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Abstract

This paper focuses on an unexamined area of trade, the behaviour of heterogeneous intermediate suppliers facing final producers of different ability and pursuing different strategies. We develop a theoretical model to analyse the choice of an intermediate supplier between selling to domestic producers, selling to multinational producers and/or exporting to foreign producers. The model's predictions are: (i) sufficiently productive firms self-select into supplying to multinationals or exporting, while the most productive firms pursue both strategies, and (ii) the order of preferred strategies between supplying to multinationals and exporting depends on foreign direct investment inflows and export set-up costs. The paper tests these theoretical predictions using firm-level data from 29 European and Central Asian countries in 2002 and 2005. The empirical analysis confirms our model's predictions. Moreover, it suggests that multinational suppliers are more likely to have higher required levels of ex-ante labour productivity than exporters, implying that exporting is easier and a more popular choice for firms.

1 Introduction

Not all firms are the same in terms of ability and their sales destinations. With regards to final goods producers, it is well established that firm productivity positively correlates with the difficulty to enter a market and that more productive firms self-select into exporting and investing in production abroad (Bernard and Jensen, 1999; Melitz, 2003; Helpman et al., 2004). Yet, the existing literature has often focused on the behaviour of final goods producers, leaving the behaviour of intermediate goods suppliers barely explored. Intermediate goods suppliers also face a choice between exporting to foreign markets and supplying to the domestic market. However, the choices facing an intermediate supplier go beyond this basic one and are more complex given the fact that it trades with final goods producers of different abilities and with different strategies, even within the same market. In this context, it is natural to inquire into whether firms supplying to foreign-oriented final producers are different from firms supplying to domestic-oriented final producers. Due to the lack of observations on firm-level intermediate goods trade, there has been a limited number of

studies looking into this issue both empirically and theoretically. Given the development of multi-nationals and their global value chains and the fact that trade in intermediate inputs represents an increasingly dominant share in total trade flows, we believe that this area of research deserves more research attention, especially in the theoretical field.

This paper extends the analysis of firm heterogeneity to the intermediate sector, and develops a theoretical model to explore the behaviour of the intermediate goods suppliers and the final goods producers simultaneously. Our model analyses the behaviour of intermediate goods suppliers in response to three types of final producers that are differentiated by their productivity and their corresponding supply destinations, namely, domestic final producers, foreign final producers and multinationals. In the model, an intermediate supplier's behaviour is determined by its own productivity, the productivity of its potential customers and market characteristics. We analyse the different characteristics between foreign-oriented intermediate suppliers, i.e., multinational suppliers and exporting suppliers, and domestic-oriented intermediate suppliers and then focus on the comparison between multinational suppliers and exporting suppliers. The characteristics of intermediate suppliers to multinationals relative to those of exporting intermediate suppliers are particularly interesting given that supplying to multinational subsidiaries in the domestic market can be considered as an alternative strategy to exporting.

The first question we address is whether there is self-selection of more productive suppliers to gain contract with multinationals and foreign final producers. Our model predicts that less productive suppliers only sell to the domestic-oriented final producers, more productive suppliers self-select into supplying to multinationals or exporting and the most productive firms pursue both supplying strategies. As it is costly to advertise products, adjust the production to the standards of multinationals and establish new distribution channels with foreign final producers, intermediate suppliers face higher fixed costs to enter a foreign market or to gain a contract with multinationals than to supply to the domestic final goods producers. Hence, only more productive intermediate goods suppliers are able to be profitable in the face of these higher fixed costs and survive in the multinational and foreign markets.

The second prediction of our model regards the comparison between multinational suppliers and exporting suppliers. On the one hand, it might be easier for an intermediate supplier to sell to multinational subsidiaries in the local market than to export, because it can save on marketing and distribution set-up costs in a foreign market. On the other hand, supplying to multinationals can be challenging since only a small number of firms with top productivity levels become multinationals (Helpman et al., 2004) and the chance to gain a contract with them is limited. Furthermore, it is plausible that multinationals have specific expectations and requirements with regards to their suppliers, as they tend to possess high level of technology and management skills and are expected to create spillovers to other firms and their suppliers (Javorcik, 2004; Lin and Saggi, 2007; Carluccio and Fally, 2013). This implies that suppliers to multinationals must have special characteristics that allow them to be chosen. Differences, therefore, may exist between an exporting supplier and a multinational supplier.

In our model, suppliers' choice between the two strategies – supplying to multinationals and exporting – is determined by their profitability in each respective market. In turn, this depends on the suppliers' productivity, the relative size of the two markets, and trade and investment costs. A change in trade or investment costs will affect an intermediate supplier's relative preference for these two choices. In particular, relatively lower trade costs make the export strategy more popular, while relatively low investment costs and, consequently, relatively higher FDI inflows make supplying to multinationals more favourable.

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Using firm-level data for 29 European and Central Asian countries in 2002 and 2005, our paper then tests these theoretical predictions about suppliers' preferences and choices. We find strong empirical support for our theoretical predictions. Specifically, in relation to the first prediction of our model, multinational intermediate suppliers and exporting suppliers have higher ex-ante productivity levels, are larger and invest more compared to domestic-oriented intermediate suppliers, while the most productive firms become both exporters and multinational suppliers. In accordance with the second prediction of our model, the empirical results also show that the probability of choosing a certain strategy changes according to trade and investment conditions.

Our paper is related to the literature on FDI's backward spillover effects on domestic intermediate suppliers. In this literature, FDI and serving multinational affiliates are often claimed to provide several benefits, including technology transfers and productivity improvements for domestic suppliers (Blomstrom and Kokko, 1998; Javorcik, 2004). While there have been abundant empirical studies with mixed results, there has been a limited theoretic base supporting these claims. Major theoretical works in this field suggest that the entry of multinationals raises the demand for intermediate products by domestic suppliers but do not look at the possibility of productivity improvements for suppliers or the mechanism through which the spillover effect may occur (Markusen and Venables, 1999). Lin and Saggi (2007) is the first paper that looks at domestic suppliers' decisions to enter in an exclusive contract with a multinational and how such decisions affect the suppliers' production costs. However, in their paper, this decision is solely based on the technology transfer offered by the multinational to their exclusive suppliers. These works do not investigate suppliers' heterogeneity, in particular with regard to the fact that some domestic suppliers become suppliers to multinationals while others do not. While the empirical evidence on FDI spillovers is non-conclusive (Sinani and Meyer, 2004), there is some empirical evidence for a positive association between the extent of FDI spillovers and firms' absorptive capacity. Blalock and Gertler (2009) show that firms that invest in R&D and have a higher percentage of educated labour force benefit more from a higher multinational presence in the case of Indonesia. Keller and Yeaple (2009) show that relatively high productivity is required for a firm to benefit from FDI spillovers in the case of the United States. Similarly, Nicolini and Resmini (2010) find that only more productive firms are able to reap the technological externalities emanating from FDI in the case of Bulgaria, Romania and Poland. However, little is known about whether the positive correlation is due to spillovers from multinationals or there is self-selection of more productive suppliers gaining a contract with multinationals.

Our contribution to this field is to show that there is a self-selection of more productive suppliers able to gain contracts with multinationals. Our predictions and the supporting empirical evidence are consistent with recent case studies providing similar observations about the relationship between suppliers and multinationals. Javorcik and Spatareanu (2005), Javorcik and Spatareanu (2009) and Godart and Gorg (2013) show that it is more common that multinationals "cherry pick" better performing suppliers and local suppliers actively upgrade their production technology to gain a contract with multinationals. These results are in contrast with the often claimed "technology transfer" or "learning-by-doing" effects on local suppliers due to the presence of multinationals.

Another strand of the international trade literature closely linked to this paper is the one looking at heterogeneous firms' behaviour and the self-selection of more productive firms into exporting (Bernard and Jensen, 1999; Melitz, 2003) and investing abroad (Helpman et al., 2004). This literature also shows that firm productivity correlates with the number of export markets that a firm serves (Eaton et al., 2011; Lawless, 2009; Wagner, 2007, 2012; Castellani and Giovannetti, 2010) and the difficulty to enter an export market (Melitz and Ottaviano, 2008; Chaney, 2008; Serti et al.,

2010). This is due to the fact that firms need to be more productive to cover the extra costs of entering more demanding or more distant foreign markets.

We contribute to this literature by focusing on intermediate goods suppliers' behaviour and by using a model structure featuring heterogeneity in both final goods sector and intermediate goods sector. We provide a framework to analyse the impact of trade liberalization and investment liberalization together with firms' behaviour in both final goods and intermediate goods sectors.

Several theoretical models have incorporated an intermediate sector to explain the input sourcing behaviour of final goods producers in international trade. In particular, Antras and Helpman (2004) study multinationals' outsourcing decision and the characteristics of the host economy. Amiti and Konings (2007), Kasahara and Rodrigue (2008) and Halpern et al. (2015) look at firms' importing input decision to find that foreign-oriented firms (i.e., multinationals or exporters) tend to import more foreign inputs compared to their domestic-oriented peers. These strands of the literature, however, focus on the strategy of the final goods producers and treat intermediate suppliers homogeneously. Thus, these papers can explain the variation in input sourcing behaviour of final producers across countries, but they cannot explain such variation within a country. In reality, not all local suppliers can export or supply their intermediate products to multinationals and the fraction of the foreign-oriented intermediate suppliers is small.

More recently, a few theoretical studies have started to explore the heterogeneity in the behaviour of suppliers in serving multinationals. Lin and Saggi (2007) and Carluccio and Fally (2013) suggest that only some suppliers switch to new technologies to supply exclusively to multinationals, while the rest do not. In these studies, intermediate suppliers are, however, homogeneous and the driving force of their different choices does not come from their own ability but depends on either the size of the technology transfer they would get or the size of the multinational presence. Thus, we provide a contribution to this literature given that so far it has not explored if certain suppliers are more likely to choose to become multinational suppliers based on their specific ex-ante characteristics.

The rest of this paper is organized as follows. Section 2 presents the analytical model, focusing on the input sourcing behaviour and the behaviour of the corresponding intermediate suppliers. It also analyses how a reduction in trade costs or investment costs would affect the behaviour of both intermediate goods suppliers and final goods producers. Section 3 presents the data and the empirical analysis confirming the model's predictions. Finally, Section 4 summarizes the findings of this paper.

2   Model

The model considers a world with two symmetric countries. In each country, a continuum of firms engage in two sectors, namely, production of a final good and production of an intermediate good. An individual firm either produces the final good, for which it is called a final producer, or produces the intermediate good, for which it is called a supplier hereinafter, but does not engage in both sectors. Each firm produces a differentiated variety of the good so it faces monopolistic competition in either sector. A final good variety is produced using labour and a composition of intermediate good varieties that can be sourced from different suppliers.

A final producer can choose to set up its production in the home country or in the foreign country via foreign direct investment (FDI) or both. In the latter case, that final producer is labelled as a multinational. Firms' decisions to set up their production in the domestic market or in the foreign country solely depend on its profitability in each market. As will be proven later, all surviving final producers sell to the domestic market. Doing FDI is a strategy to earn extra profit from the

foreign market for the sufficiently productive final producers. In all cases, a final producer in either country can source its inputs from both domestic intermediate suppliers and foreign intermediate goods suppliers via importing. Intermediate goods are traded between the two countries with a "melting-iceberg" transportation cost of τ per unit, $\tau \geqslant 1$, i.e., τ units have to be shipped for one unit to arrive at the foreign country.

The model resembles Helpman et al. (2004) in the consumer's preference structure and the final good sector, where a final producer pays a fixed entry cost that varies depending on whether it chooses to produce locally or set up production in the other country (FDI activity). The fixed entry cost comprises a firm's marketing activities to make its brand recognizable to the customers and its distribution set-up costs in the new market. It is assumed that the fixed cost to do FDI is higher than the fixed cost to enter the domestic market because it requires new marketing activities and new distribution channels in the foreign market.

The main feature that distinguishes the model from Helpman et al. (2004) is related to the input sourcing behaviour of the final producers and the corresponding behaviour of heterogeneous suppliers when facing final producers that pursue different strategies. In the intermediate good sector, a supplier faces three mutually non-exclusive strategies, i.e., (i) serving domestic final producers, (ii) exporting to final producers in the foreign country, or (iii) supplying to multinationals in the domestic country. Different fixed entry costs are required to pursue each strategy. Each supplier will then make its choice knowing the corresponding entry cost of each strategy and the demand for intermediate goods from each group of final producers.

2.1 Final consumer

In each country, consumers face a continuum of final good varieties produced by final producers of different abilities and different types. The utility function of a representative consumer over a continuum of final good varieties in a country has a standard Dixit-Stiglitz constant elasticity of substitution (CES) form

$$U = \left[\int q_j^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}},$$

where q_j is the consumption of a variety j, which is produced by final producer j, and $\theta > 1$ is the elasticity of substitution between any two different final good varieties.

The problem of the representative consumer is to choose the consumption of each variety to maximise her utility subject to the budget constraint

$$\int q_j p_j dj = Y,$$

where Y is national income and p_j is the price of a variety of the final good. This maximisation problem yields the following demand for each final good variety in terms of price and income

$$q_j = Y P^{\theta-1} p_j^{-\theta}, \tag{1}$$

where P is the price index of final good varieties

$$P = \left[\int p_j^{1-\theta} dj \right]^{\frac{1}{1-\theta}}. \tag{2}$$

As the two countries are assumed to be symmetric, consumers in each country have the same income Y and face the same final good price index P.

2.2 Firms' choices

There are two continuums of firms in each country. Final goods producers (hereinafter final producers) are indexed by j and intermediate goods suppliers (hereinafter suppliers) are indexed by i, each with its own productivity, which is denoted as φ_j for a final producer and φ_i for a supplier. Firms' productivity is assumed to be randomly drawn from a distribution $G(\varphi)$.

In order to focus on the behaviour of suppliers and to avoid further complications (i.e., to have just three types of suppliers as below instead of potentially six types), we treat all final producers operating in their home country as a single group without disaggregating them further into domestic-oriented and exporting firms.[1] Firms' types and choices are presented in Table 1.

A final producer needs to pay f^D to enter the domestic market, and f^{FDI} to do FDI in the foreign market. It is assumed that the fixed cost to do FDI is higher than the fixed cost to enter the domestic market, $f^{FDI} > f^D$. The reason is that f^{FDI} includes production and distribution set-up costs in a new country as well as marketing costs to make the firm known in that new country.

There are three types of suppliers corresponding to their chosen strategies, namely, type d, i.e., a supplier selling to domestic final producers, type x, i.e., a supplier exporting to foreign final producers, and type m, i.e., a supplier to multinationals in the home country. A supplier needs to invest to enter each market, which is interpreted in a similar way to the fixed entry cost of a final producer. Fixed costs f^d, f^x and f^m are respectively required to enter the domestic market, the export market and the multinational market.

Foreign final producers may be unfamiliar with domestic suppliers or require different standards in terms of product presentation and delivery and, hence, a domestic supplier needs to advertise or tailor its product to meet those standards before winning a contract with a foreign firm. For these reasons, the fixed cost to export, f^x, and to supply to multinationals, f^m, are assumed to be higher than the entry cost to the domestic market, f^d. It is also assumed that, when exporting, a supplier needs to set up new distribution channels in the foreign country, whereas, when selling to multinationals in the domestic market, it can use its existing distribution channel and save on that cost. Therefore, f^x is assumed to be higher than f^m. Furthermore, on their part, multinationals often actively research the host country market before entering, so there is a high chance that the currently supplied intermediate varieties of local suppliers are compatible with the production requirement of multinationals. Additionally, the distribution set-up cost would be partly shared between multinationals and the potential suppliers. In either case, the entry cost f^m for a local supplier to enter a contract with multinationals is lower than the entry cost to the export market f^x. Since exporting and supplying to multinationals are not mutually exclusive, a supplier can do both activities and, in such case, it will incur a fixed cost $f^{x+m} = f^x + f^m$.

2.3 Final producers

2.3.1 Production technology

A final good variety is produced using labour and a composition of the intermediate good varieties via the following production function

$$q_j = \varphi_j L_j^{1-\beta} I_j^{\beta}, \tag{3}$$

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[1] We also consider a model of 6 types of suppliers corresponding to different types of final producers, i.e., domestic-oriented firms, exporting firms and multinationals in each of the two countries, and obtain similar results (see Pham, 2015).

Table 1: Summary of firm types and their strategies

Firms	Type	Strategy/ Targeted market
Final producers	Type D	Set up production in its home country only
	Type FDI	Set up production in the foreign country
Suppliers	Type d	Supply to type-D final producers in the suppliers' home market
	Type x	Export to type-D final producers in the foreign market
	Type m	Supply to type-FDI final producers

where L_j is the amount of labour employed by firm j, which is determined by the firm's productivity φ_j, parameter β is the intermediate good intensity of the firm's product, $\beta \in (0,1)$, and I_j is a composite intermediate good with the CES form

$$ I_j = \left[\int q_{ji}^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}, \tag{4} $$

where $\varepsilon > 1$ is the constant elasticity of substitution between any two intermediate good varieties. It is naturally assumed that $\varepsilon \geq \theta$, because the final good varieties are perceivably more differentiated than the intermediate good varieties that are used in their production. A final producer can source its horizontally differentiated intermediate good varieties from various suppliers, with q_{ji} denoting the quantity of an intermediate good variety that final producer j sources from supplier i. The labour market in each country is assumed to be relatively large, so that each firm can hire from the local labour market at a constant wage rate w.

The specification of I_j in (4) implies that there is no pre-determined type of supplier and each final producer treats all the intermediate good varieties, and hence, their suppliers symmetrically. Since trade is allowed in the intermediate good sector, in each country, each final producer, including multinationals, faces the same mass of domestic suppliers and foreign suppliers from which it can purchase its intermediate goods. This eliminates the possibility that supplier types are predetermined and a final producer knows beforehand its suppliers depending on whether it is a multinational or a domestic-oriented firm, which would be rather implausible in reality.

A final producer firstly chooses its inputs to minimise cost subject to the production technology specified in equation (3), and then chooses the output quantity and price that maximise its profit, knowing the final consumer's demand derived in equation (1).

2.3.2 Cost minimisation

Since the following cost minimisation problem is applied to both domestic-oriented firms and multinationals, superscripts D and FDI are temporarily dropped in this subsection. Each firm's production cost, TC_j, comprises labour cost, intermediate good cost and a fixed cost to enter each market, as in

$$ TC_j = L_j w + \int q_{ji} p_i di + f, \tag{5} $$

where p_i is the price of an intermediate good variety i.

The cost minimization problem of the final producer is to choose the quantities of labour (L_j) and the intermediate goods (q_{ji}) to minimize (5) subject to the firm's technology given by (3) and

(4), taking the wage rate and the prices of the intermediate good as given. This yields the optimal employment of labour and the optimal inputs of intermediates given by

$$L_j = \frac{(1-\beta) P_I}{\beta w} I_j \tag{6}$$

$$q_{ji} = I_j P_I^\varepsilon p_i^{-\varepsilon}, \tag{7}$$

where

$$I_j = q_j \frac{1}{\varphi_j} \left[\frac{\beta w}{(1-\beta) P_I} \right]^{1-\beta} \tag{8}$$

and

$$P_I = \left[\int p_i^{\frac{1-\varepsilon}{\varepsilon}} di \right]^{\frac{\varepsilon}{1-\varepsilon}}. \tag{9}$$

A firm's demand for intermediate goods, I_j, is a function of its productivity and its output quantity. Given this demand for intermediate goods, its demand for each intermediate good variety is determined by the intermediate goods price index, P_I, and the price of each intermediate good variety. Note that a single firm is too small to affect the market price index, so the intermediate goods price index is exogenous from the point of view of a final producer and, given the above discussion of no predetermined type of suppliers, each final producer in each country faces the same intermediate goods price index.

Substituting L_j from (6) and I_j from (8) into the total cost function (5) and then taking its derivative with respect to q_j give us the marginal cost of production, which is constant with respect to q_j,

$$c_j = \frac{1}{\varphi_j} \left(\frac{w}{1-\beta} \right)^{1-\beta} \left(\frac{P_I}{\beta} \right)^{\beta}. \tag{10}$$

2.4 Profit maximisation

Given the consumer's demand (1), a final producer j chooses its optimal price and output to maximise its profit

$$\pi_j = q_j p_j - q_j c_j - f.$$

This is the standard profit maximisation problem of a monopolistic firm, in which each firm chooses the output quantity q_j in order to maximise profit π_j, yielding the well-known markup pricing rule applied to a monopolistic firm

$$p_j = \frac{\theta}{\theta - 1} c_j.$$

Substituting $c(\varphi)$ from (10) in the price function gives the optimal price of each final good variety

$$p_j = \frac{\theta}{\theta - 1} \frac{1}{\varphi_j} \left(\frac{w}{1-\beta} \right)^{1-\beta} \left(\frac{P_I}{\beta} \right)^{\beta} = \frac{B}{\varphi_j} P_I^\beta. \tag{11}$$

where for notation simplification

$$B = \frac{\theta}{\theta - 1} \left(\frac{w}{1-\beta} \right)^{1-\beta} \left(\frac{1}{\beta} \right)^{\beta}, B > 0.$$

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From (10) and (2), it can be seen that the cost and price of a final good variety are increasing in the intermediate good price index and vary with respect to φ. In particular, a more productive firm has a lower marginal cost and sets a lower price, whereas a less productive firm sets a higher price due to its higher marginal cost.

The profit for each final producer is, therefore,

$$\pi_j = \frac{Y}{\theta}\left(\frac{\varphi_j P}{B P_I^{\beta}}\right)^{\theta-1} - f,$$

which is increasing in productivity and the final good price index, and decreasing in the intermediate good price index.

After adding back the superscript D and FDI, the domestic and FDI profits for a final producer are

$$\pi_j^D = \frac{Y}{\theta}\left(\frac{\varphi_j P}{B P_I^{\beta}}\right)^{\theta-1} - f^D,$$

and

$$\pi_j^{FDI} = \frac{Y}{\theta}\left(\frac{\varphi_j P}{B P_I^{\beta}}\right)^{\theta-1} - f^{FDI}.$$

The corresponding zero-profit productivity cutoffs for each type of final producers are given by

$$\varphi^D = \frac{B P_I^{\beta}}{P}\left(\frac{\theta f^D}{Y}\right)^{\frac{1}{\theta-1}}, \tag{12}$$

and

$$\varphi^{FDI} = \frac{B P_I^{\beta}}{P}\left(\frac{\theta f^{FDI}}{Y}\right)^{\frac{1}{\theta-1}}. \tag{13}$$

These productivity cutoffs for final producers are similar to Helpman et al. (2004), except that our productivity cutoffs are dependent on the intermediate good price index. As expected, the productivity cutoff to become a multinational in (13) is higher than the domestic cutoff in (12), $\varphi^{FDI} > \varphi^D$, given the assumed higher multinational entry cost relative to the domestic entry cost. Hence, a firm will never choose to be a multinational without also selling to the domestic market, and only a small number of the most productive firms become multinationals and invest directly abroad. Given that countries are symmetric, firms' profits and, thus, the zero-profit productivity cut-offs (12) and (13) are the same for final producers in both countries.

2.5 Demand for intermediate goods

Given q_j and p_j in (1) and (2), the total demand for the composite intermediate good from a final producer, given by (8), can be expressed as follows

$$I_j = \varphi_j^{\theta-1} Y P^{\theta-1} P_I^{\beta-1-\theta\beta} B^{-\theta}\left[\frac{\beta w}{1-\beta}\right]^{1-\beta},$$

where I_j is increasing in the firm's productivity level and the local market size and decreasing in the price index of the intermediate good. Out of this total demand for the intermediate good,

according to (7), a final producer sources the following quantity from supplier i of a domestically produced intermediate good variety

$$q_{ji} = I_j P_I^\varepsilon p_i^{-\varepsilon} = \varphi_j^{\theta-1} E p_i^{-\varepsilon}, \tag{14}$$

and the following quantity from supplier i of an imported intermediate good variety (superscript x)

$$q_{ji}^x = I_j P_I^\varepsilon (p_i^x)^{-\varepsilon} = \varphi_j^{\theta-1} E (p_i^x)^{-\varepsilon}, \tag{15}$$

where

$$E = Y P^{\theta-1} P_I^{\varepsilon+\beta-1-\theta\beta} B^{-\theta} \left[\frac{\beta w}{1-\beta}\right]^{1-\beta}, \tag{16}$$

and p_i^x is the imported price of an intermediate good variety.

Integrating the demand for intermediate goods, given by (14) and (15), over all final producers in each group, i.e., firms with productivity greater than the productivity cutoff of each group, gives us the aggregate demand for an intermediate good from each group of final producers. Specifically, the demand by domestic-oriented final producers for a domestically produced intermediate good variety is given by

$$q_i^d = \int_{j|\varphi_j \geqslant \varphi^D} q_{ji} dj = E p_i^{-\varepsilon} \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j), \tag{17}$$

and for an exported intermediate good variety from foreign suppliers is given by

$$q_i^x = \int_{j|\varphi_j \geqslant \varphi^D} q_{ji}^x dj = E (p_i^x)^{-\varepsilon} \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j). \tag{18}$$

For multinationals, those with productivity greater than φ^{FDI} in each market, their demand for a domestically produced intermediate good variety is given by

$$q_i^m = \int_{j|\varphi_j \geqslant \varphi^{FDI}} q_{ji} dj = E p_i^{-\varepsilon} \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j). \tag{19}$$

2.6 Intermediate goods suppliers

2.6.1 Production technology and cost function

Each supplier produces a single differentiated variety of the intermediate good using only labour via the production function

$$q_i = \varphi_i L_i,$$

where q_i is the output of a supplier with productivity φ_i, and its labour employment L_i can be sourced from a relatively large local labour market at the same constant wage rate w. This production technology applies to suppliers of all types so we drop the superscripts for suppliers in this subsection.

The production cost of a supplier, comprising the mentioned fixed cost f and the labour cost, is

$$TC_i = L_i w + f = \frac{q_i}{\varphi_i} w + f.$$

The marginal cost of each intermediate good variety is, therefore, constant with respect to quantity

$$c_i = \frac{\partial TC_i}{\partial q_i} = \frac{w}{\varphi_i}. \tag{20}$$

A supplier will choose its type, its price p_i and output q_i to maximise its profit knowing its marginal cost (20) and the demand for its output in each market, given by (17), (18) and (19). As the demand for intermediate goods varies by firm type, in the following subsection, the profit maximisation problem will be discussed separately for each supplier type.

2.6.2 Profit maximisation problem of a domestic-oriented supplier

Given the marginal cost of production derived in (20) and the demand for its output in (17), a domestic-oriented supplier maximises profits

$$\max_{p_i, q_i} \pi_i^d = q_i p_i - q_i c_i - f^d,$$

and chooses the price

$$p_i = \frac{\varepsilon}{\varepsilon - 1} c_i = \frac{\varepsilon}{\varepsilon - 1} \frac{w}{\varphi_i}, \tag{21}$$

and output

$$q_i^d = E \left(\frac{\varepsilon}{\varepsilon - 1} \frac{w}{\varphi_i} \right)^{-\varepsilon} \int_{\varphi^D} \varphi_j^{\theta - 1} dG(\varphi_j).$$

The profit for each domestic-oriented supplier is then given by

$$\pi_i^d = \varphi_i^{\varepsilon - 1} \frac{1}{\varepsilon} \left(\frac{\varepsilon - 1}{\varepsilon w} \right)^{\varepsilon - 1} E \int_{\varphi^D} \varphi_j^{\theta - 1} dG(\varphi_j) - f^d. \tag{22}$$

As suppliers produce as long as they make at least zero profits in (22) and such profits are increasing in φ_i, a supplier will sell to the domestic final producers if its productivity is greater than the domestic zero-profit productivity cutoff φ_I^d,

$$\varphi_I^d = \left[\frac{\varepsilon f^d \left(\frac{\varepsilon w}{\varepsilon - 1} \right)^{\varepsilon - 1}}{E \int_{\varphi^D} \varphi_j^{\theta - 1} dG(\varphi_j)} \right]^{\frac{1}{\varepsilon - 1}}. \tag{23}$$

2.6.3 Profit maximisation problem of an exporting supplier

Similar to the case of a domestic-oriented firm, an exporting supplier maximises profits

$$\max_{p_i, q_i} \pi_i^x = q_i^x p_i^x - \tau q_i^x c_i - f^x,$$

and sets the price

$$p_i^x = \tau \frac{\varepsilon}{\varepsilon - 1} \frac{w}{\varphi_i} \tag{24}$$

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and output for its export product

$$q_i^x = E \left(\frac{\varepsilon}{\varepsilon - 1} \frac{\tau w}{\varphi_i} \right)^{-\varepsilon} \int_{\varphi^D} \varphi_j^{\theta-1} dG \left(\varphi_j \right).$$

Export profits are, therefore,

$$\pi_i^x = \tau^{1-\varepsilon} \varphi_i^{\varepsilon-1} \frac{1}{\varepsilon} \left(\frac{\varepsilon - 1}{\varepsilon w} \right)^{\varepsilon-1} E \int_{\varphi^D} \varphi_j^{\theta-1} dG \left(\varphi_j \right) - f^x. \quad (25)$$

Because the export profits are increasing in φ_i, suppliers will export when their productivity is greater than the export zero-profit productivity

$$\varphi_I^x = \left[\frac{\tau^{\varepsilon-1} \varepsilon f^x \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^D} \varphi_j^{\theta-1} dG \left(\varphi_j \right)} \right]^{\frac{1}{\varepsilon-1}}. \quad (26)$$

Given that countries are symmetric, final producers in both countries face the same zero-profit productivity cutoffs and, hence, domestic-oriented suppliers and exporting suppliers face the same market size. As shown in equations (23) and (26), what determines the suppliers' behaviour is the fixed entry cost and the variable trade costs to export. Both equations show that the productivity cutoffs for suppliers to sell to domestic final producers and to export to foreign final producers increase in the productivity cutoffs of the corresponding final producers. Therefore, only relatively more productive intermediate suppliers are able to supply to a market with relatively more productive final producers. In particular, when there is a higher cutoff for final producers, there will be fewer firms surviving, meaning a lower demand for intermediate goods and, thus, only the most productive intermediate goods suppliers can survive.

2.6.4 Profit maximisation problem of a multinational supplier

Finally, given the demand in equation (19) for the output of a multinational supplier, its optimal profits from selling to multinationals are given by

$$\pi_i^m = \varphi_i^{\varepsilon-1} \frac{1}{\varepsilon} \left(\frac{\varepsilon - 1}{\varepsilon w} \right)^{\varepsilon-1} E \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG \left(\varphi_j \right) - f^m. \quad (27)$$

It follows that intermediate suppliers will sell to multinationals if their labour productivity is greater than or equal to the zero-profit productivity cutoff for multinational suppliers

$$\varphi_I^m = \left[\frac{\varepsilon f^m \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG \left(\varphi_j \right)} \right]^{\frac{1}{\varepsilon-1}}. \quad (28)$$

Just like a higher productivity cutoff for final producers, φ^D, results in higher productivity cutoffs for suppliers φ_I^d and φ_I^x, as shown above, a higher productivity cutoff for multinationals, φ^{FDI}, will also result in a higher φ_I^m. This implies that only the more productive suppliers can survive when the multinational productivity cutoff increases and there are fewer multinationals in the market.

2.7 Analysis of suppliers' behaviour

The simultaneous equilibria in both sectors are determined by eight equations with eight endogenous variables. The eight endogenous variables comprise the two aggregate price indices in the two sectors (P and P_I), the two zero-profit productivity cutoff levels that determine the mass of domestic and FDI final producers (φ^D and φ^{FDI}), the three productivity cutoffs that determine the mass of each supplier (φ_I^d, φ_I^x and φ_I^m) and the variable E. The eight equations determining these endogenous variable are (2), (9), (12), (13), (23), (26), (28) and (16). These simultaneous equations can be solved with closed-form solutions for the eight endogenous variables, but the solutions are intricate given the two-sector structure of the model involving foreign direct investment and trade.

Since the aggregate prices are exogenous to the suppliers and the same across suppliers, the suppliers' behaviour can be analysed without using the closed form solutions as follows.

Proposition 1 *Both exporting suppliers and multinational suppliers have higher productivity cutoffs than domestic-oriented suppliers, i.e., $\varphi_I^x > \varphi_I^d$ and $\varphi_I^m > \varphi_I^d$, where φ_I^d, φ_I^x and φ_I^m are given by* (23), (26) *and* (28), *respectively.*

Proof. Since $f^x > f^d$ and $\tau \geq 1$, it follows that

$$\left[\frac{\tau^{\varepsilon-1} \varepsilon f^x \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j)} \right]^{\frac{1}{\varepsilon-1}} > \left[\frac{\varepsilon f^d \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j)} \right]^{\frac{1}{\varepsilon-1}},$$

or equivalently

$$\varphi_I^x > \varphi_I^d.$$

Since $\varphi^{FDI} > \varphi^D$, we have

$$\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j) < \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j).$$

Together with $f^m > f^d$, it follows that

$$\left[\frac{\varepsilon f^m \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j)} \right]^{\frac{1}{\varepsilon-1}} > \left[\frac{\varepsilon f^d \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j)} \right]^{\frac{1}{\varepsilon-1}},$$

hence

$$\varphi_I^m > \varphi_I^d.$$

■

This proposition shows that higher productivity is required to become a multinational supplier or an exporter than to become a domestic-oriented supplier. Thus, both suppliers to multinationals and exporting suppliers are more productive than the domestic-oriented suppliers. Intuitively, a supplier has to be more productive to cover the higher fixed entry costs to export and to supply to multinationals. Furthermore, there are fewer multinationals than firms of other types and, hence, it is more competitive to gain a contract with a multinational and only more productive suppliers can succeed in such competition.

Proposition 2 *Depending on relative entry costs, suppliers to foreign final producers (exporting suppliers) can be either more or less productive than suppliers to multinationals.*

(i) Under sufficiently low transportation costs and low fixed entry costs to export, the productivity cutoff to supply to multinationals is higher than the productivity cutoff to export,

$$\varphi_I^m > \varphi_I^x.$$

(ii) Under high transportation costs and high fixed entry costs to export and sufficiently low investment costs, the productivity cutoff to export is higher than the productivity cutoff to supply to multinationals,

$$\varphi_I^m < \varphi_I^x.$$

Proof. It can be seen that the comparison between φ_I^m and φ_I^x, or equivalently, between

$$\left[\frac{\varepsilon f^m \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG\left(\varphi_j\right)} \right]^{\frac{1}{\varepsilon-1}} \quad \text{and} \quad \left[\frac{\tau^{\varepsilon-1} \varepsilon f^x \left(\frac{\varepsilon w}{\varepsilon-1} \right)^{\varepsilon-1}}{E \int_{\varphi^D} \varphi_j^{\theta-1} dG\left(\varphi_j\right)} \right]^{\frac{1}{\varepsilon-1}},$$

depends on the comparison between

$$\frac{f^m}{\tau^{\varepsilon-1} f^x} \quad \text{and} \quad \frac{\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG\left(\varphi_j\right)}{\int_{\varphi^D} \varphi_j^{\theta-1} dG\left(\varphi_j\right)}.$$

If τ and f^x are sufficiently low relative to f^m and $\frac{\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j)}{\int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j)}$ is sufficiently low, such that

$$\frac{f^m}{\tau^{\varepsilon-1} f^x} > \frac{\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG\left(\varphi_j\right)}{\int_{\varphi^D} \varphi_j^{\theta-1} dG\left(\varphi_j\right)}, \tag{29}$$

we have that

$$\varphi_I^m > \varphi_I^x.$$

Otherwise, if τ and f^x and $\frac{\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j)}{\int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j)}$ are sufficiently high, then

$$\varphi_I^m < \varphi_I^x.$$

∎

This proposition sets the ground for the two scenarios that will be discussed in the empirical section. Since exporting and supplying to multinationals are distinct options for a foreign-oriented supplier, it is interesting to know the characteristics that differentiate these two types of suppliers. It should be noted that on the right-hand side of (29), the numerator is the multinationals' sales in a country and the denominator is the export sales to the foreign country, so the ratio on the right-hand side represents the ratio between FDI flows and the size of the foreign market. Intuitively, a high cost to set up multinational production results in a small number of multinationals in each country, and therefore, suppliers have to be more productive to compete for a place in the multinational market. Hence, it is more difficult to become a multinational supplier than to become an exporter facing a larger demand for its output in the foreign market. Only when the multinational set-up

cost is relatively low, and hence, there is a large mass of multinationals, does the productivity cutoff to supply to multinationals become lower than the productivity cutoff to export.

Each supplier faces the following strategies: (i) becoming a domestic-oriented supplier only, (ii) exporting, (iii) supplying to multinationals, and (iv) both exporting and supplying to multinationals. In the last case, a supplier pays a cost $f^{x+m} = f^x + f^m$ and earns profits from both markets

$$\pi_i^{x+m} = \varphi_i^{\varepsilon-1} \frac{1}{\varepsilon} \left(\frac{\varepsilon-1}{\varepsilon w} \right)^{\varepsilon-1} E \left[\tau^{1-\varepsilon} \int_{\varphi^D} \varphi_j^{\theta-1} dG(\varphi_j) + \int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG(\varphi_j) \right] - f^{x+m}. \tag{30}$$

Given these four strategies, which all involve at least supplying to domestic final producers, a firm would rationally choose the strategy that returns the highest profit.

To facilitate the exposition, it is instructive to visualize on the same diagram all the profit functions of the four supplier types, as given by equations (22), (25), (27) and (30). The following two figures graph the profit functions for each supplier type, with profits on the vertical axis and suppliers' productivity φ_i on the horizontal axis. All four profit functions are linear and increasing in productivity φ_i, which implies that more productive suppliers are more profitable in each market. In both figures, the vertical intercepts of the four profit lines are respectively: $-f^d > -f^m > -f^x > -f^{x+m}$. The zero-profit productivity cutoffs, $\varphi_I^{d^{\varepsilon-1}}$, $\varphi_I^{m^{\varepsilon-1}}$, $\varphi_I^{x^{\varepsilon-1}}$ and $\varphi_I^{x+m^{\varepsilon-1}}$ represent the four horizontal intercepts of the above four profit lines respectively.

As implied from Proposition 1, the domestic profit line π_i^d is higher than both the π_i^x and π_i^m at all levels of productivity given its higher vertical intercept and its higher slope. Therefore, selling to the domestic market is always the first choice for any supplier. Among the remaining three mutually exclusive strategies, a supplier would choose the highest return strategy, i.e., that corresponding to the highest profit line, depending on its productivity.

It is clear that π_i^{x+m} has a higher slope compared to π_i^x and π_i^m as its slope is the sum of the slopes of the last two profit lines. Given its lowest vertical intercept, there exists a sufficiently high productivity level such that π_i^{x+m} surpasses the other two profit lines.

The unclear part is the relative position between the export profit line π_i^x and the multinational supplier profit line π_i^m. The two following scenarios correspond to the two cases of Proposition 2, where these two profit lines have different relative positions to each other.

Scenario (i) - Supplier strategy in a low trade costs/high investment costs country
Figure 1 presents the first scenario of the relative positions of the four profit lines, where the export profit line π_i^x intersects with the multinational supplier profit line π_i^m at point A, lower than the zero-profit line, resulting in a lower horizontal intercept φ_I^x compared to φ_I^m. This reflects Proposition 2(i), where becoming an exporter is easier than becoming a multinational supplier.

In this case, the export profit line π_i^x is higher than the multinational supplier profit line π_i^m for any productivity $\varphi_i \geq \varphi_I^x$, making the strategy to supply to multinationals a non-preferred choice for suppliers. The preferred order of strategies for a supplier in this scenario (represented by the thick lines in Figure 1) is as follows: to exit the market if $\varphi_i < \varphi_I^d$, to serve domestic firms only if $\varphi_I^d \leq \varphi_i < \varphi_I^x$, to serve domestic firms and export if $\varphi_I^x \leq \varphi_i < \varphi_I^m$ and to serve domestic firms, export and supply to multinationals if $\varphi_I^m \leq \varphi_i$.

As discussed, the condition for this low trade costs/high investment costs scenario is given by

Figure 1: Supplier strategy in a low trade costs/high investment costs scenario
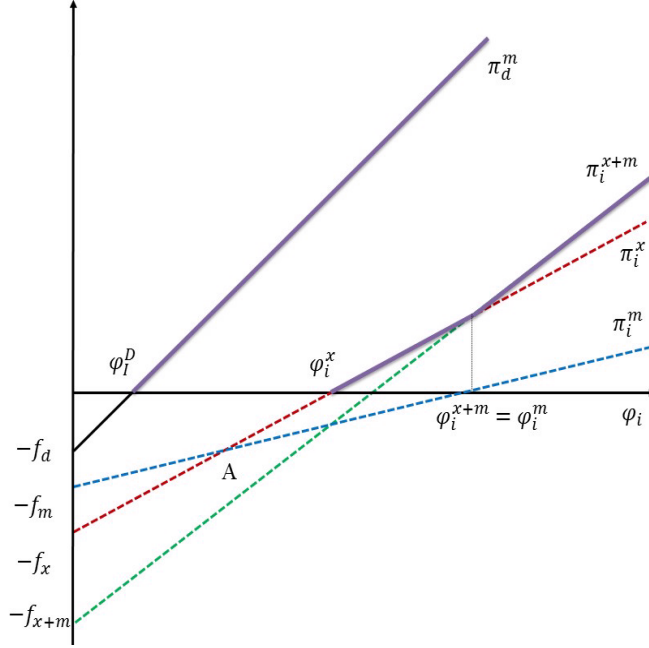
equation (29)

$$\frac{f^m}{\tau^{\varepsilon-1}f^x} > \frac{\int_{\varphi^{FDI}} \varphi_j^{\theta-1} dG\left(\varphi_j\right)}{\int_{\varphi^D} \varphi_j^{\theta-1} dG\left(\varphi_j\right)},$$

which means that the transportation cost τ between the home country and the foreign country as well as the relative fixed trade cost $\frac{f^x}{f^m}$ should be sufficiently low. At the same time, the ratio of FDI flows over the market size should be sufficiently low. In the real world, this scenario is rather likely given the fact that only few top productive firms become multinationals due to the high fixed cost to set up production overseas relative to the fixed cost to serve the domestic market or export.

Scenario (ii) - Supplier strategy in a high trade costs/low investment costs country
Figure 2 presents the second scenario for the relative positions of the four profit lines, where π_i^x either lies completely below π_i^m, or intersects with π_i^m at point B, above the zero-profit line. This reflects Proposition 2(ii), where becoming an exporter is more difficult than becoming a multinational supplier, $\varphi_I^x > \varphi_I^m$.

Firms can adopt both strategies and the profit line of such option, π_i^{x+m}, intersects with π_i^m and surpasses this profit line when $\varphi_i > \varphi_I^x$. In other words, if a firm has a higher productivity than φ_I^x, it chooses to both export and supply to multinationals to maximise its total profits. Exporting only becomes a non-preferred option for suppliers in this scenario. The condition for this case to occur is the reverse of condition (29). It means that the transportation cost τ between the home country and the foreign country as well as the relative fixed cost $\frac{f^x}{f^m}$ should be sufficiently high. At the same time, the ratio of FDI sales over the market size should be sufficiently high.

Figure 2: Supplier strategy in a high trade costs/low investment costs scenario
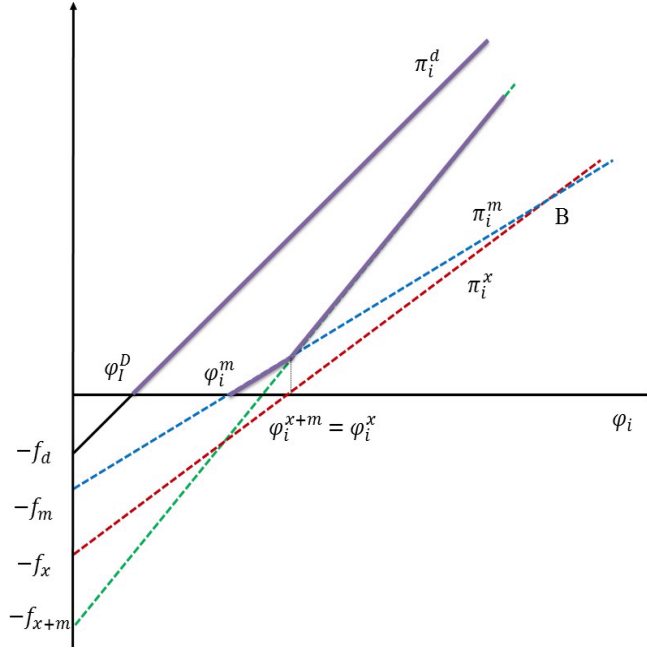
In this scenario, for a supplier with labour productivity φ_i, its strategy (reflected by the thick lines in Figure 2) will be: to exit the market if $\varphi_i < \varphi_I^d$, to serve domestic firms only if $\varphi d \leq \varphi_i < \varphi_I^m$, to serve domestic firms and supply to multinationals if $\varphi_I^m \leq \varphi_i < \varphi_I^x$, and to serve domestic firms, export and supply multinationals if $\varphi_i \geq \varphi_I^x$.

While the preferred strategy of more productive suppliers can be different under the two scenarios, the chosen strategy of the top productive suppliers is the same in both cases, which is to both export and supply to multinationals.

3 Empirical Analysis

This section reports on an empirical investigation of whether the association between a firm's productivity and its corresponding strategy follows the predictions in Proposition 1 and Proposition 2. These propositions, based on our theoretical model, establish that more productive suppliers either export or supply to multinationals, the top productive suppliers pursue both strategies, while the least productive suppliers sell to domestic final producers only. The distinction between exporting suppliers and multinational suppliers depends on the fixed trade costs relative to the fixed investment costs. In a low trade costs and high investment costs country, multinational suppliers need to be more productive to succeed compared to exporting suppliers. In contrast, in countries with high trade and low investment costs, exporting suppliers need to be more productive than multinational suppliers. Therefore, a reduction of the fixed investment costs encourages suppliers to become multinational suppliers, whereas they prefer exporting over supplying to multinationals under a liberalised trade regime.

The model's predictions can be tested by comparing average productivity levels across different types of suppliers with firms' preferences for different strategies. The following subsections will firstly describe the data, and then provide an exploratory analysis to examine if exporting suppliers and multinational suppliers show different characteristics compared to domestic-oriented suppliers. The Kolmogorov-Smirnov tests are used to compare the labour productivity distributions across the four groups of suppliers, i.e., domestic-oriented suppliers, multinational suppliers, exporters and suppliers that both export and serve multinationals. Finally, a more formal analysis of the factors that affect firms' choices is conducted with the use of the multinomial probit model.

3.1   Data

Data on firm performance and sales destinations are taken from the Business Environment and Enterprise Performance Survey (BEEPS), which was jointly collected by the World Bank and the European Bank for Reconstruction and Development. BEEPS is composed of both repeated cross-sectional datasets and a panel dataset, which include information on the characteristics of firms located in 29 European and Central Asian countries for years 2002, 2005 and 2009.[2] Data for GDP, export costs, FDI flows and exchange rates for these 29 countries are taken from the World Bank's country database.

The BEEPS survey covers all manufacturing sectors according to the group classification of ISIC Revision 3.1, construction, services, and transport, storage and communications sector. The establishments included in BEEPS are defined as commercial, service or industrial business establishments and have at least five full-time employees, while government departments and establishments in primary industries including agriculture are excluded. While the panel dataset BEEPS 2002-2009 contains information about firms' performance in each surveyed year and three years prior to each survey, it does not contain specific information on firms' domestic sales. Such information is only included in the 2002 and 2005 cross-sectional surveys due to differences in the questionnaire used in the 2008/2009 survey round. Our dataset is, thus, constructed by merging two cross-sectional datasets, BEEPS 2002 and BEEPS 2005, containing information on firms' sales composition into the main panel dataset, BEEPS 2002-2009, using for each round the identification code at the establishment level.

Our sample is limited to 12,408 observations covering the years 2002 and 2005 and including firms with non-missing information for total sales, labour force, export sales and sales to multinationals. Data on sales, components of sales, fixed assets, material input cost, operating cost, labour cost, R&D investment and other costs denominated in local currencies are converted into US dollars using the corresponding exchange rates in 2002 and 2005 for consistent comparison. Given the small number of firms that were interviewed and recorded in both years, the dataset is made up of a pooled cross-sectional sample. The first sample includes 7691 observations for 2005 and the second sample includes 4717 observations for 2002. The 2005 sample will be used for the descriptive analysis, a comparison of labour productivity between different categories of firms as well as for the main analysis using the multinomial probit model, while the 2002 sample is used as a robustness check.[3]

The survey data provide firms' shares of sales to multinationals, parent firms, governments,

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[2]Countries included in the BEEPS dataset are Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech, Estonia, Georgia, Hungary, Ireland, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Tajikistan, Turkey, Ukraine and Uzbekistan.

[3]Additional results are available upon request.

Table 2: Number of firms by category

Year 2002				
	Exporter	Non-exporter	Total	Share
MNC supplier	355	315	670	14%
Non-MNC supplier	953	3,094	4,047	86%
Total	1,308	3,409	4,717	100%
Share	28%	72%	100%	
Year 2005				
	Exporter	Non-exporter	Total	Share
MNC supplier	527	578	1,105	14%
Non-MNC supplier	1,407	5,179	6,586	86%
Total	1,934	5,757	7,691	100%
Share	25%	75%	100%	

state-owned enterprises, large domestic firms (with more than 250 employees) and individuals and small domestic firms (with less than 250 employees), which altogether make up one hundred percent of each firm's total sales. Firms with positive sales to multinationals, large domestic firms, parent firms or state-owned enterprises account for 56.72% of the total number of firms, while there are 43.28% of firms selling all their output to small domestic firms and individuals. There is, however, no further breakdown of the share of sales to this group into small domestic firms and individuals separately.

Firms are divided into four categories according to two activities, exporting and supplying to multinationals. An exporter is defined as a firm whose export sales account for a positive share of total sales of the firm. A multinational supplier (MNC supplier) is defined as a firm whose share of sales going to multinational customers is positive. Table 2 provides a frequency table for each category by year. It can be seen that exporters account for nearly 25%–28% of the total number of firms in each year, while only 14% of firms supply to multinationals in the host countries.

Table 3 provides a summary statistics of key variables, i.e., log of output sales ($\ln Y$), log of labour employed ($\ln L$), and log of labour productivity ($\ln LP$), which is calculated as the ratio of total sales over total permanent labour. The variable representing the category a firm belongs to, Type, takes value of 0 (Neither) if the firm neither exports nor supplies to multinationals (i.e., firms in this category only serve the domestic customers), value of 1 (MNC supplier) if the firm only supplies multinationals, value of 2 (Exporter) if the firm exports only and value of 3 (Both) if the firm serves both the export market and multinationals.

The summary statistics reveal that firms that export (category 2) tend to have higher sales and larger scale (in term of labour force) than firms that serve the domestic market or multinationals. Firms that supply to multinational customers (category 1) also have larger sales and larger scale than firms that serve only domestic customers (category 0). Both exporting firms and multinational-supplying firms have distinctively higher labour productivity than firms that serve only domestic customers.

Across the four categories, firms that participate in both activities, i.e., exporting and supplying to multinationals (category 3), have the largest scale and highest labour productivity on average, whereas firms that neither export nor supply to multinationals tend to have the smallest scale and lowest labour productivity.

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Table 3: Summary statistics by firm categories

Year 2002				
Type	No obs	Sales	Labour	Labour productivity
0. Neither	3,094	4.90	2.82	2.09
		(1.84)	(1.55)	(1.20)
1. MNC supplier	315	6.05	3.46	2.59
		(1.98)	(1.62)	(1.24)
2. Exporter	953	6.73	4.16	2.57
		(1.87)	(1.73)	(1.20)
3. Both	355	6.98	4.09	2.89
		(1.97)	(1.77)	(1.19)
Year 2005				
0. Neither	5,179	5.60	2.56	3.04
		(1.79)	(1.50)	(1.19)
1. MNC supplier	578	6.66	3.14	3.52
		(1.88)	(1.51)	(1.27)
2. Exporter	1,407	7.30	3.85	3.46
		(1.88)	(1.67)	(1.22)
3. Both	527	7.69	3.91	3.78
		(1.94)	(1.69)	(1.15)

Notes: The table shows mean values of the logarithm for each variable with standard deviations in parentheses.

Table 4: Summary statistics of additional firms' characteristics by firm categories in 2005

Type	No obs	Wages	Investment	Operating	Marketing	R&D
0. Neither	2,728	1.60	2.02	5.72	1.29	0.32
1. MNC supplier	362	1.85	2.98	6.66	2.24	0.67
2. Exporter	847	1.79	3.45	7.28	2.72	1.45
3. Both	365	2.09	3.78	7.60	3.21	1.75

Notes: The table shows mean values of the logarithm for each variable.

As discussed in the theoretical part, the export market and multinational markets may be more demanding and require higher product and delivery standards. A supplier, therefore, needs to make deliberate investment efforts to enter the export and multinational markets. These efforts may include investigating the new market's tastes and requirements as well as actively advertising products to the new potential customers. The marketing cost and investment to upgrade production to the required standards are parts of the fixed entry costs to enter the new market and should therefore be higher for firms in categories 1, 2 and 3. Table 4 provides the summary statistics of the variables that are used as proxies for firms' deliberate investment efforts to enter the new markets. Note that information about wages is only available for year 2005, so the table provides the summary statistics for year 2005 only. The variables *Wages*, *Investment*, *Operating*, *Marketing* and *R&D* represent, respectively, firms' average wages, new investment in fixed assets, operating costs, marketing and advertisement costs and R&D expenditures.

It can be seen from the above summary statistics that exporters and suppliers to multinationals

tend to pay higher wages, spend more on new fixed assets, operating costs and marketing and advertisement activities, and invest more in R&D. The average values of investment in R&D, total investment, operating costs and marketing costs are highest for firms participating in both activities, followed by firms exporting only, then firms supplying to multinationals and finally firms not participating in neither activity. Average wages paid to workers also follow a similar order, except that multinational suppliers pay higher wages on average than exporting suppliers.

3.2 Exporters' and multinational suppliers' premia

To explore whether firms that export or supply to multinationals have different characteristics compared to firms that engage in neither of those two activities, we follow Bernard and Jensen (1999) and estimate exporters' and multinational suppliers' premia for different firms' characteristics. The specification used is given by

$$\ln X_i = \alpha + \beta_m MNC \ supplier_i + \beta_x Exporter_i + \beta_{mx} Both_i + \tag{31}$$
$$\delta_s Size\_dummies_i + \delta_i Sector\_dummies_i + \delta_c Country\_dummies_i + e_i,$$

where X_i are firm i's characteristics, $MNC \ supplier_i$ is a dummy equal to 1 if firm i supplies to multinationals but does not export, $Exporter_i$ is a dummy equal to 1 if firm i exports but does not supply to multinationals, and $Both_i$ is a dummy indicating if firm i engages in both activities. The coefficients β_m, β_x and β_{mx}, therefore, measure the difference in the characteristics between multinational suppliers, exporters and firms doing both activities compared to domestic-oriented suppliers, the omitted category.

Based on the available data, the characteristics that this section examines include firms' labour productivity (LP), average wages ($Wages$), new investment in fixed assets ($Investment$), marketing costs ($Marketing$) and R&D spending ($R\&D$). Size dummies (in terms of labour employment), sector dummies and country dummies are also included to control for other factors that could affect firms' characteristics.

The above five regressions are run in parallel using the Seemingly Unrelated Regression (SUR) estimator via Maximum Likelihood on the 2005 sample. SUR takes into account the possible correlation across the error terms from the five regressions. The estimation results and the F-tests for the differences in the coefficients for each regression are reported in Table 5.

The results show that labour productivity, labour wages, investment, marketing costs and R&D investment are all significantly higher for firms participating in either activity compared to firms that neither export nor supply to multinationals. The point estimates tend to be the highest for firms participating in both activities. The preliminary results are in line with the theoretical model (Proposition 1) suggesting that exporters and multinational suppliers are more productive than domestic-oriented suppliers. The F-tests for the differences in labour productivity across the three firm categories all tend to be insignificant, meaning that labour productivity levels across exporters, multinational suppliers and firms doing both activities are not statistically different.

The test results show consistent evidence in support of our assumption about the fixed entry costs to each market. It is revealed that exporting firms, multinational suppliers as well as firms doing both activities have significantly higher marketing costs than firms doing neither activity. Firms that engage with both customers abroad and multinational customers, as expected, spend the most on marketing activities because they choose to access two different markets at the same time.

Table 5: Exceptional characteristics of exporters and multinational suppliers

	Labour productivity	Wages	Investment	Marketing	R&D
MNC supplier	0.311***	0.164***	0.670***	0.710***	0.943**
	(0.039)	(0.029)	(0.077)	(0.076)	(0.225)
Exporter	0.238***	0.097***	0.636***	0.784***	1.736***
	(0.031)	(0.023)	(0.061)	(0.061)	(0.179)
Both	0.317***	0.190***	0.818***	1.019***	2.166***
	(0.042)	(0.031)	(0.083)	(0.082)	(0.242)
Size dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes	yes
Number of obs.	4,608	4,608	4,608	4,608	4,608
R-squared	0.6778	0.7874	0.4630	0.5055	0.3117
$\chi 2$	9693.74	17066.48	3973.48	4710.42	2086.88
F-test results: $F_{(1, 4568)}$					
Both vs. Exporter	2.95*	7.70***	4.07**	6.91***	2.64
Both vs. MNC supplier	0.01	0.44	1.99	8.83***	15.8***
Exporter vs. MNC supplier	2.54	4.02**	0.14	0.69	9.09***

Notes: All left-hand side variables are measured in logs. Standard errors are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels.

Exporters tend to spend more on marketing activities compared to multinational suppliers, as indicated by the coefficients on marketing costs. The difference is, however, insignificant. It is possible that, in order to supply to multinational customers, local suppliers may have to carry out different marketing activities or set up different distribution channels from their domestic practices, hence the costs are comparable to the entry cost to a foreign market. It can be noted that, according to our model, the closer these two entry costs are, the higher the likelihood that Scenario (i) of Proposition 2 would occur, suggesting that exporting is an easier choice for suppliers than supplying to multinationals.

3.3 Comparison of productivity distributions

Another way to test whether exporters and multinational suppliers tend to have higher levels of labour productivity than domestic-oriented firms is to compare their productivity distributions. The comparisons are carried out for both the log of labour productivity ($\ln LP$) and the log of ex-ante labour productivity ($\ln LP_{-3}$), where the ex-ante labour productivity is calculated as the ratio of total sales over total permanent labour at time $t - 3$.[4]

Figure 3 presents the Kernel distributions for firms' labour productivity distributions (left panel) and ex-ante labour productivity distributions (right panel), measured in 2005, across the four categories, namely, exporting firms, suppliers to multinationals, firms that both export and supply to multinationals and firms that do neither. The figure shows that the distributions of firms' ex-ante productivity across different categories follow a specific pattern. The ex-ante productivity

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[4]Time t-3 is chosen because data are only available at that point in time as described in the data description.

Figure 3: Kernel distributions of labour productivity by firm categories
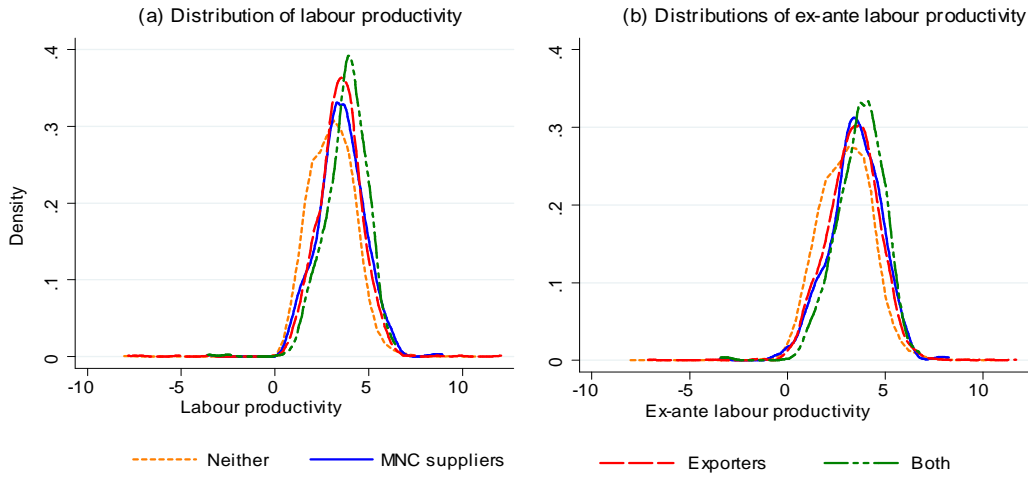
Notes: kernel = epanechnikov, bandwidth = 0.2000

distribution of firms that both export and supply to multinationals tends to be to the right of that of firms that export only and that of firms that only supply to multinationals. In turn, the latter productivity distributions tend to be to the right of the ex-ante productivity distribution of firms that do not engage in either activity. Similar figures are available for the 2002 sample.

A standard way to test for differences in distributions is to use the Kolmogorov-Smirnov test. In contrast to a comparison of means, which only evaluates a single moment of the distribution, the Kolmogorov-Smirnov test exploits the characteristics of the entire productivity distribution. For a distribution Da to be different from Db, one must reject the null hypothesis of the two-sample test on the equality of distributions.

The Kolmogorov-Smirnov test only makes it possible to compare two distributions at a time, so five distinct tests for the five pairs of categories are run: domestic-oriented suppliers (D0) versus multinational suppliers (D1) and exporters (D2), firms that both export and supply to multinationals (D3) versus firms that either export (D2) or supply to multinationals (D1), and finally, exporters (D2) versus suppliers to multinationals (D1).

The test statistics, using the 2005 sample, are presented in Table 6, where D-statistic is the distance between the cumulative distribution functions between each pair of groups. The null hypothesis that two groups come from the same distribution can be rejected with high D-statistics and p-values lower than 0.05. Based on the Kolmogorov-Smirnov test results, it can be confirmed that D1 as well as D2 are significantly different from D0, in particular firms in group D0 have generally lower productivity than firms in D1 and D2 (Panel A and Panel B). Therefore, both exporting suppliers and multinational suppliers tend to have higher current and ex-ante labour productivity compared to domestic-oriented firms. The self-selection of the most productive firms into exporting and supplying to multinationals is consistent with Proposition 1 of our model.

On the other hand, the distribution D3 is different from both D1 and D2 (Panel C and Panel D). Firms that engage in both activities tend to have higher productivity than firms exporting only or supplying only to multinationals. This evidence confirms that suppliers doing both activities

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Table 6: Kolmogorov-Smirnov test results

Panel A: MNC supplier (D1) vs. Neither (D0)				
	Distribution of $\ln LP$		Distribution of $\ln LP_{-3}$	
	D	P-value	D	P-value
D0 is the smaller group	0.178	0.000	0.178	0.000
Panel B: Exporter (D2) vs. Neither (D0)				
	Distribution of $\ln LP$		Distribution of $\ln LP_{-3}$	
	D	P-value	D	P-value
D0 is the smaller group	0.174	0.000	0.129	0.000
Panel C: Both (D3) vs. MNC supplier (D1)				
	Distribution of $\ln LP$		Distribution of $\ln LP_{-3}$	
	D	P-value	D	P-value
D1 is the smaller group	0.158	0.000	0.127	0.000
Panel D: Both (D3) vs. Exporter (D2)				
	Distribution of $\ln LP$		Distribution of $\ln LP_{-3}$	
	D	P-value	D	P-value
D2 is the smaller group	0.164	0.000	0.145	0.000
Panel E: MNC supplier (D1) vs. Exporter (D2)				
	Distribution of $\ln LP$		Distribution of $\ln LP_{-3}$	
	D	P-value	D	P-value
D1 is the smaller group	0.048	0.310	0.062	0.099

Notes: The table presents the results from the combined Kolmogorov-Smirnov tests.

tend to be the most productive firms, as predicted by our model.

When one compares the labour productivity distributions of exporters and multinational suppliers (Panel E), however, it is not possible to reject the null hypothesis that D1 and D2 come from the same distribution. Therefore, this test cannot differentiate exporting firms from multinational suppliers.

As inferred from Proposition 2, exporters would be more or less productive than multinational suppliers depending on the ratio of FDI inflows to market size and set-up costs to export. These characteristics may vary across countries and sectors in our sample, which can produce ambiguous results with the regards to the comparisons of labour distributions over the whole sample. This motivates us to analyse different characteristics at the country and sector level that may affect intermediate firms' choices with regards to the way they supply final producers.

3.4 Multinomial probability specification

As there is ambiguous evidence regarding differences in productivity between exporters and multinational suppliers in the previous analysis, the aim of this section is to analyse the conditions under which firms would choose a particular strategy over the others, and if their behaviour would change in response to trade and investment costs.

To analyse firms' choices over alternative supplying strategies, exporter, multinational supplier, neither or both, the multinomial probit (MNP) model will be employed. While the multinomial logit model with its closed form and simpler computation is more popular in most empirical studies,

its strict assumption of independence of irrelevant alternatives (IIA) may be problematic in our case. For each supplier, the opportunity to export would change the odd ratio of supplying to multinationals and doing both activities and, similarly, having the opportunity to do both activities would affect the odd ratio of supplying to multinationals and exporting. In our case, the results based on the multinomial logit model, available upon request, fail to reject the violation of IIA, which makes this specification less reliable. Moreover, the MNP model allows for different alternatives to be correlated. Hence, the MNP model is more reliable for this analysis.

Consider firm i choosing one alternative among a set of four alternatives $k = 0, 1, 2$ and 3: multinational supplier but not exporter ($k = 1$), exporter but not multinational supplier ($k = 2$), both multinational supplier and exporter ($k = 3$), and neither multinational supplier nor exporter ($k = 0$), i.e., the firm only sells to domestic customers. Type 0 will be used as the base outcome in our estimations.

These four options are mutually exclusive and exhaustive for firms. Firm i's decision to choose type k depends on its profits, which are a function of its ex-ante labour productivity, the ratio of FDI inflows over the market size, the sunk costs to export and to supply to multinational affiliates and possibly other firm-specific, sector-specific and country-specific factors. The profit function can be written as

$$U_{ik} = \beta_{0k} + \beta_{1k} \ln LP_{-3,i} + \beta_{Xk} X_i + \beta_{Zk} Z_i + \varepsilon_{ik}, \tag{32}$$

where U_{ik} is the profit of firm i with strategy k, covariates X_i include other firms' characteristics, covariates Z_i control for country and sector characteristics that might influence the decision of firm i, and ε_{ik} captures other unobserved factors that affect firm i's profits. To maximise profits, firm i chooses type k such that its profit is maximised. The probability that firm i chooses type k, therefore, is:

$$P_{ik} = \Pr\left(U_{ik} > U_{ik'}, \ \forall \ k' \neq k, k' \in [0, 3]\right).$$

Vector X_i includes firms' specific characteristics other than their ex-ante labour productivity, such that

$$X_i = \left\{\ln L_{-3,i}, \ \ln Age_i, \ \ln Age_i^2, \ FR_i\right\}, \tag{33}$$

where $\ln L_{-3,i}$ is the logarithm of a firm's labour force at time $t - 3$, $\ln Age_i$ is the logarithm of firm's age, and FR_i is a dummy variable equal to 1 if firm i has foreign-owned shares. The reason to include these controls is that larger and more experienced firms and firms with foreign-owned shares tend to be more able to pay for the fixed entry costs and, thus, have a greater advantage in exporting or supplying to multinational customers.

Depending on the variables included in vector Z_i, which controls for sector- and country-specific characteristics, we have two specifications, $M1$ and $M2$. Specification $M1$ is given by:

$$U_{ik} = \beta_{0k} + \beta_{1k} \ln LP_{-3,i} + \beta_{Xk} X_i + \beta_{Zk} Z1_i + \varepsilon_{ik}, \tag{34}$$

where

$$Z1 = \{Sector\_dummies, \ Country\_dummies\}, \tag{35}$$

and specification $M2$ is given by:

$$U_{ik} = \beta_{0k} + \beta_{1k} \ln LP_{-3,i} + \beta_{Xk} X_i + \beta_{Zk} Z2_i + \beta_{XZk} \ln LP_{-3,i} * Z2_i + \varepsilon_{ik}, \tag{36}$$

where

$$Z2 = \{\ln GDP, \ \ln(FDI/GDP), \ \ln EXC, \ Sector\_dummies\}. \tag{37}$$

In specification $M1$, we control for country and sector characteristics by including country dummies and sector dummies. While firms are grouped in eight sectors in the original dataset, some sectors have too few observations, so firms are regrouped into five larger sectors. This also helps to simplify our specification $M2$, where sector dummies are interacted with labour productivity. The 5 major sectors are: construction ($s1$), manufacturing and mining ($s2$), real estate, hotel and business service ($s3$), wholesales and retails ($s4$) and other services ($s5$).

In specification $M2$, country dummies are dropped while country-specific characteristics are added. In particular, we include $\ln GDP$ to control for countries' demand, $\ln EXC$ to control for the sunk costs to export, and $\ln(FDI/GDP)$ to control for the foreign direct investment activities in the home country.

$\ln GDP$ is the logarithm of the home country's GDP (denominated in US dollars). $\ln EXC$ is the logarithm of the average number of documents that a firm needs to complete in order to export and, thus, a proxy for the sunk costs to export. The idea is that the higher the number of documents needed the more obstacles there are and the longer the preparation procedures for exporting and, thus, the higher the cost to export. $\ln(FDI/GDP)$ is the logarithm of the ratio of FDI inflows into the home country over the GDP of the rest of the world (i.e., world GDP minus the home country GDP, in short RoW GDP). This is a proxy for the term $\frac{\int_{\varphi FDI} \varphi^{\theta-1} dG(\varphi)}{\int_{\varphi D} \varphi^{\theta-1} dG(\varphi)}$ given by equation (29) in the theoretical model, where the foreign country is now the rest of the world.

To explore how these country- and sector-specific characteristics influence the marginal effect of labour productivity on firms' behaviour, the interaction terms between these variables and labour productivity are also included. Since the data on FDI and export costs are available at country level, it is not possible to analyse these effect at the sectoral level. Instead, interaction terms between ex-ante labour productivity and sector dummies are added to explore the heterogeneous impacts of sectoral characteristics on the marginal effect of labour productivity. There are, hence, three interaction terms between $\ln LP_{-3,i}$ and $\ln GDP$, $\ln EXC$ and $\ln(FDI/GDP)$, and four interaction terms between $\ln LP_{-3,i}$ and the four sector dummies included in our specification.

In brief, the two specifications in equations (34) and (36) share the same set of firm-specific variables and sector dummies. While specification M1 includes country dummies, specification M2 includes country-specific characteristics as well as interactions between these country-specific variables and ex-ante labour productivity and further interactions between sector dummies and ex-ante labour productivity.

3.5 Multinomial probit estimation results

In what follows we first present the coefficients of the multinomial probit model estimated via maximum likelihood and then we focus on the estimation and analysis of the marginal effects. For each case analysed, the MNP coefficients and their marginal effects are reported for both specifications M1 and M2. We should note that, in this section, the term outcome is used interchangeably with firms' choice of type. The outcomes analysed are: supplier to multinationals (MNC supplier, outcome 1), exporting supplier (Exporter, outcome 2), both supplier to multinationals and exporting supplier (Both, outcome 3) and supplier to only domestic firms (Neither, outcome 0). The empirical results presented in this section are estimated using the BEEPS 2005 sample, while the BEEPS 2002 sample is used as a robustness check (results are available upon request).

Self-selection of MNC suppliers and exporters   Table 7 presents and compares the estimation results for the two specifications M1 and M2. The coefficients on ex-ante labour productivity in the specification M1 show that this variable is a statistically significant determinant of firms' decision regarding their type. In particular, the higher firms' ex-ante labour productivity is, the higher the likelihood firms choose to be a multinational supplier, an exporter or both. The results from specification M2 show that the coefficients on ex-ante labour productivity and its interaction terms with sectoral dummies and country-specific factors are jointly significant for each outcome, and, thus, are significant determinants of firms' choice.

The marginal effects of labour productivity and of other regressors on the probability of each outcome are calculated and reported in the marginal effects row for each respective variable. Given the large number of categorical variables, the marginal effects are calculated for a domestic-owned firm in the manufacturing sector – the largest sector in our sample accounting for 34% of observations –, while other variables are set at their means, unless otherwise indicated.

After controlling for all other factors, the marginal effects of labour productivity on the probabilities of each outcome shown relative to the outcome of supplying to domestic firms are significant at the 1% level. The estimates show that a small increase in ex-ante labour productivity at the mean would increase the probability of supplying to multinationals by 1.5 to 2.2 percentage points (pp), depending on the specification, the probability of exporting by 3.8 to 4.3pp, and the probability of doing both activities by 2.2 to 2.7pp. These results suggest that firms use different supplying strategies depending on their ex-ante labour productivity. In particular, more productive firms self-select into supplying to multinationals and exporting. This is consistent evidence in favour of Proposition 1 of our model.

The marginal effects of other firm-specific characteristics, in particular firms' size, age and foreign ownership, on the probability of each outcome are also positive and significant. It can be seen that when ex-ante firms' size increases, the probability of supplying to multinationals increases slightly, while the probability of exporting increases the most. This evidence suggests that larger firms are more likely to export as opposed to supplying to multinationals. Similarly, firms with foreign-owned shares significantly improve their chance to become multinational suppliers, exporters or both. In particular, having foreign-owned shares increases the probability of exporting by up to 17pp. It is possible that managers of firms with foreign-owned shares have more experience with foreign markets which, in turn, makes it easier to start exporting.

Firms' age, however, tends to be an insignificant determinant of firms' choice in our case. The marginal effects are only significant for the probability of exporting, but not in a robust way. When estimating the marginal effects of age at different levels of firms' age, the results show that the probability of supplying to multinationals decreases considerably as firms get older, while the probability of exporting increases. Hence, it may be easier for younger firms to adjust their production to better suit the taste of multinationals compared to older traditional firms that are more inclined to export.

Choice between multinational supplier and exporter   While the results above clearly show that more productive firms choose to become multinational suppliers and exporters, they do not shed much light on the choice between these two strategies. Thus, we estimate the marginal effects of ex-ante labour productivity on the probabilities of each outcome as firms' ex-ante labour productivity changes across its distribution.

The marginal effects are again estimated for a domestic manufacturing firm in an economy of average GDP size, with average FDI inflows and average export fixed costs. Table 8 shows how

Table 7: Multinomial Probit Estimation results

	MNC supplier		Exporter		Both	
	(M1)	(M2)	(M1)	(M2)	(M1)	(M2)
Labour productivity$_{-3}$	0.26***	0.57	0.24***	1.82**	0.32***	1.70
	(0.033)	(1.044)	(0.028)	(0.891)	(0.036)	(1.203)
Marginal effects	0.015***	0.022***	0.038***	0.043***	0.022***	0.027***
	(0.004)	(0.005)	(0.006)	(0.008)	(0.004)	(0.005)
Ex-ante labour	0.21***	0.196***	0.348***	0.343***	0.344***	0.33***
	(0.022)	(0.022)	(0.019)	(0.018)	(0.023)	(0.022)
Marginal effects	0.006***	0.005**	0.064***	0.067***	0.022***	0.023***
	(0.002)	(0.002)	(0.004)	(0.004)	(0.002)	(0.003)
Foreign ownership	0.67***	0.62***	0.98***	0.96***	1.14***	1.10***
	(0.097)	(0.096)	(0.08)	(0.079)	(0.092)	(0.091)
Marginal effects	0.025***	0.007	0.172***	0.171***	0.078***	0.104***
	(0.009)	(0.011)	(0.017)	(0.021)	(0.009)	(0.016)
Age	0.36	0.38	0.02	0.19	0.22	0.32
	(0.245)	(0.239)	(0.203)	(0.198)	(0.256)	(0.252)
Age (squared)	-0.07*	-0.08*	0.01	-0.02	-0.03	-0.04
	(0.044)	(0.043)	(0.035)	(0.034)	(0.044)	(0.043)
Marginal effects	0.035	-0.005	-0.014	0.026**	0.018	0.009
	(0.026)	(0.006)	(0.044)	(0.011)	(0.025)	(0.007)
FDI/GDP		0.06		-0.34**		-0.16
		(0.157)		(0.132)		(0.189)
GDP		-0.14		0.40***		0.09
		(0.154)		(0.128)		(0.182)
Export sunk costs		-0.17		-0.87***		-1.47***
		(0.286)		(0.246)		(0.345)
FDI/GDP		0.012		0.025		0.067
* Labour productivity$_{-3}$		(0.044)		(0.038)		(0.051)
GDP		-0.01		-0.08**		-0.06
*Labour productivity$_{-3}$		(0.041)		(0.035)		(0.047)
Export sunk cost		0.06		0.11		0.34***
*Labour productivity$_{-3}$		(0.08)		(0.07)		(0.094)
Constant	-3.88***	-0.58	-3.49***	-12.90***	-4.89***	-6.06
	(0.422)	(3.883)	(0.358)	(3.242)	(0.475)	(4.646)
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Productivity*Sector f.e.	No	Yes	No	Yes	No	Yes
Country fixed effects	Yes	No	Yes	No	Yes	No

Notes: Base outcome: firm is neither a MNC supplier nor an exporter. Number of observations: 7474. Standard errors are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels.

firms' choice of type differs across the distribution of labour productivity. These marginal effects are also depicted in Figure 4 for a clearer comparison. As labour productivity increases for firms with labour productivity up to the 50th percentile, the probabilities of supplying to multinationals,

Table 8: Marginal effects at different levels of ex-ante labour productivity

| Ex-ante labour productivity		Marginal effects on MNC supplier (1)	Marginal effects on Exporter (2)	Marginal effects on Both (3)
min	-7.82	0.000	0.003*	0.000
		(0.000)	(0.002)	(0.000)
1st pct	0.18	0.012***	0.037***	0.012***
		(0.001)	(0.003)	(0.001)
10th pct	1.18	0.016***	0.041***	0.016***
		(0.002)	(0.005)	(0.001)
25th pct	2.18	0.019***	0.043***	0.022***
		(0.003)	(0.006)	(0.003)
50th pct	3.18	0.022***	0.042***	0.027***
		(0.005)	(0.008)	(0.005)
80th pct	4.18	0.024***	0.039***	0.032***
		(0.007)	(0.009)	(0.007)
95th pct	5.18	0.024***	0.033***	0.036***
		(0.009)	(0.010)	(0.010)
99th pct	6.18	0.023**	0.025**	0.037***
		(0.010)	(0.011)	(0.012)
max	11.18	0.006	-0.013	0.027*
		(0.012)	(0.011)	(0.015)

Notes: The marginal effects are calculated at means of the continuous variables for domestic manufacturing firms using M2 estimates. Standard errors are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels.

exporting and doing both activities increase. Clearly, this implies that the probability of doing neither activity decreases considerably. Moreover, the marginal effects of labour productivity on the probability of exporting are considerably higher than those on the probability of supplying to multinationals. This implies that exporting would be the preferred choice compared to supplying to multinationals when firms' labour productivity is lower than or close to that of the median firm. These results are consistent with Scenario (i) of Proposition 2 of our model characterised by low trade costs and high investment costs. In this case, supplying to multinationals is associated with a higher productivity cutoff compared to exporting, which results in exporting being the more popular choice for lower values of labour productivity.

Further, as labour productivity increases at the top of the productivity distribution, the probabilities of either exporting or supplying to multinationals decrease and become less significant, while the probability of firms doing both activities rises up significantly, surpassing the probability of doing either activity separately. For the top 5% of firms in terms of labour productivity, the probability of doing both activities is at its highest level while the probability of doing either activity separately is lower or even turns insignificant. The fact that the most productive firms tend to be both multinational suppliers and exporters is also consistent with our model's predictions.

While the evidence suggests that on average firms seem to prefer exporting to supplying to multinationals, it is interesting to examine if such pattern is sensitive to the characteristics of each country, as predicted in Proposition 2. In particular, FDI inflows and the fixed costs to export are supposed to be the decisive factors affecting firms' choices.

Figure 4: Marginal effects of ex-ante labour productivity across its distribution
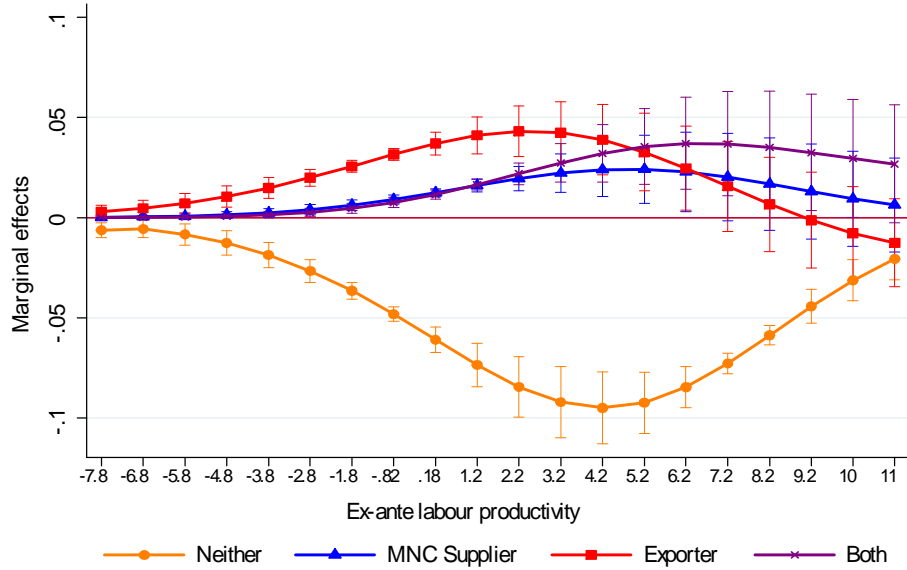
We now investigate whether a reduction in investment costs (proxied by FDI inflows over the rest-of-the-world GDP) has an effect on the probability of choosing between supplying to multinationals and exporting. Our model suggests that lower investment costs reduce the productivity threshold for firms entering the multinational market while raising the productivity threshold for firms desiring to export. Therefore, an increase in FDI inflows over the rest-of-the-world GDP (our proxy for a decrease in investment costs) is expected to have a positive effect on the probability of becoming multinational suppliers and a negative effect on the probability of exporting.

Table 9 reports the estimated marginal effects of FDI inflows on the probability of each outcome. The opposite signs on the probability to export and to supply to multinationals provide strong evidence in favour of FDI inflows affecting the choice between the two strategies, as predicted by Proposition 2 of our model. Specifically, the estimates show a positive effect of FDI inflows on the probability of supplying to multinationals with a magnitude of 2.1pp, and a negative effect on the probability of exporting with a magnitude of 7.1pp for a small increase in FDI inflows at the mean. The difference in the marginal effects between these two outcomes is also significant and increasing in FDI inflows. This implies that firms tend to supply more to multinationals than to export as FDI inflows increase.

It should be noted that the marginal effects in Table 9 are estimated at the mean of both ex-ante labour productivity and FDI inflows. Figure 5, on the other hand, graphs these marginal effects when FDI inflows change gradually from the lowest to the highest level (within the sample) for firms with ex-ante labour productivity at the 25th, 50th and 75th percentiles. As shown in panels (b) and (c), the marginal effect of FDI inflows on the probability of supplying to multinationals is consistently positive, while the marginal effect on the probability of exporting is consistently negative. The positive gradient of all three lines in (b) suggests that for any given level of labour productivity, higher FDI inflows enhance further the chance to supply to multinationals. Whereas,

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Table 9: Marginal effects of FDI inflows to RoW GDP on the probability of each outcome

	Marginal effects on MNC supplier (1)	Marginal effects on Exporter (2)	Marginal effects on Both (3)
FDI/GDP	0.021***	-0.071***	0.015*
Std. Err.	(0.007)	(0.012)	(0.008)
	Marginal effects on the difference in the probabilities between outcomes		
	(1) vs (2)	(2) vs (3)	(1) vs (3)
FDI/GDP	0.092***	0.086***	-0.006
Std. Err.	(0.015)	(0.016)	(0.011)

Notes: The marginal effects are calculated at means of the continuous variables for domestic manufacturing firms. *** and * indicate statistical significance at the 1% and 10% levels.

the relative position of the three curves suggest that, for a given level of FDI inflows, more productive firms have a higher chance to become multinational suppliers. On the other hand, panel (c) shows a U-shaped marginal effect of FDI inflows on the probability of exporting. This suggests that, at low levels of FDI inflows, any increase in FDI inflows may further lower the probability to export, but at higher levels of FDI inflows, such effect is less pronounced. This U-shaped effect, however, seems to be insignificant.

To see if there is a switch in firms' implied relative preferences when there is a change in FDI inflows, we examine firms' probability of choosing each strategy when FDI inflows increase from the lowest level (that of Kyrgyzstan) to the highest level in the sample (that of Ireland). Figure 6 compares the estimated marginal effects of ex-ante labour productivity under these two scenarios of FDI inflows at different levels of ex-ante labour productivity, while keeping all other factors at their mean values.

The switch in the relative position of the probability to export (red line) and the probability to become a multinational supplier (blue line) in the two panels suggest that firms' preferences over the two outcomes depend on investment costs, as in Proposition 2 of our model. In particular, when FDI inflows are at their lowest level (left panel), which is consistent with the low trade costs/high investment costs case, exporting is the dominant strategy for firms. When FDI inflows are at their highest level (right panel), which is consistent with the high trade costs/low investment costs case, supplying to multinationals is the dominant strategy for firms compared to exporting.

Moreover, for countries with high levels of FDI inflows, the productivity cutoff to do both activities (purple line) increases considerably, and is higher than the probability of doing either activity even for firms with relatively low levels of labour productivity. This implies that, in such a case, the productivity cutoff of doing both activities is particularly low. As a point of reference, for countries with an average level of FDI inflows as in Figure 4, the probability of doing both activities is higher than that of either activity only for the top 5% productive firms. Instead, for countries with low FDI inflows, the probability of doing both activities is close to zero even for the most productive firms.

Next, we analyse the effect of fixed trade costs (proxied by the number of documents required to export) on the probability of choosing between exporting and supplying to multinationals. Specifically, it looks at whether an increase in fixed trade costs has an effect on the probability of choosing between exporting and supplying to multinationals.

Figure 5: Marginal effects of FDI inflows over RoW GDP at different levels of labour productivity
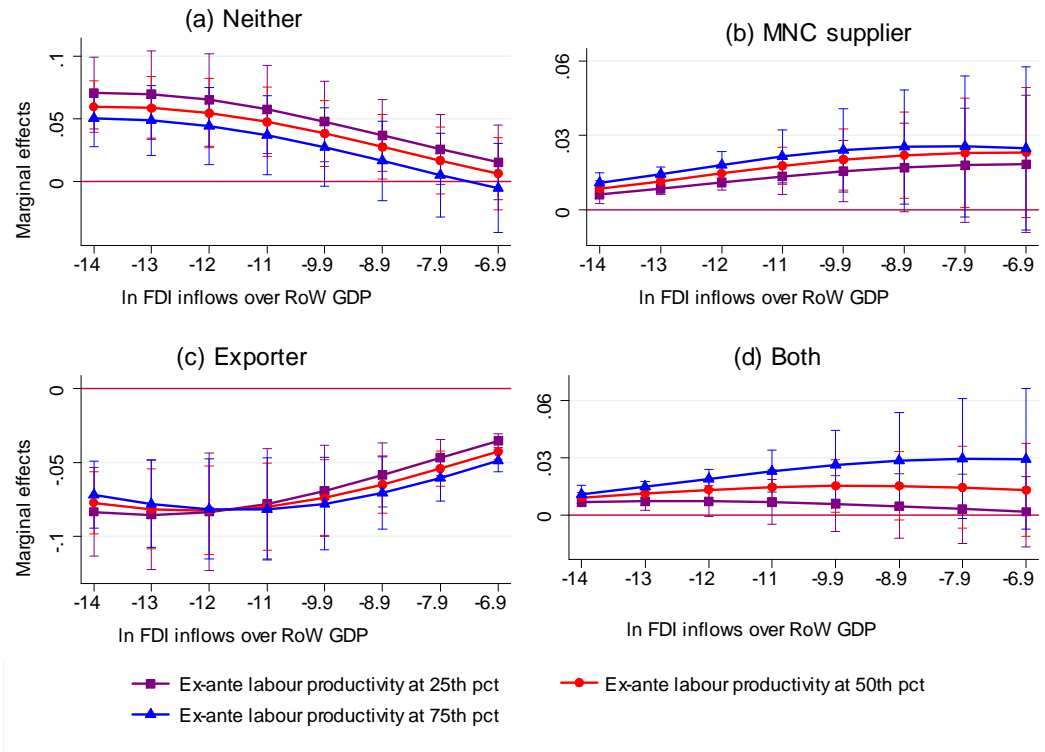

Figure 6: Marginal effects of ex-ante labour productivity by FDI inflows over RoW GDP
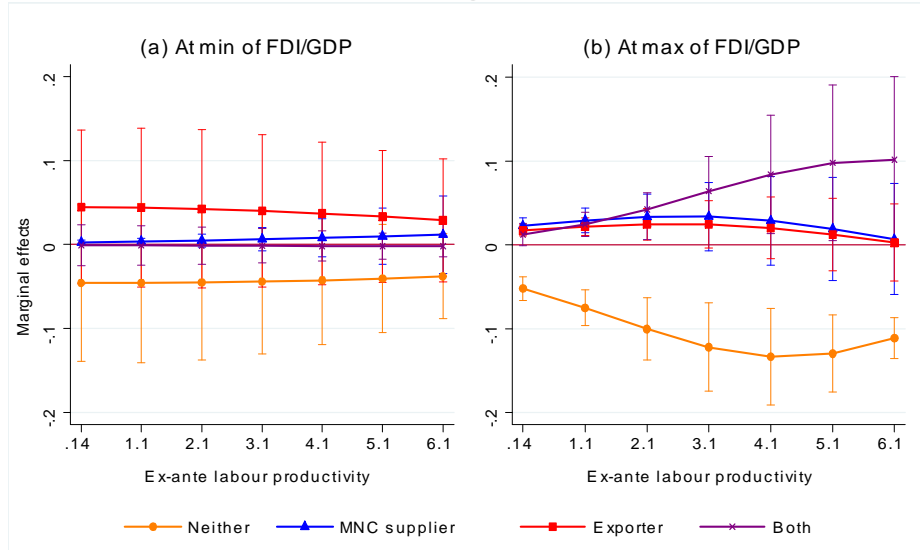
Table 10: Marginal effects of export costs on the probability of each outcome

	Marginal effects on MNC supplier (1)	Marginal effects on Exporter (2)	Marginal effects on Both (3)
Export sunk costs	0.027**	-0.114***	-0.030**
Std. Err.	(0.014)	(0.024)	(0.015)
	Marginal effects on the difference in probabilities between outcomes		
	(1) vs (2)	(2) vs (3)	(1) vs (3)
Export sunk costs	0.141***	0.084***	-0.057***
Std. Err.	(0.030)	(0.030)	(0.021)

Notes: The marginal effects are calculated at means of the continuous variables for domestic manufacturing firms. *** and ** indicate statistical significance at the 1% and 5% levels.

Table 10 presents the estimated marginal effects of export costs on the probability of choosing each strategy. The estimation results suggest that, for a firm with average productivity, a small increase in export costs raises the probability of supplying to multinationals by 2.7pp while lowering the probability of exporting by 11.5pp. The difference in marginal effects on the two outcomes is as large as 14.1pp and it is statistically significant. This is evidence in support of export costs affecting the choice between the two strategies as indicated in Proposition 2, which suggests that firms prefer to supply to multinationals when exporting becomes more costly.

We also examine these marginal effects at different levels of export costs and ex-ante labour productivity. Figure 7 displays the marginal effects of export costs on the probability of the four outcomes when export costs change gradually from the lowest to the highest level (within the sample) for firms with ex-ante labour productivity at the 25th, 50th and 75th percentiles. As export costs increase, the marginal effects on the probability to export (panel c) are consistently negative and significant. The negative effect is larger for firms with low productivity. Meanwhile, the effects of an increase in export costs on the probability to supply to multinationals (panel b) are consistently positive across all firms.

Export costs are also shown to have a positive and large marginal effects on the probability to serve domestic customers only (panel a). As exporting becomes more costly, suppliers may focus more on the domestic market, which is in line with the predictions of our model.

To examine the possibility of a switch from preferring exporting to preferring supplying to multinationals depending on the size of export costs, the marginal effects of labour productivity on the probability of the four outcomes are estimated under two scenarios: when the number of documents required to export is as low as 2 as in Ireland (the lowest in the sample), and when the number of documents required to export is as high as 15 as in Kyrgyzstan (the highest in the sample), keeping all other factors at their mean levels.

Figure 8 shows that, in both cases, exporting is still the dominant strategy for suppliers compared to supplying to multinationals (Scenario (i) of Proposition 2 of our model). This is seemingly inconsistent with the model, where supplying to multinationals is expected to be a dominant strategy when fixed export costs are high. However, we should recall that Scenario (ii) of Proposition 2, i.e., supplying to multinationals is preferred to exporting, only occurs at sufficiently high levels of both export fixed costs and transportation costs relative to fixed investment costs. In this sample of mainly Eastern European countries, transportation costs and fixed export costs may not be high enough to satisfy condition (29) and reverse the relative probability of choosing between exporting
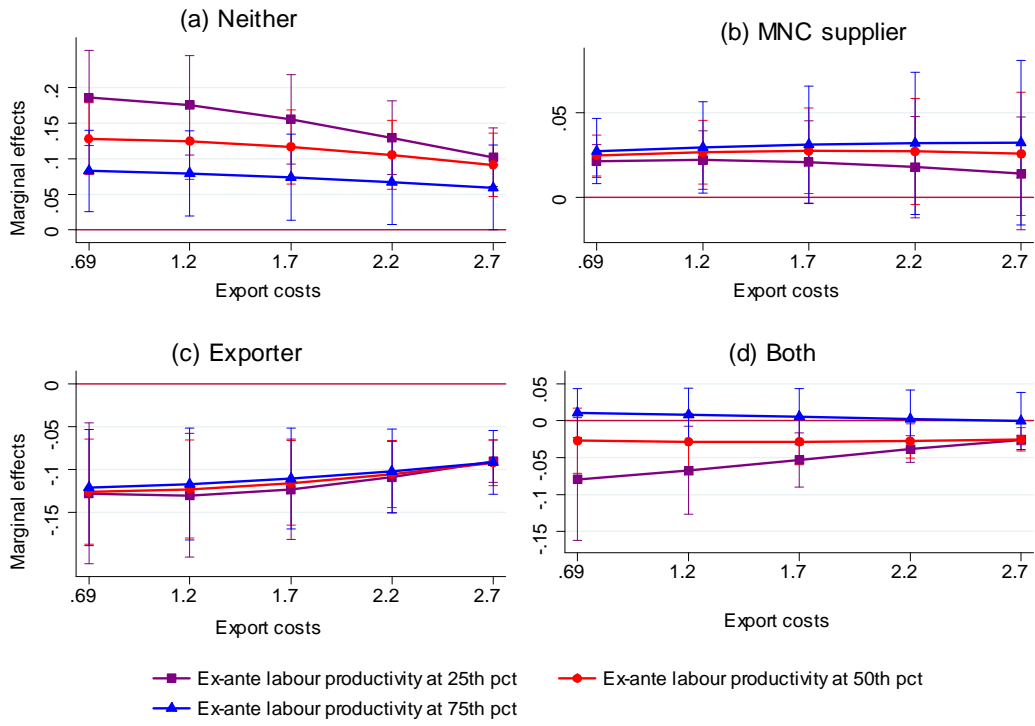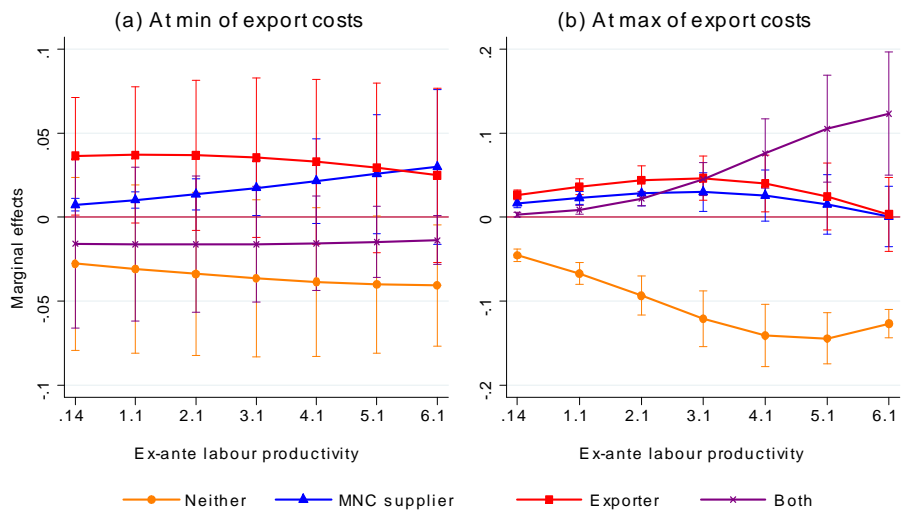
Figure 7: Marginal effects of export sunk costs

Figure 8: Marginal effects of labour productivity by export sunk costs

and supplying to multinationals given the close geographical distance to the main foreign market, i.e., Western Europe.

Finally, the probability of doing both activities increases considerably and is higher than the probability of exporting only when export costs are high. This is again consistent with our model.

4   Conclusion

This paper investigates the important but so far neglected area of intermediate suppliers' behaviour, namely the self-selection of intermediate suppliers into different supply strategies. We present a theoretical model and then test its predictions using firm-level data from a cross-section of 29 European and Central Asian countries for years 2002, used as a robustness check, and 2005. Our theoretical model suggests that, as firms' productivity increases, domestic suppliers become more likely to export and/or supply to multinationals and less likely to serve only local final producers.

With regard to the choice between exporting and supplying to multinationals, firms' preferences for one strategy over the other depend on ex-ante labour productivity and on the entry costs to export and to set up production for multinationals. Suppliers can also choose to both export and supply to multinationals at the same time but only the most productive suppliers are able to do so.

A significant contribution of this research is to provide a framework to analyse the impact of trade liberalization and investment liberalization together with firms' behaviour. The model predicts that, in countries and sectors with low trade costs and high investment costs, the productivity cutoff for multinational suppliers is higher than that for exporters. In this case, exporting or doing both activities are the preferred strategies for highly productive firms as opposed to supplying to multinationals only. On the other hand, in countries or sectors with high trade costs and low investment costs, the productivity cutoff for exporters is higher than that for multinational suppliers. Domestic suppliers in such sectors and countries prefer supplying to multinationals or doing both activities over exporting alone.

The empirical evidence supports the predictions of our model. The results show that there is significant and consistent self-selection of more productive firms into supplying to multinationals and exporting. Both exporters and suppliers to multinationals tend to be larger, have higher investment, R&D and marketing costs and pay higher wages to workers in comparison to domestic-oriented suppliers. We also find evidence suggesting that firms' choice in favour of exporting or supplying to nationals depends on investment costs, proxied by FDI inflows, and trade costs, proxied by the number of documents required to export.

It is shown that, when FDI inflows increase, the probability of supplying to multinationals increases while the probability of exporting decreases. An increase in FDI inflows also increases the probability of firms doing both activities and lowers the probability of serving domestic customers only. On the other hand, an increase in export set-up costs raises the probability of supplying to multinationals and lowers the probability of exporting. This is consistent with the predictions of our model.

Moreover, the case of low trade costs/high investment costs is revealed to be more prevalent in our sample. It is suggested that, while many countries have promoted trade liberalization, the investment liberalization process may possibly remain more sluggish, resulting in low FDI inflows. This may explain why, in this sample, higher ex-ante labour productivity is required to become a multinational supplier while it is easier for firms to export. Domestic suppliers, therefore, prefer exporting to supplying to multinationals alone, yet the most productive firms prefer doing both activities.

These robust findings in favour of self-selection of multinational suppliers suggest that the claimed spillover effects from multinationals to local suppliers need to be re-examined both theoretically and empirically. For instance, they may help to explain the lower spillover effects from FDI found in some papers when firms' fixed effects are included in the empirical analysis. On the other hand, these results can be used as evidence in favour of the pro-competitive effect on the productivity of local suppliers due to the presence of multinationals. A large presence of multinationals, corresponding to large FDI inflows in our analysis, can result in greater competition and an increase in the productivity cutoff of producers in the final goods market. This, in turn, may heighten the productivity cutoff of domestic-oriented and exporting suppliers.

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