be biased towards zero if the Asian crisis is not adequately controlled for in the full sample. On the other hand, if only the strongest firms are able to export during the Asian crisis we might expect that these exporting firms are very productive and have a strong incentive to invest.

<sup>22</sup>The two sample periods are genuinely disjoint. For instance, while a new exporter in 1995 is included in the pre-crisis sample, but is not analyzed in the years  $t + 1$ ,  $t + 2$  or  $t + 3$ , which are part of the Asian crisis.

exporting appears to have a stronger impact on investment rates after entry. Before the crisis the average treatment effect on the treated is 0.16 in the year of entry; after the crisis the same point estimate is more than three times larger.<sup>23</sup> Our results strongly suggest that as the domestic market contracted sharply during the Asian crisis, export markets were particularly important in determining investment behavior among new exporters.

#### 5.1.4 Disaggregated Investment

In each year our data records how much a given manufacturing firm invests in new machinery and equipment, new vehicles and new buildings and land. To get a sense of the nature of firm-level capital expansion during entry into export markets we repeat our matching exercise separately for each type of capital.<sup>24</sup> To the extent that expansions of firm capacity are most closely associated with the investment in a particular type of capital we might expect that different types of physical capital (e.g. land vs. machinery) to increase at different rates with exporting. Our expectation is that the increase in the firm's productive capacity is most closely associated with the physical machinery and equipment necessary for production. Consistent with our interpretation, we observe highly significant results for investment in machinery and equipment both in the year of initial entry and in the first two years after entry. The point estimates suggest that exporting causes the investment rate for machinery and equipment to increase by 3.6 percentage points in the year of entry and 1.4-3.2 percentage points in the three years after entry. We observe similar, significant increases in vehicles, both in the year of entry and the three years after entry into export markets. In contrast, investment in new land and buildings only increases moderately during the year of entry (1.9 percentage points) among exporting plants and there is no significant difference in any other year.

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<sup>23</sup>Moreover, the  $ATT/\bar{T} \times 100 \approx 16\%$  in year of entry during the pre-crisis period, while this same calculation jumps to 61% during the crisis period.

<sup>24</sup>Because the data for the individual components of investment tends to be much more volatile than that of total investment we trim the bottom and top one percent of each disaggregated investment series before performing our analysis. Among total capital holdings in our data machinery and equipment, buildings and land, and vehicles account for nearly 19, 41, and 8 percent of recorded holdings, respectively. Likewise, among investing firms machinery and equipment, buildings and land, and vehicles account for nearly 40, 26, and 18 percent of new investment, respectively. The remaining investment, capital sales or capital stock is classified as "other investment not classified elsewhere."

### 5.1.5 Perennial Exporters

In general, we follow literature in defining a new exporter as a firm which exports in year  $t$ , but not year  $t - 1$ . Recent literature, such as Blum et al. (2013) show that it is not unusual for firms to exit and re-enter export markets. As such, we wanted to check if our results were robust to a more stringent definition of new entry into export markets by focusing on firms which export for at least three consecutive years after entry into export markets. We find that the impact of exporting on investment is similar to those from the full sample in the year of entry and slightly larger than those found using the main sample thereafter. Specifically, we find that exporting increases the investment rate among new perennial exporters by 3.5 percentage points in the year of entry and 3.6-3.8 percentage points in the first and second years after entry. We do not find any significant difference three years after entry.

### 5.1.6 Definition of a ‘New’ Exporter

Related to the concern outlined immediately above, we might expect that our definition of a new exporter includes numerous firms which are recent exporters. To address this issue we repeat our experiment but restrict the sample such that new exporters are defined as firms which have not exported for at least two years prior to initial entry. Specifically, we repeat our first stage probit exercise to estimate a model of export entry where we only include firms which have not exported for at least two years. We then reconsider our matching experiment on a restricted sample where we define new exporter as firm  $a$  which exports in year  $t$  but has not exported in year  $t - 1$  and  $t - 2$ .

We find that exporting has a similar impact upon entry as that found in the full sample; exporting is found to increase the investment rate by 4.0 percentage points in the first year. Notably, since these firms are slightly smaller than the average firm in our full sample this increase represents a 43 percent of total investment among new exporters in their first year of exporting. We similarly observe statistically significant differences in the subsequent three years after entry where exporting is found to increase investment rates by 1.3-3.6 percentage points in each year.

### 5.1.7 Sample Selection

A potential concern is that our main estimates will be broadly affected by sample attrition. We examine this issue by studying a sample of firms which are in our sample for at least three years. Specifically, the treated sample includes firms which exist for at least one year before entering export markets and one year after entry. In this fashion, none of the new exporters exit the sample immediately after entry into export markets. Likewise, the group of control firms include firms which exist 3 consecutive years but never export. Despite the additional sample restriction we find very similar results to those found in the full sample both in terms of size and significance. Specifically, we find average treatment effects on the treated of 2-4 percentage points, all of which are statistically significant.

## 6 Foreign Exporters, Investment and Credit Constraints

We now turn our attention to the differences in investment behavior between foreign and domestic firms upon entry into export markets. In particular, we are interested in identifying differences across domestic and foreign exporters which are consistent with the impact of financial frictions on firm-level investment rates. In this experiment, we regress the investment rate in year  $t+l$  on dummy variables capturing the firm export and ownership status and a large set of control variables where  $l = 0, 1, 2, 3$ . The idea is to capture differences in firm-level investment rates across foreign and domestic firms in comparison to a given set of control firms. Specifically, the variable  $x_{jt}^d$  takes a value of 1 if a domestic firm is a first-time exporter in year  $t$  and 0 otherwise. Likewise, the variable  $x_{jt}^f$  similarly takes a value of 1 if the firm is simultaneously a first time exporter in year  $t$  and owned by foreign investors.<sup>25</sup> Finally, we also include a large number of controls for firm-level characteristics in the pre-entry year, on the right-hand side. This leads us to consider the following specification

$$r_{j,t+l} = \alpha_0 + \alpha_d x_{jt}^d + \alpha_f x_{jt}^f + \beta X_{j,t-1} + u_{jt} \quad (10)$$

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<sup>25</sup>Our definition of a foreign firm is as before. For a firm to be considered foreign at least 10 percent of equity must be held by foreign investors before entry into export markets

where  $X_{j,t-1}$  includes firm-level measures of productivity, age, capital stock, average wages, skill-intensity and the investment rate in the pre-entry year.<sup>26</sup> Importantly, we include a dummy variable which captures the firm’s ownership status as an explanatory variable. This implies that  $\alpha_f$  will capture the impact of exporting on investment above and beyond any investment premium that pertains to foreign firms in and of themselves.

We expect that the domestic export premium  $\alpha_d$  will be positive and significant in numerous years after initial entry into export markets, while foreign exporters will have a positive export premium  $\alpha_f$  in only one or at most two years around export entry. A positive and significant difference between the foreign and domestic export premia,  $\alpha_f - \alpha_d > 0$ , would represent evidence of underinvestment by domestic firms upon initial entry.

In the spirit of our previous matching exercise we consider a set linear regressions on a sample of matched firms. Our intention is to minimize the impact of unobserved shocks which may affect the treated and control groups differently (Meyer, 1995). Given that foreign and domestic firms are likely to operate under different institutional structures and have differing access to credit markets, we might worry that unobserved shocks may affect non-exporting firms differently than exporting firms. Matching firms by their propensity scores allows us to control for these potential unobserved shocks. For each new exporter, foreign or domestic, we use our previous propensity score matching technique to find a similar control firm as a match.<sup>27</sup>

Consistent with our previous results, the estimates in Table 6 suggest that domestic exporters increase their investment rate by 2-3 percent in the years around entry into export markets. As expected, these coefficients are significant at conventional levels from the year of entry all the way through three years after entry. In contrast, the export premium among foreign firms is more than double that of domestic exporters in the year of entry and strongly significant.

Our primary interest is the difference between  $\alpha_f$  and  $\alpha_d$ , which is large in the year of entry into export markets and also highly significant. This result is strongly consistent with the notion that firms with better access to foreign credit are able to expand capital holdings twice as fast as those without access to foreign credit markets in the year of entry. As noted above, the

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<sup>26</sup>Note that any unobserved differences across firms which influences firm level expectations (e.g. demand differences) will be reflected in firm behavior in the year preceding entry for dynamic variables, such as investment.

<sup>27</sup>Full results are available in the Supplemental Appendix.

difference between  $\alpha_f$  and  $\alpha_d$  does not reflect omitted differences in firm-ownership alone or firm-level productivity; both productivity and ownership are individually included as control variables.

After the first year, however, we do not find a statistically significant difference between foreign and domestic firms. To the extent that credit constraints affect investment among domestic firms, our results would suggest that these are most acutely felt in the year of entry into export markets when foreign firms are able to expand capital stock much more rapidly. This evidence is consistent with the hypothesis that domestic exporters face more stringent credit constraints than their foreign counterparts in an environment where investment in physical capital is subject to non-convex adjustment costs.

## 6.1 Credit Constraints, Foreign Firms and the Asian Crisis

Our preceding results suggest that the impact of exporting on investment may be larger during the 1997-2000 period. As such, a natural concern is that our previous exercise is picking up the effect of the Asian crisis across firms with different types of ownership. To test this hypothesis we repeat our experiment on the period before the crisis, 1991-1995, and compare it the period during the crisis and post-crisis years, 1997-2000.

Table 7 documents the estimated regression coefficients in both matched samples. The impact of exporting on investment in the year of entry rises substantially during the crisis period. However, the gains are nearly identical across foreign and domestic firms. This is consistent with the idea that exports became a particularly important source of revenue when the domestic, Indonesian market contracted during the Asian crisis, but did not systematically differ across foreign and domestic exporters. As such, the estimated impact of exporting on capital accumulation changes very little both in terms of magnitude and significance. Further, even if we only focus on the pre-crisis period we could conclude that foreign exporters tend to expand capital holdings faster than their domestic counterparts upon entry into export markets

## 6.2 Credit Constraints, Foreign Firms and Export Intensity

Credit constraints provide a natural interpretation the differential behaviour between foreign and domestic firms documented above. However, it is possible that this pattern may emerge because foreign firms make systematically larger entries into export markets relative to their domestic counterparts. In this sense, investment among foreign firms may be initially larger simply because they export more intensively immediately upon entry. To address this concern, we repeat our matched sample exercise across two different groups of firms. Specifically, we first determine the average percentage of sales from exports among first year exporters in each industry. Second, in each industry we classify all firms which initially export more than average as “high intensity” exporters and all those which initially export less than average as “low intensity” exporters. Finally, we collect each group of new exporters individually along with their matched non-exporting pairs and repeat the above regression exercise to determine if the observed difference continues to hold across initial export intensity.

Table 8 documents the estimated regression coefficients across export intensities. First, we observe that both foreign and domestic firms increase investment substantially upon entry into export markets; new high-intensity domestic exporters increase their investment rate by 2.7 percentage points relative to comparable firms, while new foreign exporters increase their investment rate by 5.6 percentage points. Despite both domestic and foreign firms making relatively large entries into export markets, we continue to observe that the percentage point increase in the investment rate among new foreign exporters is more than twice that of new domestic exporters. Moreover, this difference is highly significant in the year of entry, but not in any other year after entry, consistent with our previous results. The right panel of Table 8 documents the same estimated coefficients in the matched sample of new, low-intensity exporters. The estimates again report that both foreign and domestic firms increase investment upon entry into export markets and that the relative percentage point increase in the investment rate among new foreign exporters is more than double that observed for new domestic exporters. We note that the observed difference is just shy of the typical standards needed for statistical significance,

though this is not altogether unexpected given the sharp fall in sample size.<sup>28</sup>

In the right panel of Table 8 we also observe that new domestic exporters continue to invest at a higher than comparable domestic non-exporters in the two years after initial entry. In contrast, this is never true for new foreign exporters in either sample. Finally, as before, there is no evidence of any difference between foreign and domestic firms in any year except the initial year of entry despite the fact that these firms share similar export intensities. Although our findings do not rule out that the observed differences are not the result of further unobserved demand differences across foreign and domestic firms, they lend credibility to the hypothesis that the observed investment patterns are at least partially driven by credit constraints.

## 7 Conclusion

This paper documents that exporting has a large impact on firm-level investment. We find that exporting increases firm-level investment by 37 percent in the initial year of entry into export and that firm-level capital stocks continue to adjust to exporting for at least 3 years after initial entry. The estimates are strongly significant for both large and small firms, before and after the Asian crisis and across all types of disaggregated capital holdings, among other robustness checks. Our results further suggest that access to foreign credit markets may have a large impact on firm-level investment patterns upon entry into export markets. We document that new domestic exporters, with relatively poor access to credit markets, accumulate capital slowly over time. In contrast, foreign-owned firms tend to make larger changes in the year of entry, but not otherwise.

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<sup>28</sup>This feature is particularly true among foreign exporters who are more likely to export intensively upon entry.



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## A Estimating Productivity

As suggested by our model, total factor productivity is a key variable in our analysis since firm-level export and investment decisions are largely determined by firm productivity. We measure total factor productivity using a multilateral index developed by Caves et al. (1982). The key advantage of this index is that it allows for consistent comparisons of total factor productivity (TFP) in firm-level panel data.<sup>29</sup> The idea underlying the index is that each firm's productivity is measured relative to a single reference firm. Specifically, the index compares firm  $j$ 's inputs (capital, labor, materials, energy) and output in year  $t$  to a hypothetical reference firm with average input cost shares, average log inputs and average log output:

$$\ln TFP_{jt} = (\ln Y_{jt} - \ln Y_R) - \sum_{m=1}^n \frac{1}{2}(SN_{jmt} + SN_R)(\ln N_{jmt} - \ln N_R)$$

where  $m$  indexes the type of input. As noted above output  $Y$  is measured in real terms along with inputs,  $N$ : labor (the number of employees), materials (real value of materials costs), energy (real value of electricity and fuel) and capital.  $SN$  captures input shares for each input. For example, the labor share is measured as the ratio of the real wage bill to output. The capital share is obtained by assuming constant returns to scale. Finally,  $N_R$ ,  $Y_R$ , and  $SN_R$  are the inputs, output, and input shares of the hypothetical reference firm.

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<sup>29</sup>Van Biesebroeck (2007) compares the robustness of five commonly used measures of productivity (index numbers, data envelopment, stochastic frontier, GMM and semi-parametric estimation). He finds that the index number approach taken here tends to produce very robust results. Arnold and Javorcik (2011) similarly compute firm-level productivity on a similar set of Indonesian firms and report that this measure is strongly robust in their sample. Nonetheless, for robustness, we have also estimated a productivity series for each firm following the methods described in Olley and Pakes (1996) and applied to this data set as in Amiti and Konings (2007). We could not reject the hypothesis of constant returns to scale in any industry. Since the results from the matching exercise were very similar in all cases we have omitted them from the main text.

## B Tables

Table 1: Investment and Export Moments

	All	Non-Exporters	New-Exporters
Average investment rate (I/K)	0.061	0.055	0.104
Inaction frequency	0.724	0.746	0.542
Fraction of observations with negative investment	0.002	0.002	0.003
Average export intensity	0.061	0	0.638
Export frequency	0.131	0	1
Correlation of log export sales and log investment	—	—	0.566

Notes: Table 1 reports investment and export moments. The first row reports the average firm-level investment divided by capital stock. Rows 2 and 3 report the fraction of firms with no (net) investment and the fraction of firms with negative investment, respectively. The fourth row documents the average percentage of sales from exports, while the fifth row reports the fraction of firms which export. Row 6 computes correlation between export sales and investment among investing exporters.

Table 2: Investment Rate and Exporting

	OLS			Firm Fixed Effects		
	Coefficient	Std. Error	$R^2$	Coefficient	Std. Error	$R^2$
All firms/investment	0.057***	(0.002)	0.037	0.012***	(0.003)	0.395
Machinery only	0.049***	(0.004)	0.048	-0.001	(0.004)	0.480
Domestic firms only	0.048***	(0.003)	0.033	0.008***	(0.003)	0.400
Foreign firms only	0.047***	(0.007)	0.082	0.042***	(0.008)	0.441
Pre-Crisis (1991-1996)	0.057***	(0.003)	0.038	-0.005	(0.005)	0.314
Post-Crisis (1997-2000)	0.054***	(0.003)	0.032	0.018***	(0.004)	0.543
Small firms	0.062***	(0.005)	0.032	0.012**	(0.006)	0.543
Large firms	0.046***	(0.003)	0.052	0.011***	(0.003)	0.431

Notes: Table 2 reports the estimates from an OLS regression of the investment rate on a export status dummy variable. Additional controls include 4-digit ISIC industry fixed effects, year fixed effects and region fixed effects. Robust standard errors are clustered at the firm-level. Our sample purposefully excludes existing exporters at the beginning of our sample to focus on new exporters between 1991-2000. The full sample has 154,221 firm-year observations, 95 percent of which are domestically-owned, 55 percent of which occur before 1996. Foreign firms are defined as firms where at least 10 percent of firm ownership is held by foreign investors. We exclude a small number of firms who start exporting in the same year that they are purchased by foreign investors. Large firms are defined as firms which hold more than the average level of capital for their industry in the year before they enter export markets.

Table 3: Probit: Predicting Export Entry

	Coefficient	Std. Error
$\log \text{TFP}_{t-1}$	0.024***	(0.001)
$(\log \text{TFP}_{t-1})^2$	-0.002***	(0.001)
$\log \text{Age}$	-0.200***	(0.010)
$(\log \text{Age})^2$	0.001***	(0.0001)
$\log \text{Capital}_{t-1}$	0.020***	(0.002)
$(\log \text{Capital}_{t-1})^2$	-0.0002*	(0.0001)
$\log \text{Average Wage}_{t-1}$	0.0003	(0.002)
$(\log \text{Average Wage}_{t-1})^2$	-0.001***	(0.0004)
$\log \text{Skill Intensity}_{t-1}$	-0.009***	(0.003)
$(\log \text{Skill Intensity}_{t-1})^2$	-0.001*	(0.0006)
$\text{Foreign Ownership}_{t-1}$	0.047***	(0.005)
$\text{Investment Ratio}_{t-1}$	0.023***	(0.003)
No. of obs.	65,729	
Chi <sup>2</sup>	7,702.09	
Pseudo R <sup>2</sup>	0.233	

Notes: The table reports the coefficients from a probit regression for the decision to export among first time exporters in Indonesia. Four-digit ISIC industry dummies, region (province) dummies and year dummies are included but not reported. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively. We have tried including the square of the lagged investment rate but it is generally estimated to be insignificantly different from zero.

Table 4: Investment Rate and Exporting, Full Sample

	One Year Before Entry	Year of Entry <sup>(a)</sup>	One Year Later <sup>(b)</sup>	Two Years Later <sup>(c)</sup>	Three Years Later <sup>(d)</sup>
Treatment Group: $T$	0.119	0.105	0.088	0.092	0.094
Control Group: $\bar{C}$	0.112	0.066	0.071	0.078	0.068
<b>ATT</b>	0.007 (0.005)	<b>0.039***</b> (0.005)	<b>0.017***</b> (0.006)	<b>0.014*</b> (0.008)	<b>0.026***</b> (0.008)
ATT/ $\bar{T}$		<b>0.371</b>	<b>0.193</b>	<b>0.152</b>	<b>0.277</b>
No. of matched pairs	4,415	4,415	3,213	1,581	1,577
Mean difference in propensity score	0.007	0.007	0.007	0.007	0.008

Notes: The first two lines present the outcomes observed in the given time period. The average treatment effect on the treated (ATT) is presented in the third row along with bootstrapped standard errors in parentheses. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively.

$$\begin{aligned}
 \text{(a) } ATT &= \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}+0}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}+0}^{\text{control}} \right] - \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{control}} \right] \\
 \text{(b) } ATT &= \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}+1}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}+1}^{\text{control}} \right] - \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{control}} \right] \\
 \text{(c) } ATT &= \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}+2}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}+2}^{\text{control}} \right] - \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{control}} \right] \\
 \text{(d) } ATT &= \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}+3}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}+3}^{\text{control}} \right] - \frac{1}{n} \sum_1^n \left[ \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{treated}} - \left( \frac{i}{k} \right)_{\text{entry year}-1}^{\text{control}} \right]
 \end{aligned}$$

Table 5: Investment Rate and Exporting, Robustness Checks

	Average Treatment Effect on the Treated				
	One Year Before Entry	Year of Entry <sup>(a)</sup>	One Year Later <sup>(b)</sup>	Two Years Later <sup>(c)</sup>	Three Years Later <sup>(d)</sup>
Large Firms	0.002	0.033***	0.011	0.014	0.026***
Small Firms	0.021	0.050***	0.030***	0.019	0.013
Foreign Firms	-0.013	0.058***	-0.003	0.015	-0.001
Domestic Firms	0.009	0.033***	0.020***	0.020***	0.028***
Pre-Crisis (1991-1995)	0.005	0.019***	0.019**	0.017*	0.015
Post-Crisis (1997-2000)	0.009	0.061***	0.015*	0.004	0.038***
Machinery and Equipment	-0.005	0.031***	0.014*	0.020**	0.032***
Vehicles	0.009	0.030***	0.013	0.037***	0.038***
Buildings and Land	0.002	0.019***	0.001	0.013	0.006
Perennial Exporters	0.023	0.035**	0.036**	0.038***	0.019
Defn. of a New Exporter	-0.003	0.040***	0.036***	0.013*	0.028***
Sample Selection	0.012	0.040***	0.017***	0.017*	0.020**

Notes: The average treatment effect on the treated (ATT) across robustness checks is documented in Table 5. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively. The average treatment effects on the treated are computed as in Table 4. A full set of results and extended discussion of each robustness check can be found in the Supplemental Appendix.

Table 6: Foreign vs. Domestic Firms Revisited

Dependent Variable: Investment Rate, 1991-2000				
Export Premium	Year of Entry	One Year Later	Two Years Later	Three Years Later
$\alpha_d$ (Dom.)	0.030*** (0.005)	0.015*** (0.006)	0.018** (0.007)	0.020*** (0.007)
$\alpha_f$ (For.)	0.074*** (0.011)	0.025 (0.016)	0.008 (0.021)	0.025 (0.021)
$\alpha_f - \alpha_d$	<b>0.042***</b>	0.010	0.011	0.005
Wald Stat	13.44	0.33	0.22	0.05
p-value	0.0002	0.567	0.636	0.815
Obs.	8,244	6,014	2,976	2,936

Notes: Robust standard errors clustered at the firm-level in parentheses. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively. The total number of observations captures the total number of data points in the regression, not the number of matched pairs.

Table 7: Foreign Firms, Domestic Firms and the Asian Crisis

Export Premium	Year of Entry	Dependent Variable: Investment Rate				Year of Entry	One Year Later	Two Years Later	Three Years Later
		One Year Later	Two Years Later	Three Years Later	Year of Entry				
Pre-Asian Crisis: 1991-1995					Asian Crisis and Post-Crisis: 1997-2000				
$\alpha_d$ (Dom.)	0.011* (0.007)	0.018** (0.007)	0.023*** (0.009)	0.011 (0.010)	0.050*** (0.006)	0.011 (0.008)	-0.00001 (0.014)	0.030*** (0.010)	
$\alpha_f$ (For.)	0.053*** (0.020)	0.028 (0.028)	0.007 (0.027)	0.018 (0.031)	0.092*** (0.012)	0.021 (0.017)	0.030 (0.035)	0.036 (0.028)	
$\alpha_f - \alpha_d$	<b>0.041**</b>	0.010	-0.016	0.007	<b>0.042***</b>	0.010	0.030	0.006	
Wald Stat	3.98	0.15	0.35	0.05	8.98	0.31	0.61	0.04	
p-value	0.046	0.699	0.555	0.829	0.003	0.578	0.436	0.846	
Obs.	4,230	3,220	2,266	1,520	4,014	2,794	710	1,416	

Notes: Robust standard errors clustered at the firm-level in parentheses. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively. Investment data is not collected in 1996.

Table 8: Foreign Firms, Domestic Firms and the Export Intensity

Export Premium	Year of Entry	Dependent Variable: Investment Rate				Year of Entry	One Year Later	Two Years Later	Three Years Later
		One Year Later	Two Years Later	Three Years Later	Year of Entry				
High-Intensity Entrants					Low-Intensity Entrants				
$\alpha_d$ (Dom.)	0.025*** (0.006)	0.008 (0.007)	0.010 (0.009)	0.004 (0.010)	0.024*** (0.006)	0.013* (0.007)	0.019** (0.009)	0.008 (0.010)	
$\alpha_f$ (For.)	0.056*** (0.014)	0.009 (0.020)	-0.006 (0.029)	-0.030 (0.029)	0.054*** (0.018)	-0.002 (0.025)	-0.022 (0.032)	0.060 (0.037)	
$\alpha_f - \alpha_d$	<b>0.031**</b>	0.007	-0.016	-0.034	<b>0.030</b>	-0.015	-0.041	0.052	
Wald Stat	4.05	0.00	0.33	1.31	0.02	0.33	1.59	1.91	
p-value	0.044	0.963	0.564	0.252	0.112	0.568	0.208	0.167	
Obs.	4,584	3,376	1,452	1,428	3,578	2,578	1,494	1,478	

Notes: Robust standard errors clustered at the firm-level in parentheses. \*\*\*, \*\*, \* indicate significance at the 1%, 5%, and 10% levels, respectively. Investment data is not collected in 1996.