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Abstract:
This paper uses micro-data from the World Bank Enterprise Surveys 2002-2006 to investigate how foreign ownership affects the likelihood of manufacturers in developing countries to export and/or import. Applying propensity score matching to control for differences across firms in terms of labor productivity and other characteristics, we find that foreign ownership is an economically important and statistically significant determinant of the likelihood that a firm will export and/or import. Foreign ownership raises the propensity to export by over 17 and the propensity to import by more than 13 percentage points. The effects are even bigger for the lowest-income countries.

Keywords: international trade, multinational enterprise, foreign direct investment, foreign ownership, development, intermediation.

JEL classification: F12, F14, F23, O19

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1 Introduction

Access to world markets is generally considered to be one of the necessary conditions for sustained economic growth and poverty reduction in developing countries (see WTO (2001)). Much has been written on the nexus between international market access and growth at the aggregate level and on export-led growth strategies, for instance, of China or the Asian Tiger countries.[1] By contrast, we have little systematic evidence at the micro level on how firms in developing countries actually connect with foreign customers and suppliers, and on the factors that may help them do so. The current paper focuses on one such factor, namely foreign ownership, and uses microdata from the World Bank Enterprise Surveys 2002-2006 to determine how foreign ownership affects the propensity of manufacturing firms to engage in exporting and/or importing.

It is a well established stylized fact that firms generally face substantial "fixed costs" when accessing export and import markets (Roberts and Tybout (1997)). In the case of developing countries there is reason to believe that these "fixed costs" are especially large relative to firms' own capacity to bear them, and that firms therefore depend on external support. Foreign ownership is likely to provide such support. First, firms in less developed countries are less likely to have the technological and marketing know-how and the foreign contacts to identify potential customers and to produce according to these customers' needs. Moreover, they are less likely to be able to link up with overseas suppliers and to make use of foreign intermediate goods. As suggested by a good deal of research conducted by the World Bank and summarized by Keesing (1983), developing country firms have been surprisingly successful in exporting certain types of consumer goods

[1] See, for instance, Edwards (1993), Frankel and Romer (1999), United Nations (2008) or Rodrik (2007)). The large literature on the role of trade in alleviating poverty in developing countries is surveyed by Bhagwati and Srinivasan (2002), Goldberg and Pavcnik (2004) and Winters et al. (2004). McCaig (2011) finds a strong causal effect of trade on reducing poverty in Vietnam. See also Topalova (2010) for evidence from India.

because they received help from overseas buyers that provided contacts and, more precisely, technical, logistical and management capabilities. Similarly, Gereffi (1999) sees the role of "buyer-driven global commodity chains" as critical to understand why, despite formidable spatial and cultural distances, countries like Japan, South Korea, Taiwan, Hong Kong, Singapore, and now China have been so successful in exporting to Western countries.[2] Foreign ownership is only one way to organize this outside support, but it is likely to be an important one (see also Markusen and Trofimenko (2009)). Second, developing countries tend to have poorly developed financial markets, providing limited financing opportunities for firms (see, for instance, Kletzer and Bardhan (1987) or Beck (2002)). Foreign owners may provide better access to external finance, allowing firms to more easily bear the fixed costs of exporting or importing.

We view foreign ownership in a wider sense as a form of intermediation of international trade. We also observe in our dataset firms that rely on intermediation in a narrow sense, namely by exporting and importing through independent distributors. The use of this indirect as opposed to direct trade is, of course, correlated with foreign ownership. In foreign-owned firms the distribution of exports and imports is likely to be internalized, i.e., carried out within the firm and therefore not directly observable. We would hence expect foreign-owned firms to rely less on independent distributors. Hence it is all the more important to be very precise about the way foreign ownership interacts with firms' own capabilities and the use of independent distributors.

We therefore proceed in two steps, namely by building a simple theoretical model to guide our empirical analysis, and then using propensity score matching to determine the effect of foreign ownership. In the theoretical model heterogeneous firms draw support from foreign ownership when engaging in direct or indirect trade. Selection into direct and indirect modes

[2] Feenstra and Hamilton (2006) provide a detailed discussion of the trade strategies of firms in South Korea and Taiwan.

of trade are thus functions of the firms' productivity (as a measure of its own capabilities) and foreign ownership. In the empirical analysis we establish an effect of foreign ownership on the propensity to export and import directly or indirectly by matching each firm with at least 10% foreign ownership with a control group of firms from the same industry and country that, in terms of their labor productivity, employment and other characteristics, are equally likely to exhibit foreign ownership. By comparing the average export and import propensities of "treated" firms with those of firms in the control group we can isolate the effect of foreign ownership over and beyond the effect stemming from firm productivity and other characteristics that are already well known to be highly correlated with export and import activities of firms.[3]

We find that foreign ownership significantly increases the propensity of firms to engage in international trade, namely by 17.6 percentage points in the case of exporting and by 13.4 percentage points in the case of importing. All of this increase is attributable to direct exporting, respectively importing. The effect of foreign ownership on the propensity to trade is even bigger for firms in low-income countries, namely 25 percentage points for exporting and 16.8 percentage points for importing.

The paper is related to three strands of literature. First, while there is a large literature that explores trade activities at the firm level, few papers focus on the role of foreign ownership, and if they do they study firms in developed countries.[4] An interesting exception is a paper by Manova and Zhang (2009) on exports and imports by Chinese firms. That paper shows that foreign-owned firms trade more on average than local privately owned firms and that their trading relationships tend to be more stable. However, it

[3] See, for instance, Bernard and Jensen (2004) on the firm-specific determinants of trade. The large literature on firm heterogeneity and selection into exporting and importing is surveyed by Greenaway and Kneller (2007) and Wagner (2012).

[4] See, for instance, Raff and Wagner (2014) on the effect of foreign ownership on the extensive margins of exports of German manufacturing firms.

does not attempt to measure the effect of foreign ownership on the propensity to engage in trade. Girma et al. (2008) study the role of foreign ownership and financial constraints on Chinese firms, but the emphasis is on innovation activity not trade.

Second, there is a quickly growing literature on the role of intermediaries in international trade. The most closely related part of this literature examines the selection of firms into direct and indirect modes of exporting or importing.[5] But none of these papers considers the role of foreign ownership. Third, there is a large literature on how domestic firms in developing countries may benefit from the presence of multinational enterprises, in particular when it comes to exporting.[6] However, the emphasis of this literature is on measuring spillovers across firms, rather than on comparing the trade performance of matched domestically controlled and foreign owned firms.

The rest of the paper is organized as follows. In the next section we introduce a simple theoretical model to make precise the interaction between firms' productivity and foreign ownership. Section 3 contains a description of the data and summary statistics. In Section 4 we discuss the empirical methodology, present results for our baseline model, and explore several alternative empirical specifications to check the robustness of our results. Conclusions follow in Section 5.

2 Theoretical Framework

In this section we develop a simple theoretical framework with heterogeneous firms, based on Chaney (2013), to set the stage for our empirical analysis.[7]

[5] Among the papers are Abel-Koch (2013), Ahn et al. (2011), Crozet et al. (2013), Felbermayr and Jung (2011), McCann (2013). Imbruno (2014) discusses direct and indirect modes of importing. Basker and Van (2010) present empirical evidence on the role of retailers in intermediating imports from developing countries.

[6] Görg and Greenaway (2004) provide a survey of the literature. For more trade-related aspects see Swenson (2008), and Mayneris and Poncet (2015).

[7] Raff and Wagner (2014) develop a related model to examine the effect of foreign ownership on the extensive margins of exports, that is, the number of export destinations

The model allows us to identify how foreign ownership interacts with the more standard firm-level determinants of foreign-market participation, in this case the firm's productivity. We focus on foreign market access for exports, noting that models of firm heterogeneity can be easily adapted to study firms that import intermediates or engage in both exporting and importing (as in Kasahara and Lapham (2013)).

Consider two symmetric countries, home and foreign. Each country has two industries that use labor as the only input. One industry produces a homogeneous, freely tradable good with a constant unit labor requirement of 1. This is the numeraire good and, since its price is set to 1, we also obtain a wage rate of 1. The other industry produces a continuum of differentiated goods under increasing returns to scale and monopolistic competition.

2.1 Households

Home and foreign each have L consumers/workers, each endowed with one unit of labor. Individual preferences are given by the utility function

$$U = q_0 + \rho \ln Q_c, \qquad \rho < 1, \tag{1}$$

where q_0 denotes the consumption of the numeraire, and Q_c is the aggregate individual consumption of differentiated goods. Letting $q_c(i)$ denote the quantity consumed of variety i, we assume that Q_c takes the following CES form:

$$Q_c = \left(\int_{i \in \Delta} q_c(i)^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}, \tag{2}$$

where $\sigma > 1$ is the constant elasticity of substitution between varieties and Δ is the set of varieties.

Maximizing utility subject to the consumer's budget constraint and aggregating individual demands over the L consumers yields the following total

and exported product varieties.

demand for variety i:

$$q(i) = \frac{\rho L}{P^{1-\sigma}} p(i)^{-\sigma}, \tag{3}$$

where $p(i)$ is the consumer price of variety i, and

$$P = \left(\int_{i \in \Delta} p(i)^{1-\sigma} di \right)^{\frac{1}{1-\sigma}} \tag{4}$$

is the CES price index.

2.2 Firms

Firms in each country have access to the same technology. In the differentiated good industry each firm draws a random unit labor productivity $z \geq 0$. When entering the domestic market a firm incurs a fixed cost F_d. To enter the export market a firm has to choose between two strategies: strategy x is to export directly, strategy w is to export indirectly with the help of a wholesaler. Strategy x involves a fixed cost of exporting F_x. Going through a wholesaler requires a smaller fixed cost, $F_w < F_x$, because the wholesaler is able to spread market access costs across a number of exporters whose goods it distributes. The trade-off is that the wholesaler has to be paid in kind for each unit that it ships abroad. This cost of wholesaling is denoted by $\omega > 1$. Both exporting strategies also involve an iceberg transport cost $\tau \geq 1$. We may hence summarize the cost of producing quantities q_d for the domestic market and q_w or q_x for sale in the foreign market via indirect, respectively direct trade as follows:

$$C_d(q_d) = \frac{q_d}{z} + F_d, \tag{5}$$

$$C_w(q_w) = \frac{\omega \tau q_w}{z} + F_w, \tag{6}$$

$$C_x(q_x) = \frac{\tau q_x}{z} + F_x. \tag{7}$$

Profit maximization in the case of CES demand functions requires a firm with labor productivity z to set a price at a constant mark-up over its marginal

cost, c, so that $p(c) = \sigma c/(\sigma - 1)$. The marginal cost c of supplying output is equal to $1/z$ in the domestic market, $\omega\tau/z$ and τ/z, respectively, in the foreign market. The corresponding profits that such a firm can earn in the respective markets and using the respective modes of delivery are then given by:

$$\pi_d(z) = \frac{\rho L}{\sigma}\left(\frac{\sigma}{(\sigma-1)zP}\right)^{1-\sigma} - F_d, \tag{8}$$

$$\pi_w(z) = \frac{\rho L}{\sigma}\left(\frac{\sigma\omega\tau}{(\sigma-1)zP}\right)^{1-\sigma} - F_w, \tag{9}$$

$$\pi_x(z) = \frac{\rho L}{\sigma}\left(\frac{\sigma\tau}{(\sigma-1)zP}\right)^{1-\sigma} - F_x. \tag{10}$$

2.3 Foreign Ownership

We are interested in determining how foreign ownership affects the export market participation of firms and the choice of export mode, w or x; and we want to separate the impact of foreign ownership from that of labor productivity. A simple and very useful way to model the effect of foreign ownership is to assume that it allows a firm to draw a random endowment of an ability, A, that may help it to overcome barriers to foreign-market entry. In particular, let A and z be drawn from the joint cumulative distribution $G(A, z)$, and let the marginal distribution of z be given by $G_z(z) \equiv \lim_{A\to\infty} G(A, z)$.[8] Modelling foreign ownership as a random draw of ability is useful, precisely because in our data we do not directly observe how much, if at all, an individual firm benefits from it.

We formally treat A as an ability that a firm can combine with the profit it earns in the domestic market to bear the fixed cost of exporting directly or through intermediaries:

$$\pi_d(z) + A \geq F_i \quad \text{for } i = w, x. \tag{11}$$

[8] In his model Chaney (2013) interprets A as a liquidity shock and examines how draws of z and A affect the propensity of a firm to export. Our model extends Chaney's by allowing for both direct trade and indirect trade through an intermediary.

We thus implicitly assume that the firm cannot leverage potential export proceeds to finance this fixed cost. This market failure can be overcome if the firm draws a big enough A.[9] More precisely, since $\pi_d(z)$ is strictly increasing in z, only a very productive firm may be able to pay F_i without a large endowment of A, whereas a firm with a very low labor productivity may not be able to export indirectly even if A is big.

2.4 Equilibrium

To simplify the characterization of equilibrium we assume that import prices have a negligible effect on the domestic price index. That is, we approximate the price index in (4) by:

$$P \approx \left(\int_{z \in \Delta} p_d(z)^{1-\sigma} dG_z(z) \right)^{\frac{1}{1-\sigma}}. \tag{12}$$

We can then derive the equilibrium in three steps. The first step is to consider firms that do not face any "ability" constraint. For such firms we can use equations (8) and (9) to implicitly define two cut-off levels of labor productivity, $\bar{z}_d$ and $\bar{z}_w$, at which they would earn exactly zero profit in the domestic market and in the export market using a wholesaler, respectively:

$$\pi_i(\bar{z}_i) = 0 \quad \text{for } i = d, w. \tag{13}$$

Next we can compare (9) and (10) to derive a cut-level of labor productivity, $\bar{z}_x$, at which a firm is indifferent between exporting with the help of a wholesaler and exporting directly:

$$\pi_w(\bar{z}_x) = \pi_x(\bar{z}_x). \tag{14}$$

Assuming, reasonably, that the trade and wholesaling costs are such that $\bar{z}_d < \bar{z}_w < \bar{z}_x$, we obtain four types of firms.[10] The most efficient firms, i.e.,

[9] See Raff et al. (2009) for a more detailed discussion of potential market failures that could be solved by foreign ownership.

[10] Note that a sufficient condition for $\bar{z}_d < \bar{z}_w$ is simply $F_d \leq F_w$. For $\bar{z}_w < \bar{z}_x$ we require F_x to be sufficiently greater than F_w, specifically $F_x > F_w(1 + w^{\sigma-1}(1 - w^{1-\sigma}))$.

those with $z > \bar{z}_x$, sell both on the domestic market and export directly to the foreign market. Firms with labor productivity in the range $\bar{z}_w < z \leq \bar{z}_x$ sell at home and export through wholesalers. Firms in the productivity range $\bar{z}_d < z \leq \bar{z}_w$ sell only on the domestic market; and firms with labor productivity $z < \bar{z}_d$ do not sell on either market.

Using (12) in (13) we can derive implicit expressions for these cutoffs. From $\pi_d(\bar{z}_d) = 0$ we obtain

$$\bar{z}_d = \left(\frac{\sigma F_d}{\rho L} \int_{z \geq \bar{z}_d} z^{\sigma-1} dG_z(z) \right)^{\frac{1}{\sigma-1}}. \tag{15}$$

For what follows it turns out to be convenient to define a function $h(\cdot)$ with $h' > 0$ such that

$$\bar{z}_d = h(F_d). \tag{16}$$

Likewise for the other two cutoffs we have

$$\bar{z}_w = \omega\tau \left(\frac{F_w}{F_d} \right)^{\frac{1}{\sigma-1}} h(F_d), \tag{17}$$

$$\bar{z}_x = \tau \left(\frac{F_x - F_w}{(1 - w^{1-\sigma}) F_d} \right)^{\frac{1}{\sigma-1}} h(F_d). \tag{18}$$

Figure 1 shows cutoffs $\bar{z}_w$ and $\bar{z}_x$ as horizontal lines.

The second step is to consider the cut-off levels of labor productivity in the presence of an "ability" constraint, specifically to use (11) to implicitly define $\bar{z}_w(A)$ and $\bar{z}_x(A)$ such that a firm below the respective cut-off cannot export through a wholesaler, respectively directly:

$$\pi_d(\bar{z}_i(A)) + A = F_i \quad \text{for } i = w, x. \tag{19}$$

Using (19) we obtain

$$\bar{z}_w(A) = \left(\frac{F_d + F_w - A}{F_d} \right)^{\frac{1}{\sigma-1}} h(F_d), \tag{20}$$

$$\bar{z}_x(A) = \left(\frac{F_d + F_x - A}{F_d} \right)^{\frac{1}{\sigma-1}} h(F_d). \tag{21}$$

Notice that $\bar{z}_w(A)$ and $\bar{z}_x(A)$ are both decreasing in A with $\bar{z}_w(A) < \bar{z}_x(A)$. These two curves are also shown in Figure 1.

The third step is to combine the "unconstrained" cut-off lines from step 1 that are relevant when firms have sufficient ability with the "constrained" cut-off lines from step 2 that are appropriate when firms have little ability. This is also illustrated in Figure 1. First consider the two curves $\bar{z}_x(A)$ and $\bar{z}_x$, where we have assumed that $(F_d + F_x) > (F_x - F_w)\tau^{\sigma-1}\left(1 - w^{1-\sigma}\right)^{-1}$ so that $\bar{z}_x(0) > \bar{z}_x$ and the two curves intersect at a positive level of A. Firms in the set Ω in Figure 1 thus do not have enough ability to export directly despite the fact that their productivity exceeds $\bar{z}_x$. However, these firms would be able to export directly, if they had a large enough endowment of A (to the right of $\bar{z}_x(A)$). Put differently, for these firms having more A raises the probability of exporting directly. Hence the more A they have, the less likely they are to export through a wholesaler.

Next, consider the two curves $\bar{z}_w(A)$ and $\bar{z}_w$. In Figure 1 they are drawn assuming that $(F_d + F_w) > F_w(\omega\tau)^{\sigma-1}$ so that $\bar{z}_w(0) > \bar{z}_w$ and the intersection is again at a positive level of A. Firms with a productivity between $\bar{z}_w$ and $\bar{z}_x$ are productive enough to export through a wholesaler provided they have a sufficient endowment of A; those in the set Ψ have insufficient A to export. Hence for firms in this productivity range having more A increases the probability of exporting through a wholesaler.

2.5 Testable Predictions

By assuming that foreign ownership represents a draw of ability, we can turn the model's results into testable predictions about the effects of foreign ownership. First, consider how foreign ownership affects the overall likelihood of exporting. Firms with productivity exceeding $\bar{z}_w$ are more likely to export (directly or indirectly) if they are foreign owned, whereas firms with productivity below $\bar{z}_w$ do not export. Hence we may state:

Hypothesis 1 Controlling for productivity, a firm is more likely to export either directly or indirectly if it is foreign owned.

Second, consider the effect of foreign ownership on the probability that a firm exports directly. Only for firms with productivity greater than $\bar{z}_x$ does foreign ownership raise their likelihood of exporting directly. For the other firms foreign ownership has no effect, because these firms would be unable to export directly even if they were foreign owned. Hence we obtain:

Hypothesis 2 Controlling for productivity, a firm is more likely to export directly if it is foreign owned.

Third, consider the relationship between foreign ownership and the propensity of a firm to export through a wholesaler. Here we observe that for firms with productivity in the interval $\bar{z}_w$ to $\bar{z}_x$ foreign ownership unambiguously raises their likelihood of exporting through a wholesaler. However, for firms with productivity exceeding $\bar{z}_x$ being foreign owned may reduce the likelihood of exporting through a wholesaler. We summarize this as follows:

Hypothesis 3 For firms with a sufficiently moderate productivity, foreign ownership raises the likelihood of exporting through a wholesaler. But for firms with sufficiently high productivity, foreign ownership may reduce the likelihood of exporting through a wholesaler.

3 Data and Summary Statistics

Our empirical analysis is based on firm-level data collected by the World Bank as part of the Enterprise Surveys project (for more information about the surveys visit http://www.enterprisesurveys.org). The data cover the period of 2002 to 2006, but the firms are not followed up in later years, so the data do not constitute a panel. We restrict the sample to those countries for which there are enough observations with sufficient information across all

variables of interest after cleaning the data for missing values and obvious errors. Our final sample contains 14,585 firms from 30 countries and 14 industries.[11] Ranking the countries according to income, we distinguish between low-, lower-middle and upper-middle-income countries: Bangladesh, Benin, India, Kyrgyzstan, Moldova, Uzbekistan and Vietnam (low income countries); Armenia, Ecuador, Egypt, El Salvador, Guatemala, Guyana, Honduras, Kazakhstan, Morocco, Nicaragua, Philippines, Romania, Serbia, Sri Lanka and Syria (low-middle income countries); Brazil, Chile, Costa Rica, Hungary, Poland, Russia, South Africa and Turkey (upper-middle income countries).[12] The data cover light industries (beverages, food, garments, leather and textiles) and heavy industries (auto and auto components, chemicals and pharmaceuticals, electronics, metals and machinery, non-metallic and plastic materials, other manufacturing, other transport equipment, paper, wood and furniture).[13] The survey records information on a number of firm characteristics, such as the firm's location, industry, ownership structure, employment, etc. The survey also records detailed information on the distribution of sales between domestic and foreign markets, where foreign sales are broken down into direct and indirect exports (exports through a distributor), and on the domestic and foreign sourcing of inputs, where foreign sourcing is divided into direct and indirect imports.

Table 1 shows the export structure of the data. We group the firms in each industry and country by productivity terciles ("low", "medium" and "high"). On average 40.6% of the firms in the sample are exporters, ranging

[11] To be precise the data are provided at the establishment (plant) level. We use "firm", "plant" and "establishment" interchangeably.

[12] We follow the World Bank Atlas Method to determine the income group of a country. We take each country's per capita GNI over the five-year sample period and classify the countries according to the average World Bank Atlas intervals to account for country classification changes that occur within that period.

[13] We set the minimum requirement for the number of firms in an industry in a country to 60 to guarantee a sufficiently large number of observations. Results are essentially unaffected if we increase the minimum amount. Applying the restriction, industries contain 182 firms on average.

from 48.9% among the group of high-productivity firms to 32.1% among the low-productivity firms. Of those firms that export about 73.5% only export directly, 15.5% export only through distributors (indirect exporters), and 11% are classified as mixed exporters that export both directly and indirectly. The share of direct exporters ranges from 77.6% among the most productive firms to 67% for the least productive firms. The share of indirect exporters is highest for firms in the low-productivity range (21.2%).

We also observe variation in the selection into export modes across low-, lower-middle- and upper-middle-income countries (not reported in the table). The share of exporters is higher for upper-middle income countries (45.9%) than for low-income countries (34.2%), with lower-middle-income countries in between (41.1%). The share of direct exporters is highest among low-income-country exporters (77%). The share of indirect exporters is higher for lower-middle-income countries (20.5%) than for low-income countries (15.9%) and upper-middle-income countries (10.7%). 27.7% of the firms engage in exporting and importing simultaneously, ranging from 20% in lower-middle-income countries to 31.4% in upper-middle-income countries. On average, direct exporters export a slightly higher share of their production (56.7%) than indirect exporters (53.3%).

Table 2 shows the import structure by productivity tercile. More firms in the sample (47.3%) engage in importing than in exporting. The share of direct importers (54.9%) is lower than the share of direct exporters (73.5%). Instead the use of intermediaries is of greater importance for importers than for exporters. 32% of importers import only indirectly, and 13.1% are mixed importers. The share of importers is highest among the most productive firms (56.7%) and lowest for the least productive firms (38%). Likewise the share of direct importers and mixed importers is highest among high-productivity firms, whereas the share of indirect importers is largest among low-productivity firms. Additional evidence (not reported in the table) reveals that the share of importers is lowest in the low-income countries (36.5%)

and higher for lower-middle-income countries (53.2%) than for upper middle-income countries (41.1%). The data show a much larger share of direct importers for low-income and lower-middle-income countries than for upper-middle-income countries. Direct importers on average import 17.2% and indirect importers on average 8.3% of their inputs.

For our study we follow the IMF convention and define a firm as foreign owned if it reports a share of ownership by foreigners of at least 10%.[14] Based on this definition, about 9% of plants in the sample are foreign owned. The share of foreign owned firms increases with productivity; about 5.6% of the lowest productivity firms and about 13.1% of the highest productivity firms are foreign owned. In our data the share of foreign owned firms is highest in lower-middle-income countries (12.1%) and lowest in low-income countries (5.9%).

4 Empirical Methodology and Results

In this section we present our empirical analysis of the role of foreign ownership. As our theoretical model suggests, in order to isolate the effect of foreign ownership it is essential to control for other determinants of foreign market participation of firms, such as productivity. In addition, we want to control for firm characteristics that are likely to affect whether or not a firm is foreign owned. To reduce the dimensionality problem when considering a large number of observable firm characteristics, these characteristics are summarized into a single scalar (propensity score) reflecting the probability of a firm to be foreign owned. In our baseline model we apply standard nearest-neighbor propensity score matching. The results of the baseline model are presented in the next subsection. We then explain in more detail why we consider this choice of matching procedure to be reasonable and report the results of alternative statistical procedures (propensity score reweighting as

[14] In our estimation we also tried thresholds of 0%, 20%, 30%, 40% and 50%. Results are largely unaffected by the choice of threshold.

well as propensity score matching with kernel and caliper specifications).

4.1 Baseline Model

In our basic setup we pair each foreign-owned firm with three otherwise very similar domestic firms, where similarity is based on a number of background characteristics. In addition to labor productivity (sales per worker) we include as covariates the number of employees, R&D-intensity (R&D expenditure relative to sales), the employment structure (share of skilled production workers, share of professionals), whether the firm offers formal training for its employees, the manager's education, and whether the firm has problems to access external sources of finance.[15] Specifically, we use propensity scores to match each foreign owned firm to 3 domestic firms within the same industry and country that have a similar predicted probability of being foreign owned based on the covariates. We opt for this 3-to-1 matching due to this estimator's lower variability at the cost of higher bias in comparison to 1-to-1 matching, since our balancing tests (details are reported below) indicate that bias is not a concern in our sample.

As Table 3 indicates, foreign owned and domestic firms differ widely in their propensity to engage in international trade, especially in direct trade. The first three columns show the propensities of foreign owned firms and domestic firms to engage in various modes of trade for an unmatched sample and the difference between them. The last three columns show the same information after matching every foreign owned firm with the three most similar domestic firms. In the unmatched sample, the difference can be as large as 40.9 percentage points for firms engaging in both im- and exporting. This is because in the entire pool of domestic firms the average propensity

[15] We also tried a large number of other covariates as robustness check. These included lagged firm performance (sales per worker and employment 2 and 3 years ago), productivity relative to the industry average, whether the firm received an ISO certification, introduced a new technology within the past three years, launched a new product within the last three years and uses the web and email. Results remained largely unaffected and thus proved to be robust to the choice and combination of covariates.

to engage in trade is generally much lower than for foreign owned firms. It is only after we focus on the subgroup of domestically owned firms that are very similar to the foreign owned ones that we see a higher propensity to trade. As a consequence a lot of the difference in trade propensities disappears when we match firms. But the outcome of the matching procedure reported in the last column of the table shows that an economically sizeable and statistically significant difference in trade propensities still exists. Consistent with Hypothesis 1, foreign owned firms are 17.6 percentage points more likely to export and 13.4 percentage points more likely to import than their domestic counterparts. The effect is especially big for direct trade (in line with our Hypothesis 2): foreign owned firms are about 18.3 percentage points more likely to export directly and 17.3 percentage points more likely to import directly than domestic firms. We do not observe significant differences in the propensity to engage in mixed exporting or mixed importing or in exporting indirectly. The propensity to import indirectly slightly decreases for foreign owned firms in line with Hypothesis 3. The propensity to engage in both ex- and importing at the same time is much higher for foreign owned firms: 67.9 percent compared to 49.1 percent for domestic firms. In summary, the evidence clearly supports Hypotheses 1 and 2 and is also consistent with Hypothesis 3.

Our model predicts that the impact of foreign ownership should differ for different productivity levels. In particular, foreign ownership should have little effect on very productive firms. In fact, firms with z above $\bar{z}_x(0)$ should trade regardless of whether or not they are foreign owned. To study this predicted heterogeneity in treatment effects, we divide our sample of firms into productivity terciles. The results are summarized in Table 4. We find that the effects of foreign ownership indeed differ in magnitude across productivity terciles. The pattern that emerges is consistent with the theoretical predictions for all trade modes (except for simultaneous importing and exporting): the effects are smaller the higher is productivity. We find the largest dif-

ference in trade propensities across productivity levels for direct importing. Foreign ownership raises the direct-importing propensity of low productivity firms by 27.2 percentage points, whereas foreign-owned high-productivity firms are only 13.7 percentage points more likely to import directly. For exporting and direct exporting as well as for importing and indirect importing the effect size differs by about 2 to 6 percentage points between low and high productivity firms.[16]

In Table 5 we break down the analysis according to the income level of the country. Specifically, we investigate the differences between low-income, lower-middle-income and upper-middle-income countries. Foreign owned firms are more likely to engage in international trade in all country groups, but the difference in trade propensities is biggest for low-income countries and smallest for lower-middle-income countries. This holds for exporting and importing and for direct exporting and importing, where the magnitude of the effect differs by up to 14.3 percentage points between low- and lower-middle-income countries. Specifically foreign owned firms in low-income countries are 28.1 percentage points more likely to export directly and 25.5 percentage points more likely to import directly than domestic firms; for lower-middle income countries we estimate a treatment effect of only 13.8 percentage points for direct exporting and 11.9 percentage points for direct importing. In the case of indirect importing we find a highly significant negative effect of foreign ownership in low-income countries, but no or only weak evidence for an effect for lower-middle-income countries and high-middle-income countries, respectively.

[16]Notice that the model also predicts that treatment effects of foreign ownership should be zero for firms with sufficiently low productivity (z below $\bar{z}_w$): these firms will not trade no matter whether or not they are foreign owned. We are not able to confirm this prediction. The most likely reason is that our dataset is biased towards more productive firms. A clear sign of this is already visible in the descriptive statistics presented in Section 3, where the share of firms engaging in trade turns out to be much higher than expected.

4.2 Balancing Test and Alternative Specifications

The validity of our findings obviously depends on the quality of the matching. Table 6 summarizes the balancing test for our baseline model. The test reveals that the matching is successful and the covariates are well balanced. In particular, for all covariates the bias after matching is either below or very close to the 5% criterion. The t-tests indicate that after matching the difference between the treated and untreated groups does not differ from zero, while before matching the two groups differed significantly in all but two covariates. After matching the Pseudo-R^2 is close to zero and the LR-X^2-Test is insignificant indicating a high matching quality.[17]

One of the disadvantages of our baseline propensity score method is the fact that it discards a lot of potentially useful information. Specifically we match 1103 foreign owned firms with at most 3309 ($3 * 1103$) domestic firms, thereby ignoring at least 4996 other domestic firms in the sample that could potentially be included in the analysis. Alternative methods, such as propensity score matching with kernel and caliper specification as well as propensity-score reweighting, make use of the full (or at least a larger proportion of the) untreated sample. Kernel matching uses weighted averages of all (or almost all) untreated observations and caliper-matching uses the untreated observations that, in our specification, lie within a range of a quarter standard deviation of the propensity score. The propensity-score-reweighting estimator has been shown to generate an efficient estimate of the average treatment effects on the basis of reweighting by the inverse of the propensity score.[18] Intuitively, this method adjusts for differences between foreign owned and domestic firms by assigning higher weights to domestic firms that are more similar to the foreign owned firms. Rather than completely dismissing domestic firms that are not very similar, this method simply assigns a lower weight

[17] We additionally conduct a Rosenbaum sensitivity analysis. The results indicate that our estimated treatment effects are very robust with respect to a potential hidden bias. We still find significant effects (at a 10%-level) up to $\Gamma = 2.6$.

[18] See, for instance, Hirano et al. (2003) and Cerulli (2014) for further information.

to such firms. Table 7 contains the estimation results for nearest-neighbor, caliper, kernel matching and propensity score reweighting. Column 1 is identical with the effect size column after matching in Table 3. The interpretation for the estimates is identical for the other three columns. The main point to note about the results is that they are remarkably similar to the effects found in our standard nearest neighbor propensity score analysis.[19] The results are thus highly robust with respect to the choice of the statistical procedure. The fact that the nearest-neighbor matching specification produces relatively conservative estimates of the effect of foreign ownership is another reason why this specification is a good choice for our baseline model.

5 Conclusions

The paper uses micro-data from the World Bank Enterprise Surveys to study to what extent foreign ownership helps manufacturing firms in developing countries connect with overseas customers and suppliers. Defining foreign owned firms as firms with a foreign equity participation of at least 10%, we find that foreign ownership has a statistically significant and in many cases economically large impact on the export and import propensities of developing-country firms. In our baseline specification foreign owned firms are 17.6 percentage points more likely to engage in exporting and 13.4 percentage points more likely to engage in importing than domestic firms. This advantage of foreign owned firms over domestic firms in the propensity to trade is especially large when it comes to direct trade, namely 18.3 percentage points in case of direct exporting and 17.3 percentage points in case of direct importing. While foreign owned firms are significantly more likely to trade than matched domestic firms, they are around 4.9 percentage points less likely import through intermediaries. Foreign ownership has no impact

[19] The balancing tests for the alternative specification mostly show well balanced covariates. For two covariates, however, t-tests indicate that after matching the difference between treated and untreated does still differ from zero.

on the propensity to export through intermediaries. The effect of foreign ownership differs across different levels of productivity. We find that effects are smallest for high-productivity firms. Overall the empirical evidence confirms the theoretical predictions of our model.

The effect of foreign ownership differs in magnitude across low-income, lower-middle-income and upper-middle-income countries. The impact tends to be highest for low-income countries, where foreign ownership boosts the propensity to export by 25 percentage points and the propensity to export directly by 28.1 percentage points. Foreign ownership also has a bigger effect on the propensity to import in these countries than for the sample of countries as a whole, with direct importing being 25.5 percentage points more likely for foreign owned than for domestic firms.

Overall the evidence presented in the current paper suggests that foreign market access of developing-country firms benefits strongly from the intermediation provided by foreign owners. This benefit tends to be largest for the lowest-income countries. These results are obviously relevant for public policy, as they provide clear evidence of the important role played by multinational enterprises in facilitating international trade for low-income countries. At the same time the heavy reliance on foreign direct investment (FDI) may pose a problem for these countries, if FDI comes under strain, as has happened during the financial crisis. According to UNCTAD (2011, Table I.1), world outflows of FDI were 46% lower in 2009 compared to 2007, with the drop in outflows from developed countries exceeding 50%. The direct acquisition of ownership in foreign companies through cross-border mergers and acquisitions fell even more during this period, namely by over 75% measured in net purchases (UNCTAD, 2011, Table I.3). Given the importance of foreign owners in intermediating exports, the financial crisis may have long-term negative effects on developing country trade.

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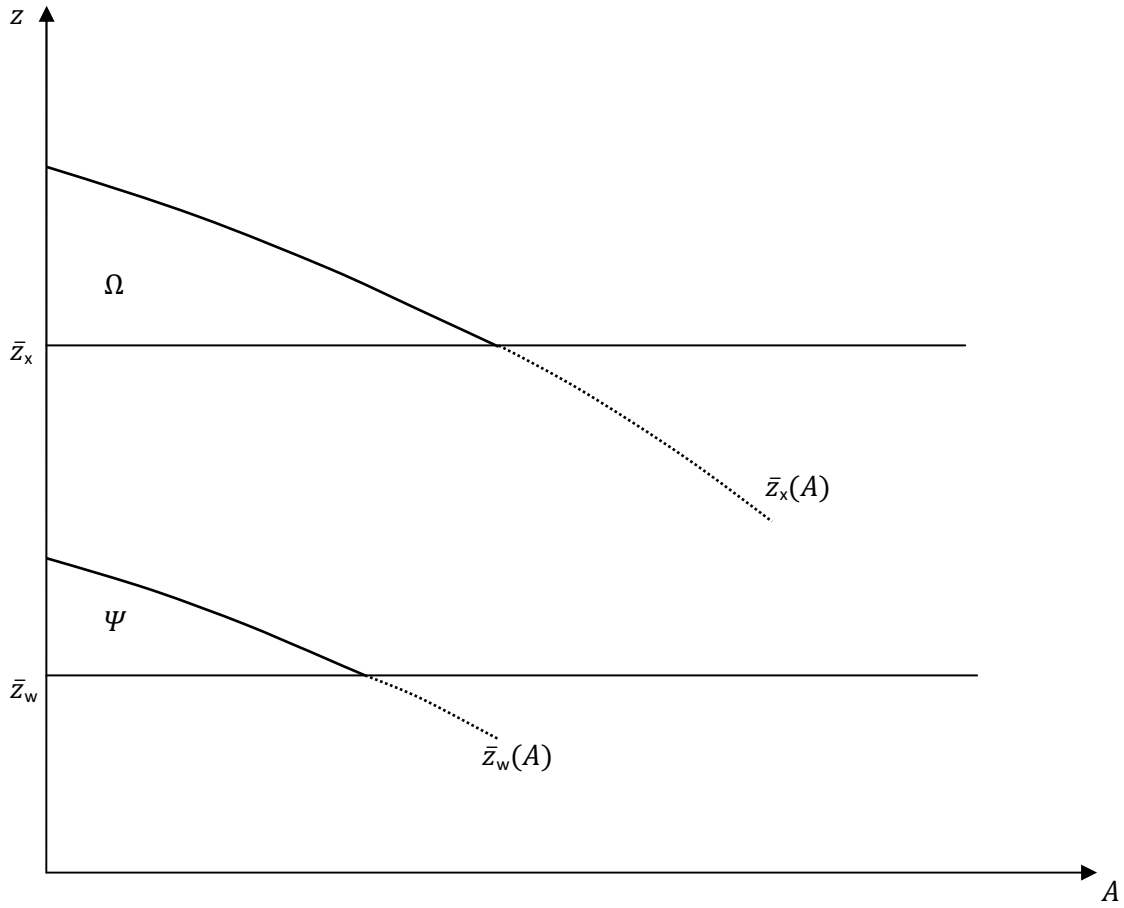
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Figure 1

Table 1: Export Structure by Productivity Level

				Mode of Exp. cond. on being Exporter		
Productivity	#Firms	#Exporters	Share Exporters	Only Directly	Only Indirectly	Mixed
low	4916	1578	32.1%	67.0%	21.2%	11.8%
medium	4814	1968	40.9%	73.7%	14.9%	11.3%
high	4855	2374	48.9%	77.6%	12.1%	10.2%
Total	14585	5920	40.6%	73.5%	15.5%	11.0%

Table 2: Import Structure by Productivity Level

				Mode of Imp. cond. on being Importer		
Productivity	#Firms	#Importers	Share Importers	Only Directly	Only Indirectly	Mixed
low	4916	1868	38.0%	45.2%	42.6%	12.2%
medium	4814	2278	47.3%	54.5%	32.5%	12.9%
high	4855	2753	56.7%	61.8%	24.4%	13.8%
Total	14585	6899	47.3%	54.9%	32.0%	13.1%

Table 3: Effect of Foreign Ownership on Trade Propensities

	Before Matching			**After Matching**		
Mode of Trade	Foreign Owned	Domestic	Effect Size	Foreign Owned	Domestic	Effect Size
Exporting	0.7706	0.3939	0.3768*** (0.0154)	0.7706	0.5943	0.1759*** (0.0181)
Direct Exporting	0.6618	0.2831	0.3787*** (0.0145)	0.6618	0.4787	0.1826*** (0.0202)
Indirect Exporting	0.0490	0.0667	-0.0177** (0.0079)	0.0490	0.0590	-0.0100 (0.0119)
Mixed Exporting	0.0598	0.0441	0.0158** (0.0067)	0.0598	0.0566	0.0033 (0.0099)
Importing	0.8368	0.4751	0.3617*** (0.0156)	0.8368	0.7036	0.1338*** (0.0165)
Direct Importing	0.6482	0.2680	0.3802*** (0.0143)	0.6482	0.4756	0.1729*** (0.0247)
Indirect Importing	0.0734	0.1436	-0.0702*** (0.0109)	0.0734	0.1226	-0.0490*** (0.0140)
Mixed Importing	0.1151	0.0635	0.0517*** (0.0081)	0.1151	0.1054	0.0100 (0.0184)
Im- and Exporting	0.6791	0.2701	0.4090*** (0.0143)	0.6791	0.4914	0.1880*** (0.0196)

Notes:
Heterskedasticity-consistent analytical standard errors (Abadie and Imbens (2006)) in parentheses;
*** p<0.01, ** p<0.05, * p<0.1
N=9408, Foreign Owned: 1103

Table 4: Heterogeneous Treatment Effects

Mode of Trade	Low Productivity Firms	Medium Productivity Firms	High Productivity Firms
Exporting	0.1934***	0.1803***	0.1756***
	(0.0420)	(0.0332)	(0.0289)
Direct Exporting	0.2284***	0.1876***	0.1643***
	(0.0537)	(0.0460)	(0.0320)
Indirect Exporting	-0.0309	-0.0124	0.0113
	(0.0393)	(0.0219)	(0.0107)
Mixed Exporting	-0.0041	-0.0181	0
	(0.0253)	(0.0235)	(0.0165)
Importing	0.1564***	0.1424***	0.1065***
	(0.0503)	(0.0410)	(0.0233)
Direct Importing	0.2716***	0.2294***	0.1371***
	(0.0520)	(0.0455)	(0.0327)
Indirect Importing	-0.0823**	-0.0576*	-0.0426**
	(0.0401)	(0.0295)	(0.0200)
Mixed Importing	-0.0329	-0.0294	0.0120
	(0.0379)	(0.0284)	(0.0242)
Im- and Exporting	0.1831***	0.1751***	0.1929***
	(0.0496)	(0.0458)	(0.0313)
N	1254	1603	2371

Notes:
Heterskedasticity-consistent analytical standard errors (Abadie and Imbens (2006)) in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 5: Effect of Foreign Ownership on Trade Propensities by Country Income

Mode of Trade	Low-Income Countries	Lower-Middle-Income Countries	Upper-Middle-Income Countries
Exporting	0.2496***	0.1624***	0.1791***
	(0.0363)	(0.0266)	(0.0345)
Direct Exporting	0.2814***	0.1380***	0.1801***
	(0.0389)	(0.0294)	(0.0384)
Indirect Exporting	0	-0.0159	-0.0083
	(0.0181)	(0.0217)	(0.0112)
Mixed Exporting	-0.0317*	0.0177	0.0072
	(0.0173)	(0.0134)	(0.0219)
Importing	0.1688***	0.0800***	0.2008***
	(0.0387)	(0.0207)	(0.0341)
Direct Importing	0.2554***	0.1190***	0.2070***
	(0.0416)	(0.0406)	(0.0385)
Indirect Importing	-0.0808***	-0.0379	-0.0435*
	(0.0254)	(0.0222)	(0.0230)
Mixed Importing	-0.0058	-0.0012	0.0373
	(0.0188)	(0.0316)	(0.0302)
Im- and Exporting	0.2063***	0.1447***	0.2453***
	(0.0401)	(0.0280)	(0.0376)
N	3285	3761	2577

Notes:
Heterskedasticity-consistent analytical standard errors (Abadie and Imbens (2006)) in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6: Balancing Test

Covariate	Unmateched / Matched	Mean Treated	Mean Control	%Reduct %bias	%Reduct |bias|	T-Test t	T-Test p>|t|
Log (Employment)	U	5.3173	4.2885	70.6		21.89	0.000
	M	5.3158	5.2307	5.8	91.7	1.36	0.174
Log (Sales per Worker)	U	6.2244	5.3423	28.4		8.94	0.000
	M	6.2255	6.2517	-0.8	97.0	-0.20	0.842
Job Training	U	0.5802	0.4008	36.5		11.41	0.000
	M	0.5795	0.6061	-5.4	85.1	-1.27	0.203
R&D	U	0.0531	0.7920	-1.9		-0.45	0.655
	M	0.0531	0.0294	0.1	96.8	1.19	0.234
Share Skilled Production	U	0.4722	0.4957	-3.0		-0.74	0.460
	M	0.4718	0.4728	-0.1	95.5	-0.07	0.948
Share Professionals	U	0.0078	0.0326	-11.9		-2.79	0.005
	M	0.0078	0.0088	-0.5	96.2	-0.64	0.520
Degree Manager	U	0.7425	0.5565	39.7		11.84	0.000
	M	0.7421	0.7520	-2.1	94.6	-0.54	0.590
Access to Capital	U	0.3681	0.5145	-29.8		-9.18	0.000
	M	0.3688	0.3875	-3.8	87.2	-0.91	0.364

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R
Unmatched	0.092	628.31	0.000	27.7	29.1	27.9*	0.04*
Matched	0.002	7.26	0.509	2.3	1.5	11.4	1.07

Table 7: Alternative Statistical Procedures

Mode of Trade	Nearest Neighbor	Caliper	Kernel	PSR
Exporting	0.1759***	0.1944***	0.1647***	0.2144***
	(0.0181)	(0.0281)	(0.0245)	(0.0148)
Direct Exporting	0.1826***	0.1916***	0.1688***	0.2253***
	(0.0202)	(0.0287)	(0.0243)	(0.0183)
Indirect Exporting	-0.0100	-0.0064	-0.0063	-0.0142*
	(0.0119)	(0.0126)	(0.0127)	(0.0082)
Mixed Exporting	0.0033	0.0091	0.0022	0.0033
	(0.0099)	(0.0139)	(0.0114)	(0.0075)
Importing	0.1338***	0.1399***	0.1309***	0.1643***
	(0.0165)	(0.0261)	(0.0238)	(0.0143)
Direct Importing	0.1729***	0.1817***	0.1652***	0.2113***
	(0.0247)	(0.0289)	(0.0242)	(0.0162)
Indirect Importing	-0.0490***	-0.0544***	-0.0464***	-0.0562***
	(0.0140)	(0.0183)	(0.0165)	(0.0094)
Mixed Importing	0.0100	0.0127	0.0121	0.0093
	(0.0184)	(0.0176)	(0.0146)	(0.0112)
Im- and Exporting	0.1880***	0.2013***	0.1806***	0.2275***
	(0.0196)	(0.0286)	(0.0239)	0.0188

Notes:
Heterskedasticity-consistent analytical standard errors (Abadie and Imbens (2006)) in parentheses; bootrapped standard errors for PSR; *** p<0.01, ** p<0.05, * p<0.1
N=9408, Foreign Owned: 1103; for PSR: N=12949