

A Theory on the Role of Wholesalers in International Trade based on Economies of Scope*

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Abstract

Intermediaries and wholesalers play an important role in international trade. This paper develops a two-country model of international trade with heterogeneous firms that offers an explanation for the existence of wholesalers. All exporting firms have to pay a fixed cost of establishing a distribution network in the foreign market. However, wholesalers possess a technology different to normal manufacturing firms: they can buy manufacturing goods domestically and sell in foreign markets and handle more than one good. A wholesaler therefore faces an additional fixed cost which is convex and monotonically increasing in the number of goods it ships. The entry of wholesale firms leads to productivity sorting. The most productive firms export on their own, as in the standard model, by paying a fixed cost to do so, while the least productive firms do not export. However, a range of firms with intermediate productivity levels export through international wholesalers. The existence of wholesale firms increases total exports and the number of firms that export. Moreover, a higher fixed cost of exporting leads to (i) a higher share of the total value of exports that is distributed by wholesalers, and (ii) a higher share of exported product scope that is distributed by wholesalers. A higher fixed cost of exporting gives wholesalers a larger role since these can spread the fixed cost across more than one good. The wholesale technology therefore exhibits economies of scope. Moreover, a larger fixed cost of exporting increases the scope of each wholesaler firm. Finally, a gravity model is developed with more than two countries. The “multilateral resistance variable” is found to include the number of wholesalers of trading partners and their presence lowers a country’s price index as well as mitigates the positive effect that fixed trade costs have on the price level. Empirical evidence from Swedish firms’ export patterns supports the main predictions of the model.

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1 Introduction

Recent empirical evidence attributes an important role to wholesalers and intermediaries in international trade. Blum, Claro, and Horstmann (2009a) report that around 35% of imports into Chile are done through wholesalers. Bernard, Jensen, Redding, and Schott (2010) find that US trading firms exhibit substantial heterogeneity as regards export mode (either firms manage their own exporting activity or export through wholesalers). Consequently, the common assumption that firms are always responsible for their own exporting activities does not provide a full picture of firm behaviour in international trade.¹ A growing theoretical literature is currently exploring the issue of intermediation in international trade. So far, this has mainly focused on either contracting or matching frictions between buyers and sellers, as in Antras and Costinot (2009) or Blum, Claro, and Horstmann (2009b), or on the presence of networks in international trade, as in Rauch and Watson (2004) or Petropoulou (2007).

This paper tells a rather different story about why intermediaries exist in international trade. Here, intermediaries are wholesalers that are able to pool the fixed cost of exporting across more than one good. I utilise a standard model of international trade with firm heterogeneity and introduce a sector of wholesalers that do not produce themselves, but instead buy goods in their local market and export these goods to foreign markets. They only have to incur the fixed cost of establishing a “beachhead” in a foreign market once (regardless of how many goods they export), but face a convexly increasing fixed cost in expanding the set of goods they handle: the fixed cost of their distribution network increases in the range of goods that they export. Wholesalers are assumed to be homogeneous in the model, since I am mostly interested in how aggregate trade flows and producers of goods respond to the possibility of exporting through wholesalers rather than managing their own distribution networks.

The paper defines the general equilibrium of a model with wholesalers. The model generates a number of predictions about how exporting is conducted in the presence of intermediation. First, producers sort according to productivity in determining their mode of exporting. The most productive firms continue to manage their own exporting activities and incur the fixed cost associated with this as in the standard model. However, some firms that were almost productive enough to export on their own in a standard model now choose to do so but through wholesalers instead. The least productive firms do not export through any of the two modes. Second, the size of the foreign market does not matter, instead the size of the fixed cost of exporting drives the dynamics with regard to export mode. A higher fixed cost is associated with a larger importance of wholesalers: a larger share of aggregate exports is now intermediated rather than exported directly by the producing firms. Moreover, a larger number of firms choose to export through wholesalers rather than managing their own distribution systems when fixed costs of exporting are high. Finally, a larger fixed cost is associated with each wholesaler handling more goods (having a larger scope).

¹For further empirical evidence, see also Basker and Van (2008a, b).

The core mechanism at work in the model is the following: Wholesalers manage to spread the fixed cost of exporting across more than one good, but to cover the fixed cost, they need to charge a markup between the procurement price of the good and what it charges the final consumer in the foreign country. This markup that wholesalers charge causes productivity sorting as regards export mode: the most productive firms choose to incur their own fixed cost of exporting since their operating profit is large enough. However, some goods, which cannot be profitably exported by the producer itself, can be exported at a lower fixed cost *per good* by wholesalers since these export several goods but only have to make one investment in the fixed cost. This means that the wholesale technology exhibits *economies of scope*. When fixed costs are larger, wholesalers become more important since fewer firms can export on their own. Moreover, wholesalers have to expand and handle more goods to be able to cover the larger fixed cost.

To reach the above conclusions, I have assumed free entry of manufacturing firms in order to restrict the model as little as possible. In the final theoretical section, however, I drop the free entry assumption and develop a multicountry gravity model under the assumptions in Chaney (2008) which does not allow for free entry in the manufacturing sector. The “multilateral resistance variable” is found to include the number of wholesalers of trading partners and their presence lowers a country’s price index as well as mitigates the positive effect that fixed trade costs have on the price level. Since the price level is indirectly a measure of welfare, wholesalers therefore contribute positively to welfare.

To test the main predictions, the paper uses Swedish firm level data from 2005 which matches customs data with firms. It is therefore possible to see a firm’s sector classification and its trade flows by SITC5 and HS8 product code and destination. It can therefore be observed what goods are exported by firms listed as “wholesalers” and “manufacturers” where the latter are treated as the producers of goods. The analysis supports the main predictions of the model. Wholesalers export, on average, less per firm within a product category than producers. Moreover, wholesalers are more important in the exporting patterns to markets with high fixed costs.

The two papers in the literature that seem most closely related to mine are Ahn, Khandelwal, and Wei (2010) and Felbermayr and Jung (2009) who also focus on the interaction between fixed costs and export mode. The former assume, in a standard multi-country model with firm heterogeneity, that fixed costs are lower for producers if they export by using an intermediary than on their own but that they, in this case, have to pay an additional variable cost.² The

²While similar to the outcome presented here, my model provides a microeconomic foundation for how intermediaries and wholesalers operate and why fixed costs matter. Moreover, my empirical section utilises Swedish data which classifies firms according to reasonably narrow sectors while the Chinese data used by Ahn, Khandelwal, and Wei (2010) do not provide such sector classifications. Instead, wholesalers and other intermediaries are identified by whether the firm name includes words related to intermediary activities. However, the key empirical result, that wholesalers/intermediaries are more important for destinations with high fixed costs, is found in both papers.

latter paper mentioned above models intermediaries at the micro level but the driver here is not economies of scope, but rather a bargaining process over the profits between the intermediary and the producer. Finally, Krautheim (2009) develops a model of “Export-Supporting FDI” where firms can transfer tasks related to “distribution” to a foreign affiliate in the export destination.

Section 2 develops the model and derives the main results. Section 3 provides the empirical analysis. Section 4 concludes.

2 The Model

The basic model builds on the structure in Helpman, Melitz, and Yeaple (2004), which adds a sector with constant returns to Melitz (2003).

2.1 Basics

The model depicts two economies (“Home” and “Foreign”) with a primary production factor labour, L , which is used in all sectors. Ignoring the wholesale sector for the moment, there are two main sectors in the economy. First, the agricultural sector is a Walrasian, homogeneous-goods sector with costless trade. Second, the manufacturing sector is characterized by increasing returns, Dixit-Stiglitz monopolistic competition and iceberg trade costs. Manufacturers face constant marginal production costs and three types of fixed costs. The first fixed cost, F_E , is the standard Dixit-Stiglitz cost of developing a new variety. The second and third fixed costs are “beachhead” costs reflecting the one-time expense of introducing a new variety into a market: \tilde{F}_D if it is the domestic market and \tilde{F}_X for the foreign market.

There is heterogeneity with respect to firms’ productivity levels, φ . Each Dixit-Stiglitz firm/variety is therefore associated with a particular labour output coefficient denoted as φ_i for firm i . After sinking F_E units of labour in the product innovation process, the firm is randomly assigned φ_i from a probability distribution $G(\varphi)$.

The analysis exclusively focuses on steady-state equilibria and intertemporal discounting is ignored; the present value of firms is kept finite by assuming that firms face a constant Poisson hazard rate δ of forced exit.

Consumers in each nation have two-tier utility functions with the upper tier (Cobb-Douglas) determining the consumer’s division of expenditure among the sectors and the second tier (CES) dictating the consumer’s preferences over the various differentiated varieties within the manufacturing sector.

All individuals in Home have the utility function

$$U = C_M^\mu C_A^{1-\mu}, \tag{1}$$

where $\mu \in (0, 1)$, and C_A is the consumption of the homogeneous good. Manufactures enter the

utility function through the index C_M , defined by

$$C_M = \left[\int_0^N c_i^{(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)}, \quad (2)$$

N being the mass of varieties consumed, c_i the amount of variety i consumed and $\sigma > 1$ the elasticity of substitution.

Each consumer spends a share μ of his income on manufactures, and demand for a variety i is therefore

$$x_i = \frac{p_i^{-\sigma}}{P_j^{1-\sigma}} \mu Y, \quad (3)$$

where p_i is the consumer price of variety i , Y is income, and $P \equiv \left(\int_0^N p_i^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}$ the price index of manufacturing goods available in the Home country.

The unit factor requirement of the homogeneous good is one unit of labour. This good is freely traded and since it is chosen as the numeraire

$$p_A = w = 1; \quad (4)$$

w being the nominal wage of workers.

Neglecting the role of wholesalers for the moment, shipping the manufactured good involves a frictional trade cost of the “iceberg” form: for one unit of a good from Home to arrive in the Foreign country (denoted by “ F ”), $\tau > 1$ units must be shipped. It is assumed that trade costs are equal in both directions. Profit maximisation by a manufacturing firm i located in Home but exporting to the Foreign country leads to the following consumer price in Foreign:

$$p_i^F = \frac{\sigma}{\sigma-1} \tau \varphi_i^{-1}. \quad (5)$$

Manufacturing firms draw their marginal productivity, φ , from the probability distribution $G(\varphi)$ after having sunk F_E units of labour to develop a new variety. Having learned their productivity, firms decide on entry in the domestic and foreign market, respectively. Firms will enter a market as long as the operating profit in this market is sufficiently large to cover the beachhead (market entry) cost associated with the market. Because of the constant mark-up pricing, it is easily shown that operating profits equal sales divided by σ . The critical “cut-off” levels of the marginal costs (for the operating profit to be as large as the discounted fixed cost of entry) are given by:

$$\varphi_D^{\sigma-1} B = F_D, \quad (6)$$

$$\left(\varphi_X' \right)^{\sigma-1} \phi B^F = F_X \quad (7)$$

where

$$B \equiv \frac{\mu L}{P^{1-\sigma}} \quad (8)$$

$$B^F \equiv \frac{\mu L^F}{(P^F)^{1-\sigma}} \quad (9)$$

and $F_D \equiv \delta\sigma\tilde{F}_D$, $F_X \equiv \delta\sigma\tilde{F}_X$, and $\phi \equiv \tau^{1-\sigma} \in [0, 1]$ represents trade freeness. B and B^F are the “per firm” demand of the Home market and the Foreign market, respectively. The notation φ'_X is used here since this will change when wholesalers are introduced.

Result 1: *In a world without wholesalers, only firms with a marginal productivity above φ'_X choose to export, firms with a productivity between φ_D and φ'_X serve the domestic market and firms with a marginal productivity below φ_D exit immediately.*

2.2 Introducing wholesalers

2.2.1 Assumptions

The third sector, which is the novel feature of my model, is the wholesale sector (denoted by “W”). The wholesale technology gives a wholesaler firm j the ability to source a range of goods (“ n_j^W ”) and ship these to the Foreign country. The sector is homogeneous with free entry and firms are indexed by “ j ”. A wholesaler faces the same cost as manufacturing firms to establish a retail channel in the foreign country, F_X , but has the technology to export several goods. Operations are assumed to become more costly the more goods a firm handles, so it also faces a per-period fixed cost that is monotonically and convexly increasing in the range of goods it handles:

$$s_j^W = \frac{(n_j^W)^\gamma}{\gamma} \quad (10)$$

where $\gamma > 1$ and n_j^W is the number of domestic manufacturing goods the wholesale firm j is handling. Its total fixed cost is therefore $F_X + s_j^W$.

The marginal cost of the wholesaler is, first, the iceberg trade cost, τ , and, second, the procurement price of the domestic manufacturing good. I assume that the price the wholesaler pays the manufacturing firm for its product is simply p_i , which is a constant markup over the marginal cost of the manufacturing firm (the same cost that producers charge local consumers in the Home country). This is the case if producers that sell in the Home country cannot discriminate between final consumers and wholesalers. The total marginal cost of wholesaler firm j sourcing from manufacturing firm i will therefore be:

$$\begin{aligned} MC_{ij} &= \tau p_i \\ &= \tau \frac{\sigma}{\sigma - 1} \varphi_i^{-1}. \end{aligned} \quad (11)$$

The wholesaler is assumed to get the exclusive right to sell the manufacturing good in the foreign market (thereby excluding the possibility that more than one wholesaler sell the same manufacturing good) and faces the demand $B^F p_{ij}^{-\sigma}$ where p_{ij}^F is the price that wholesale firm j charges for manufacturing good i in Foreign. It will therefore charge the standard CES markup over its marginal cost, thereby creating a “double markup” over the marginal cost of the manufacturing firm:

$$p_{ij}^F = \frac{\sigma}{\sigma - 1} MC_{ij} \quad (12)$$

$$= \left(\frac{\sigma}{\sigma - 1} \right)^2 \tau \varphi_i^{-1}. \quad (13)$$

A manufacturing firm i that exports through wholesalers will therefore sell the quantity $\tau B^F \left(\left(\frac{\sigma}{\sigma - 1} \right)^2 \tau \varphi_i^{-1} \right)^{-\sigma}$ at its standard price $\frac{\sigma}{\sigma - 1} \varphi_i^{-1}$. Its operating profits from the sales to the wholesaler will therefore be

$$B^F (\tau \varphi_i^{-1})^{1-\sigma} \left(\frac{\sigma - 1}{\sigma} \right)^\sigma \quad (14)$$

while a manufacturing firm exporting on its own would earn

$$B^F (\tau \varphi_i^{-1})^{1-\sigma} - F_X. \quad (15)$$

Comparing the profits for a manufacturing firm choosing between the two export modes yields the following condition, using (14) and (15), for the firm to choose to export in its own:

$$B^F (\tau \varphi_i^{-1})^{1-\sigma} \left(\frac{\sigma - 1}{\sigma} \right)^\sigma < B^F (\tau \varphi_i^{-1})^{1-\sigma} - F_X \quad (16)$$

$$\varphi_i^{\sigma-1} > \frac{F_X}{\phi B^F} \frac{1}{\left(1 - \left(\frac{\sigma-1}{\sigma} \right)^\sigma \right)} \quad (17)$$

Note that the left side increases in the productivity, φ_i , which means that more productive firms will want to export on their own rather than through a wholesaler. This is due to the fact that they are productive enough to take the fixed cost of exporting themselves and avoid the markup incurred on them by the wholesaler. The denominator $\left(1 - \left(\frac{\sigma-1}{\sigma} \right)^\sigma \right)$ depends on the size of the wholesaler’s markup: the larger the markup over the marginal cost, the lower the export cutoff since more producers wish to export on their own to avoid the wholesaler’s markup.

Note also that (18) defines the new export cutoff

$$\varphi_X^{\sigma-1} = \frac{F_X}{\phi B^F} \frac{1}{\left(1 - \left(\frac{\sigma-1}{\sigma} \right)^\sigma \right)} \quad (18)$$

$$> \frac{F_X}{\phi B^F} = \left(\varphi'_X \right)^{\sigma-1}. \quad (19)$$

The inequality sign demonstrates that, with wholesalers present, some producers that previously exported on their own now decide to use wholesalers instead. Therefore the export cutoff

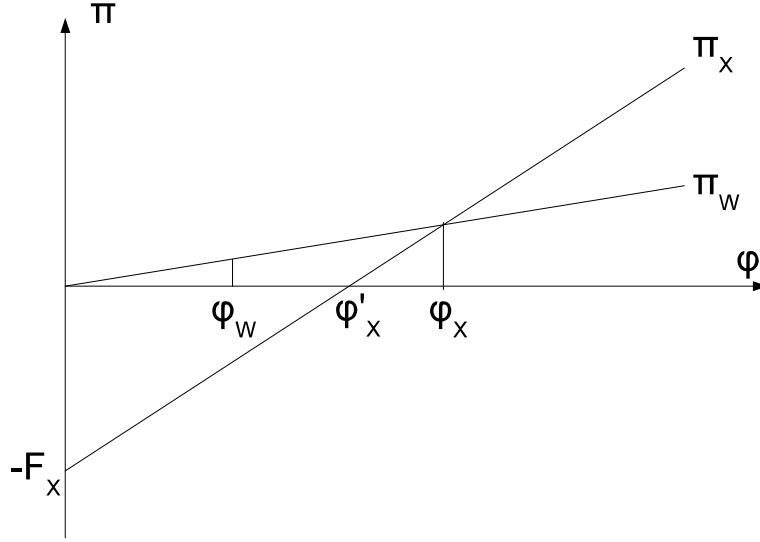


Figure 1: Relative profits for different export modes. π_X indicates the operating profit of a producer which exports on its own and π_W indicates the operating profit of a producer exporting through a wholesaler.

is higher with wholesalers in the model than without. This phenomenon is illustrated in figure 1. Note also that since wholesaler prices are higher, they also export smaller volumes per good. The reason that their prices are higher is due to (i) their additional markup and (ii) the fact that they export goods produced by less productive firms.

Result 2 *As long as a manufacturing firm's operating profits minus the fixed cost of exporting exceeds the operating profit from using a wholesaler, the firm will prefer to export on its own to exporting through a wholesaler. This is due to the markup that a wholesaler charges in the foreign country.*

Result 3 *Export sales per good are lower for wholesalers than for producers exporting on their own.*

Result 4 *The model generates productivity sorting. The most productive firms, $\varphi > \varphi_X$, export their products on their own, the second most productive firms, $\varphi \in [\varphi_W, \varphi_X)$, export through wholesalers and the least productive firms, $\varphi \in [\varphi_D, \varphi_W)$, do not export. That $\varphi_D < \varphi_W$ has, however, to be assumed.*

The fixed cost of a wholesaler is

$$TC_j = F_X + s_j^W = F_X + \frac{(n_j^W)^\gamma}{\gamma} \quad (20)$$

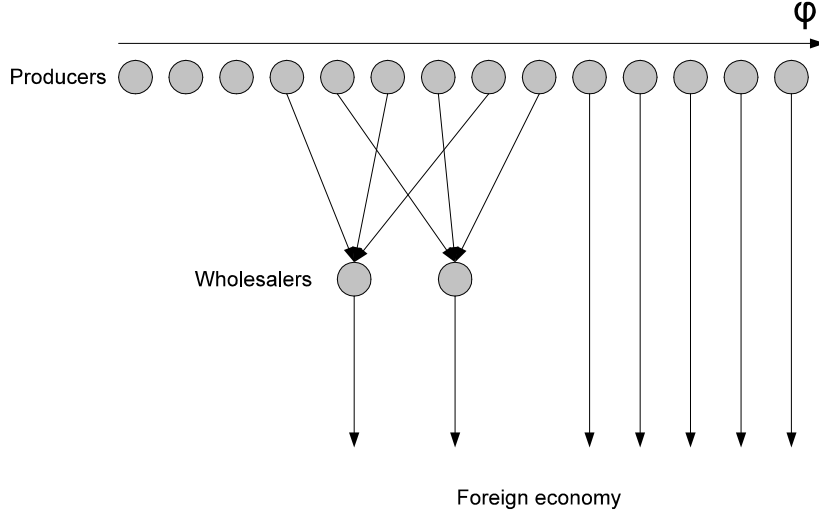


Figure 2: Productivity sorting and export mode.

Wholesale firms are homogeneous and I assume that the atomistic manufacturing firms that use wholesalers for the distribution of their goods are “randomly” matched with wholesaler firms (see figure 2). This ensures that wholesaler firms in equilibrium will have identical “baskets” of goods that they export. They will have the same range and distribution of productivity among the goods in their baskets. The scope of goods that a wholesaler firm then handles will be equal to the number of manufacturing firms with a productivity between φ_W and φ_X ($M^M \frac{G(\varphi_X) - G(\varphi_W)}{1 - G(\varphi_D)}$) where M^M is the mass of manufacturing firms, divided by the total mass of wholesale firms, M^W :

$$n_j^W = \frac{M^M}{M^W} \frac{G(\varphi_X) - G(\varphi_W)}{1 - G(\varphi_D)} \quad (21)$$

The fixed cost can therefore be written:

$$\begin{aligned} TC_j &= F_X + \frac{(n_j^W)^\gamma}{\gamma} \\ &= F_X + \frac{1}{\gamma} \left(\frac{M^M}{M^W} \frac{G(\varphi_X) - G(\varphi_W)}{1 - G(\varphi_D)} \right)^\gamma \end{aligned} \quad (22)$$

where φ_W is the marginal productivity of the least productive manufacturing firm that sells to wholesalers.

2.2.2 Solving the model with wholesalers

A wholesaler takes as given the number of other wholesale firms and the number of domestic manufacturing firms. Solving backwards, once the fixed cost is sunk, the pricing mechanism is as

described in (13), a constant markup over the marginal cost. Therefore the number of wholesale firms and the range of goods they consume can be determined by two conditions. First, the free entry condition states that the profits of wholesale firms should be zero. Second, the marginal increase in operating profits for a wholesaler firm to expand its set of goods distributed must equal the resulting marginal increase in fixed costs.

The operating profits of a wholesale firm is

$$n_j^W \tilde{\pi}_j^W(\varphi_W, \varphi_X) = n_j^W \frac{1}{G(\varphi_X) - G(\varphi_W)} \phi B^F \left(\left(\frac{\sigma}{\sigma - 1} \right)^2 \right)^{1-\sigma} \int_{\varphi_W}^{\varphi_X} \varphi^{\sigma-1} dG(\varphi) \quad (23)$$

$$= \frac{M^M}{M^W} \frac{1}{1 - G(\varphi_D)} \phi B^F \left(\left(\frac{\sigma}{\sigma - 1} \right)^2 \right)^{1-\sigma} \int_{\varphi_W}^{\varphi_X} \varphi^{\sigma-1} dG(\varphi) \quad (24)$$

where $\tilde{\pi}_j^W(\varphi_W, \varphi_X)$ is the average operating profit per good handled given the range of productivity in the basket.

Now, the two conditions determining the structure of wholesalers are:

$$F_X + \frac{(n_j^W)^\gamma}{\gamma} = n_j^W \tilde{\pi}_j^W \quad (\text{Zero profit condition}) \quad (25)$$

$$\frac{\partial}{\partial n_j^W} \left(F_X + \frac{(n_j^W)^\gamma}{\gamma} \right) = \frac{\partial}{\partial n_j^W} (n_j^W \tilde{\pi}_j^W) \quad (\text{Optimal number of goods distributed}) \quad (26)$$

These two conditions determine the range of goods handled (n_j^W) and the weighted average of operating profit per good handled

$$n_j^W = F_X^{\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma - 1} \right)^{\frac{1}{\gamma}} \quad (27)$$

$$\tilde{\pi}_j^W = F_X^{\frac{\gamma-1}{\gamma}} \left(\frac{\gamma}{\gamma - 1} \right)^{\frac{\gamma-1}{\gamma}}. \quad (28)$$

We see that the fixed cost of exporting, F_X , is the key variable to understand how the size of wholesaler firms is determined. A larger fixed cost of exporting forces wholesaler firms to expand their scope so that the fixed cost is spread across more goods. The operating profit per good handled must also be larger in equilibrium for wholesaler firms. The variable determining how difficult it is for wholesalers to handle more goods, γ , also plays a role. The more difficult it is to handle many goods, the greater the effect of the fixed costs on size and average operating profit.

Result 5 *The scope of wholesalers increases in the size of the fixed cost of exporting.*

Combining (23), and (28) gives:

$$\frac{1}{G(\varphi_X) - G(\varphi_W)} \phi B^F \left(\left(\frac{\sigma}{\sigma - 1} \right)^2 \right)^{1-\sigma} \int_{\varphi_W}^{\varphi_X} \varphi^{\sigma-1} dG(\varphi) = F_X^{\frac{\gamma-1}{\gamma}} \left(\frac{\gamma}{\gamma - 1} \right)^{\frac{\gamma-1}{\gamma}} \quad (29)$$

where φ_W is the equilibrium level of the lowest productivity needed for a manufacturing firm to use a wholesaler firm to export. The export cutoff, φ_X , is determined according to (7) by ϕ , F_X and B^F (note that φ_X increases in the fixed cost of exporting and decreases in the foreign market size, ϕB^F). The variable and fixed trade costs are exogenous but B^F is endogenous. Taking the solution for B^F from the following paragraph (or by assuming a fixed foreign demand), this means that equation (29) yields an implicit and unique solution for φ_W since the left side of (29) is monotonically increasing in φ_W .

Using the equilibrium value for φ_W , it is also possible to find a solution for the number of wholesale firms by combining (21) and (27):

$$\frac{M^M}{M^W} \left(\frac{G(\varphi_X) - G(\varphi_W)}{1 - G(\varphi_D)} \right) = F_X^{\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma - 1} \right)^{\frac{1}{\gamma}}. \quad (30)$$

Finally, the free entry condition for manufacturing firms says that, in expectation, the expected total profit of entrepreneur must equal the fixed entry cost:

$$\int_{\varphi_D}^{\infty} (\varphi^{\sigma-1} B - F_D) dG(\varphi) + \int_{\varphi_W}^{\varphi_X} \left(\varphi^{\sigma-1} \phi B^F \left(\frac{\sigma-1}{\sigma} \right)^{\sigma} \right) dG(\varphi) + \int_{\varphi_X}^{\infty} (\varphi^{\sigma-1} \phi B^F - F_X) dG(\varphi) = F_E. \quad (31)$$

The set of equations (6), (7), (8), (29), (30) and (31) yield solutions for the productivity cutoffs φ_D , φ_W , φ_X , the mass of wholesale and manufacturing firms, M^W , M^M and the “per firm” demand B in both Home and Foreign.

2.3 Imposing the Pareto distribution

The equilibrium described in Proposition 2 is somewhat difficult to analyse without any further assumptions about the distribution of productivity, $G(\varphi)$. I therefore impose the scale-free Pareto distribution to yield solutions that are easier to interpret. The scale-free property of the Pareto distribution make general conclusions easier since the exact levels of productivity do not matter as much as relative levels. Moreover, the Pareto distribution has been found to correspond reasonably well with the real distribution of firm productivity, see Axtell (2001) or Luttmer (2007). Now:

$$G(\varphi) = 1 - \left(\frac{b}{\varphi} \right)^k \quad (32)$$

where $\beta \equiv \frac{k}{\sigma-1} > 1$ and $\varphi \in [b, \infty)$.

To calculate the relative export volumes that occur by firms exporting on their own versus through wholesalers, it can be noted that the export volume of a good through the two export modes is:

$$V_X(\varphi_i) = \varphi^{\sigma-1} \phi B^F \quad (\text{direct exporting}) \quad (33)$$

$$V_W(\varphi_i) = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma-1} V_X(\varphi_i) \quad (\text{wholesale}). \quad (34)$$

The ratio of total export volumes will therefore be

$$\frac{V_W}{V_X} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma-1} \left(\left(\frac{\varphi_X}{\varphi_W}\right)^{k-(\sigma-1)} - 1 \right) \quad (35)$$

which is a direct function of the relative productivity cutoffs φ_X and φ_W .

The relative mass of firms exporting on their own versus through wholesalers can be written

$$\frac{M_W}{M_X} = \left(\frac{\varphi_X}{\varphi_W}\right)^k - 1 \quad (36)$$

which is also a direct function of the relative productivity cutoffs.

The equilibrium ratio of productivity cutoffs can be found in (29):

$$\frac{\left(\frac{\varphi_X}{\varphi_W}\right)^k - 1}{\left(\frac{\varphi_X}{\varphi_W}\right)^{k-(\sigma-1)} - 1} = \lambda_1 F_X^{\frac{1}{\gamma}} \quad (37)$$

where λ_1 is a constant of parameters.³

First, it is interesting to note that neither the variable trade cost, ϕ , or per firm demand, B^F , play any role for the choice of export mode. This is due to the fact that for the operating profit, these variables affect wholesalers and direct exporters in identical ways. Second, a higher fixed cost causes the relative productivity cutoff to *increase*.⁴ This, therefore, causes: (i) more firms to export through wholesalers (which is equivalent to more varieties being exported and (ii) the relative export volume that is managed by wholesalers to increase. This result originates in the central dynamic provided by the model: the wholesale industry pools the export fixed costs across goods and can therefore make the fixed cost per good to be lower. We saw previously

³ $\lambda_1 \equiv \left(\frac{\gamma-1}{\gamma}\right)^{\frac{\gamma-1}{\gamma}} \frac{\beta}{\beta-1} \left(\left(\frac{\sigma-1}{\sigma}\right)^2\right)^{1-\sigma} \frac{1}{(1-(\frac{\sigma-1}{\sigma})^\sigma)}$.

⁴ The following is a proof that

$$\frac{\partial}{\partial x} \left(\frac{x^a - 1}{x^b - 1} \right) > 0 \quad \text{if } x > 1 \text{ and } a > b > 0.$$

First, the condition for the derivative to be positive can be simplified to

$$x^a (a - b - ax^{-b}) + b > 0.$$

Now, consider the first two terms of the first product. x^a is minimised when $x = 1$ and $a - b - ax^{-b}$ is minimised when $x = 1$ (recall that $x > 1$). When $x = 1$, the expression on the left hand side is equal to 0. However, as x increases, both x^a and $a - b - ax^{-b}$ increases, meaning that the whole expression on the left hand side will increase. Therefore, the condition holds since x has to be *strictly* greater than 1. ■

that a higher fixed cost also causes wholesale firms to expand the set of goods that they handle. By doing so, the fixed cost per good decreases.

Result 6 *A higher fixed cost is associated with (i) a higher share of total exports being shipped by wholesalers and (ii) a larger number of firms exporting through wholesalers relative to exporting on their own. This is due to the fact that wholesalers spread the fixed cost of exporting across more goods.*

The wholesaler technology therefore exhibits an increasing returns to scale property with regard to product scope. At low enough numbers of goods handled, an increase in the product scope lowers the fixed cost *per good*, making wholesalers more important as fixed costs increase.

2.4 Gravity and Welfare

The free entry condition in (31) closes the model outlined above. However, to find analytical solutions and especially to relate the findings to the gravity model and welfare, this section will remove the assumption of free entry in the manufacturing sector, as in (31), and impose assumptions similar to those in Chaney (2008). The main assumption here is that, in the manufacturing sector, there is a constant number of “potential entrants” and this is proportional to the size of an economy i

$$M_i^M = w_i L_i. \quad (38)$$

Naturally, this means that the expected profit of firms is no longer zero. Instead, profits are collected into a global fund in which workers own shares according to their income, w_i (wages are determined by the productivity level in the homogeneous sector). The dividend per share is equal to π and is the same across countries. Therefore, the output levels in the two countries are then equal to

$$Y = (1 + \pi) w L \quad (39)$$

$$Y^F = (1 + \pi) w^F L^F. \quad (40)$$

The dividend, π , can be written

$$\pi = bk \frac{\sum_i w_i L_i \left(\int_{\varphi_{Di}}^{\infty} \pi_{Di}(\varphi) \varphi^{-k-1} d\varphi + \sum_j \left(\int_{\varphi_{Xij}}^{\infty} \pi_{Xij}(\varphi) \varphi^{-k-1} d\varphi + \int_{\varphi_{Wij}}^{\varphi_{Xij}} \pi_{Wij}(\varphi) \varphi^{-k-1} d\varphi \right) \right)}{\sum_i w_i L_i}. \quad (41)$$

The rest of the equilibrium conditions are as before (and listed in Appendix A.1). This section also allows for the presence of wholesalers in all countries (not just the Home country as above) as well as wage differences which stem from the productivity in the homogeneous sector. Equations (39) to (41) and (54) to (63) provide the equilibrium conditions for all endogenous variables: $\varphi_D, \varphi_X, \varphi_W, Y, M^W, P, \varphi_D^F, \varphi_X^F, \varphi_W^F, Y^F, M^{WF}, P^F$ and π .

Now, I follow Chaney (2008) to find the equilibrium price levels of the two countries. Since there is no longer free entry in the manufacturing sector, the price levels can be simplified to a

large extent. All endogenous variables can also be solved for, except the number of wholesalers, M^W and M^{WF} , and the cutoff conditions for manufacturers to use wholesalers, φ^W and φ^{WF} . This is due to the nonlinear structure of equations (60) to (63). However, the main conclusion of this section can be proven without finding the solutions to these variables.

Using the equilibrium conditions, the price levels can be written (assuming that $b = 1$ for simplicity)

$$P^{\beta(1-\sigma)} = \mu \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \frac{\beta}{\beta-1} \frac{\left(wLw^{\beta(1-\sigma)}F_D^{1-\beta} + w^FL^Fw^{F\beta(1-\sigma)}\phi^\beta F_X^{1-\beta}\rho^{1-\beta} \right)}{\mu wL(1+\pi) - M^{FW}F_X \frac{\gamma}{\gamma-1}} \quad (42)$$

$$P^{*\beta(1-\sigma)} = \mu \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \frac{\beta}{\beta-1} \frac{\left(w^FL^Fw^{F\beta(1-\sigma)}F_D^{1-\beta} + wLw^{\beta(1-\sigma)}\phi^\beta F_X^{1-\beta}\rho^{1-\beta} \right)}{\mu w^FL^F(1+\pi) - M^WF_X \frac{\gamma}{\gamma-1}}. \quad (43)$$

where $\rho \equiv \frac{1}{(1-\frac{\sigma-1}{\sigma})^\sigma} > 1$.

Two results can be found. First, the presence of wholesalers in the Foreign (Home) country, $M^{WF} > 0$ ($M^W > 0$) lowers the price level in the Home (Foreign) country which increases competition there and also raises welfare. Second, an increase in the fixed cost in a model without wholesalers increases the price level. However, when wholesalers are present, the positive effect of an increase in the fixed cost is lower due to the presence of $M^{WF}F_X$ in the denominator. Wholesalers therefore mitigate the effect of fixed costs on price levels.

Finally, an expression similar to the key equation in Anderson and van Wincoop (2003) can be found when more than two countries are included in the model. The price level of country j can then be expressed as

$$P_j = \lambda_2 \left(\frac{Y_j}{Y} \right)^{-\frac{1}{k}} \theta_j \quad (44)$$

where

$$\theta_j^{-k} \equiv \frac{\sum_i \left(\frac{Y_i}{Y} w_i^{-k} \tau^{-k} F_{ij}^{1-\beta} \right)}{1 - \frac{1}{\mu Y_j} \frac{\gamma}{\gamma-1} \sum_i M_i^W F_{ij}} \quad (45)$$

is similar to the “multilateral resistance variable” as in Anderson and van Wincoop (2003), an aggregate index of the remoteness of country j .⁵ The equivalent variable in Chaney (2008) is

$$\theta_j^{-k} \equiv \sum_i \frac{Y_i}{Y} w_i^{-k} \tau^{-k} F_{ij}^{1-\beta} \quad (46)$$

where the difference lies in the absence of wholesale firms ($M_i^W = 0$ for all i). It is therefore the case that the presence of wholesale firms lowers the price index in all countries and increases both welfare and competition.⁶ Moreover, it can be seen that the presence of wholesale firms (higher M_i^W) mitigates the effect of a higher fixed cost on the price level.

⁵ $\lambda_2 \equiv \left(\frac{\sigma}{\sigma-1} \right)^\beta \left(\frac{\beta}{\beta-1} \right)^{-\frac{1}{k}} (1+\pi)^{\frac{1}{k}} \rho^{\frac{\beta-1}{\beta(\sigma-1)}}$.

⁶ The profit level is equal to:

$$\pi = \frac{b}{\beta-1} \frac{\sum_i w_i L_i \left(\varphi_{D_i}^{-k} F_D + \sum_j \varphi_{X_{ij}}^{-k} F_X \left(1 + \beta \left(\frac{\sigma-1}{\sigma} \right)^\sigma \left(\left(\frac{\varphi_{X_{ij}}}{\varphi_{W_{ij}}} \right)^{k-(\sigma-1)} - 1 \right) \right) \right)}{\sum_i w_i L_i}$$

Result 7 *The presence of wholesalers in the economies of trading partners lowers a country’s price index and increases welfare and competition in this country. Moreover, the presence of wholesalers mitigates the effect of an increase in the fixed cost on the price index.*

3 Empirical evidence

3.1 Main predictions

The model yields three main falsifiable hypotheses that this section aims to evaluate empirically:

1. *Export sales per good are lower for wholesalers than for producers exporting on their own (Result 3).*
2. *A larger share of aggregate export volumes is handled by wholesalers to countries with high fixed costs of entry (Result 6).*
3. *A larger share of the number of exported goods is handled by wholesalers to countries with high fixed costs of entry (Result 6).*

In this section, the number of goods and number of products per firm or destination mean the same thing: the number of (HS8) categories of goods that are exported. The first prediction originates from the fact that goods sold abroad through wholesalers are produced in a less productive way than other export goods and the fact that wholesalers charge an additional markup. The last two predictions, however, are all related to the core mechanism highlighted in the theoretical section. When fixed costs increase, the ability of wholesalers to generate economies of scope by spreading the fixed cost of entry across more goods becomes more valuable. Variation in all variables listed is therefore driven by the variation in fixed costs. Measures of fixed costs of entry are always imperfect. The analysis will, however, try to do this in two ways: (i) by utilising a measure of institutional quality relating to trade as a proxy of fixed costs, and (ii) backing out a proxy for fixed costs from a gravity model.

3.2 Data

The data on trade will be based on Swedish firm data from the year of 2005 (the most recent year for which such data is available). A firm in this dataset is classified according to its main activity and the analysis will utilise firms that are listed as “wholesalers”⁷ and firms active in any of the manufacturing sectors. From now on, producers exporting on their own will sometimes be referred to as “manufacturers” since firms that are listed as exporting manufacturers (and not

which decreases when the number of wholesalers increases since φ_D and φ_X decrease in the price indices (wholesalers decrease prices) and $\left(\frac{\varphi_{Xij}}{\varphi_{Wij}}\right)^{k-(\sigma-1)}$ is constant.

⁷Both “wholesalers” and “retailers” will be called “wholesalers” in the analysis since their activities are probably very similar for the purposes of this paper. The results are, however, robust to using only pure “wholesalers”.

listed as wholesalers) can be assumed to export on their own. Only exporting firms⁸ are used and in 2005 there were 8,725 wholesaler firms exporting and 8,509 manufacturing firms. The firm level data is from the Swedish firm database called “Företagsdatabasen” and is collected by Statistics Sweden. The trade data is from Customs Sweden and records all trade flows per firm, product code (according to both the Harmonised System, HS, up to 8 digits and the Standard International Trade Classification, SITC, up to 5 digits) and destination country. For 2005, there are in total 496,648 transactions reported over 8,330 HS8 categories and 194 destination countries. Due to the extreme detail of the HS8 classification, the analysis will use the number of HS8 products exported by a firm as a proxy for the scope of a firm. An HS8 category can therefore be seen as a variety or a product in the analysis. SITC4 will be used as a control for a more aggregated sector classification.

The average number of product categories that a firm exported was 11 for wholesalers and 9 for manufacturers. However, manufacturers are much larger and account for 85% of aggregate export volumes (measured in Swedish currency).

As for market size (GDP) and the institutional variables used, all data comes from the World Bank’s World Development Indicators (WDI) and Doing Business databases. Distance measures are from *Centre d’Etudes Prospectives et d’Informations Internationales* (CEPII).

Table 1 reports descriptive statistics for exporting wholesalers and manufacturers.

3.3 Prediction 1

This part examines whether sales per good are lower for wholesalers than manufacturers. The theoretical motivation for this is that wholesalers handle goods that are produced with lower productivity than manufacturers and are therefore more expensive. Moreover, wholesalers need to charge an extra markup which exporting manufacturers do not.

As noted, manufacturers account for 85% of aggregate exports which gives an indication that this prediction holds. However, to account for effects that are specific for products and destination countries, a regression analysis using fixed effects for these variables is applied.

The regression equation that is used will be:

$$x_{ijl} = \alpha + \beta W_j + f_l + f_i + \varepsilon_{ijl} \quad (47)$$

where x_{ijl} is the logarithm of the exports of product i by firm j to country l . W_j takes the value 1 if the product is sold by a wholesale firm and 0 if it is sold by a manufacturer. The coefficient β therefore measures the difference in export levels *per good* between wholesalers and manufacturers. To account for characteristics of specific product categories and specific markets, fixed effects are included for product codes, f_i , and destination countries, f_l . Otherwise, if wholesalers export within different categories than manufacturers, or serve different markets, the coefficient might be biased. Table 2 lists the result of these regressions.

⁸Firms with no employees are excluded. Moreover, the results are robust to dropping the top half percentile of exporters according to export volume.

Table 1

Descriptive statistics (only exporting firms included)

	<i>Wholesalers</i>	<i>Manufacturers</i>		<i>Wholesalers</i>	<i>Manufacturers</i>
<i>Number of firms</i>	8 725	8 509			
<i>Size</i>			<i>Production</i>		
<i>Total exports (1000 SEK)</i>			<i>Capital intensity (%)</i>		
Mean	13 212	78 562	Mean	10	24
10th perc.	5	10	10th perc.	0	1
Median	172	679	Median	2	11
90th perc.	13 457	68 443	90th perc.	16	44
<i>Scope (HS8)</i>			<i>Labour intensity (employees per million SEK output)</i>		
Mean	11	9	Mean	1.2	0.9
10th perc.	1	1	10th perc.	0.1	0.3
Median	3	3	Median	0.4	0.7
90th perc.	21	19	90th perc.	1	1.4
<i>Export destinations</i>			<i>Turnover (1000 SEK)</i>		
Mean	4	8	Mean	111 192	172 683
10th perc.	1	1	10th perc.	2 123	2 357
Median	2	2	Median	14 476	17 898
90th perc.	9	22	90th perc.	136 651	203 050

Table 2

	(1)	(2)	(3)	(4)
	Log(export)			
Wholesale dummy	-0.730*** (0.00832)	-0.427*** (0.00850)	-0.833*** (0.00878)	-0.570*** (0.00998)
<i>Fixed effects</i>				
Product	NO	YES	NO	YES
Destination	NO	NO	YES	YES
Categories	1	8329	194	149274
Observations	495365	495365	495365	495365
R-squared	0.015	0.192	0.034	0.350

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

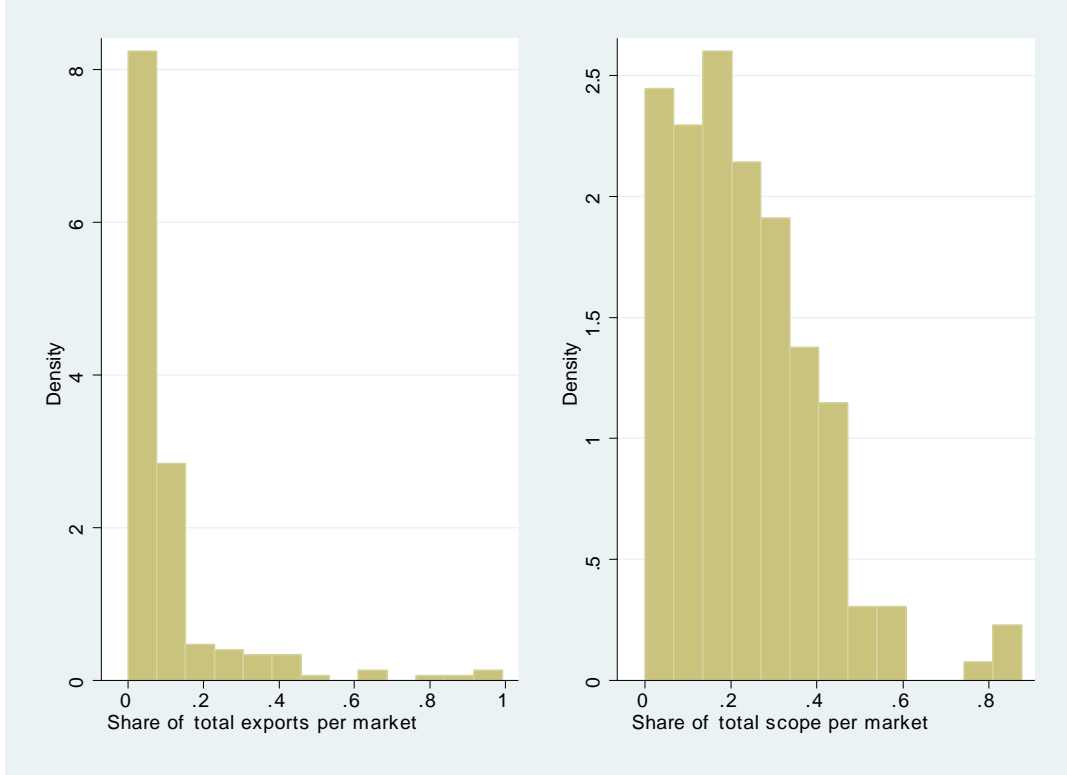


Figure 3: The role of wholesalers in exporting.

The regressions indicate that wholesalers, on average, sell between 34% or 57% less of a given product to a given country. The negative effect is significant at the 1% level for all four combinations of fixed effects. It therefore seems as if Prediction 1 holds in the data, wholesalers sell less per good than producers. The effect of including fixed effects is of some magnitude (which means that there is some selection) but not of a very large nature since the results are qualitatively similar.

3.4 Predictions 2 to 3

3.4.1 Using measures of institutional quality as a proxy for fixed costs

Regarding predictions 2 to 3, the explanatory variable is the fixed cost of entry in both cases. Therefore, these predictions will be examined in the same context in the following text. The theory states that a higher fixed cost increases the importance of the wholesalers' ability of generating economies of scope. Wholesalers are able to spread the fixed cost across several products and are therefore better equipped to export to markets where the fixed cost is high. They therefore also control a larger share of export volumes and export scope to markets with higher fixed costs of entry.

Figure 3 shows the distribution of how large a share of aggregate exports and the export scope, respectively, that is controlled by wholesalers across the markets to which Swedish firms

exported in 2005. The share of total exports is calculated by summing the value of all exports to a specific market and then calculating how much of this value was exported by firms listed as wholesalers. The graph shows that, to most markets, the share is rather small, about 10%, but not for all. To some, but very few markets, the share of wholesalers is above 50%. The second graph shows what share of goods that are exported to a specific market that is exported by wholesalers. Since some products are, of course, exported by both wholesalers and producers, the variable listed here is how many products wholesalers export divided by the number of products manufacturers export *plus* how many products wholesalers export.⁹ The relationship is similar to the previous one, although the distribution lies much more to the right. This means that to most countries, most products are exported only by the producers.

Finding measures of fixed costs is difficult but this section describes the first approach. A measure of institutions relating to international trade will be used. This variable has to fulfill two criteria: (i) it has to be available for a large enough number of countries, and (ii) be related to international trade. This leads to the choice of the following measures from the World Bank: (i) time to start a business, (ii) time to open a warehouse, (iii) the number of procedures to open a warehouse, and (iv) the cost, time and number of documents needed to import.¹⁰ The variables can be argued to be important for the type of costs that the model describes. It should also be noted that Ahn, Khandelwal, and Wei (2010) find similar results for these regressions using data from the same year for Chinese firms.

To see the effect that fixed costs have on the importance of wholesalers, the following regressions are used:

$$\left(\frac{V_W}{V_W + V_X}\right)_{il} = \beta_0 + \beta_1 Q_i + \beta_2 Y_i + \beta_3 dist_i + f_l + \varepsilon_i \quad (48)$$

$$\left(\frac{N_W}{N_W + N_X}\right)_{il} = \beta_0 + \beta_1 Q_i + \beta_2 Y_i + \beta_3 dist_i + f_l + \varepsilon_i \quad (49)$$

where $\left(\frac{V_W}{V_W + V_X}\right)_{il}$ denotes wholesalers' share of aggregate export volumes in sector l to destination country i , $\left(\frac{N_W}{N_W + N_X}\right)_{il}$ the share of HS8 products handled by wholesalers, Q_i the institutional measure for country i , Y_i the GDP level of country i , $dist_i$ the distance from Sweden to country i and f_l a sector fixed effect. SITC4 fixed effects are used here to control for potential selection effects of how exporters and wholesalers choose in which sectors to operate.¹¹ In this and the following section only product and destination pairs where wholesalers are active are included in the analysis since this is the case on which the model focuses.

⁹Therefore, if wholesalers and producers export exactly the same products, the variable here will have the value 0.5.

¹⁰The first three variables (reported in Table 3a) are collected from the World Bank's World Development Indicators and the last three (Table 3b) are from the World Bank's Doing Business Survey. The last three variables did not include 2005 so instead data from 2006 is used for these.

¹¹SITC4 is a much higher aggregate than HS8 and SITC4 is therefore used as a sector fixed effect while HS8 is used to see the number of varieties or products exported.

Table 3 (a)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Share of total exports handled by wholesalers			Share of scope handled by wholesalers (HS8)		
Time to start business	0.0163*** (0.00256)			0.0161*** (0.00166)		
Procedures to open a warehouse		0.0355*** (0.00485)			0.0205*** (0.00316)	
Time to open a warehouse			0.0184*** (0.00335)			0.0144*** (0.00218)
GDP	-0.0578*** (0.00124)	-0.0592*** (0.00120)	-0.0591*** (0.00121)	-0.0352*** (0.000807)	-0.0369*** (0.000783)	-0.0366*** (0.000787)
Distance	0.0408*** (0.00218)	0.0419*** (0.00215)	0.0425*** (0.00215)	0.0214*** (0.00142)	0.0230*** (0.00140)	0.0233*** (0.00140)
Sector fixed effects (SITC4)	YES	YES	YES	YES	YES	YES
Observations	22353	22353	22353	22378	22378	22378
R-squared	0.499	0.499	0.499	0.499	0.498	0.498

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3 (b)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Share of total exports handled by wholesalers			Share of scope handled by wholesalers (HS8)		
Documents to import	0.0709*** (0.00557)			0.0465*** (0.00362)		
Cost to import		0.0297*** (0.00498)			0.0355*** (0.00323)	
Time to import			0.0591*** (0.00360)			0.0443*** (0.00233)
GDP	-0.0558*** (0.00124)	-0.0580*** (0.00123)	-0.0516*** (0.00130)	-0.0339*** (0.000808)	-0.0347*** (0.000801)	-0.0304*** (0.000841)
Distance	0.0286*** (0.00241)	0.0397*** (0.00221)	0.0255*** (0.00238)	0.0136*** (0.00157)	0.0193*** (0.00143)	0.0100*** (0.00154)
Sector fixed effects (SITC4)	YES	YES	YES	YES	YES	YES
Observations	22271	22271	22271	22296	22296	22296
R-squared	0.502	0.499	0.504	0.501	0.500	0.506

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Tables 3a and 3b report the regression result for equations (48) and (49). All the measures of institutional qualities are positive and significant. If it is the case that these are positively correlated with the fixed cost of entering a specific market, then the regression results mean that wholesalers are more important, both in quantity and scope, for entering markets characterised by large fixed costs.

3.4.2 Backing out fixed costs from observed export patterns

An alternative method would be to use observed export patterns and back out measures of fixed costs from a fitted gravity model. This method is based on the recent literature on how firm heterogeneity impacts the gravity model. Helpman, Melitz, and Rubinstein (2008) show that firm heterogeneity affects the selection of firms and that this has strong impacts on the gravity model, mostly by the presence of trade flows with zero values which have previously often been ignored. I follow, to some extent, this methodology by using the gravity equation and use the residual from a gravity regression as a proxy inversely related to fixed costs of exporting. The gravity model controls for market size (in the form of GDP and GDP per capita) and variable trade costs (here distance and a measure of institutional quality). What remains can then be argued to be inversely related to the fixed cost and can be used to test the predictions for the aggregate variables in predictions 2 to 3.

The methodology here will therefore be to, first, use the gravity model to control for market demand and variable costs of exporting. The regression equation is:

$$V_{W,il} + V_{X,il} = \alpha + \beta_1 GDP_i + \beta_2 distance_{SWE,i} + POP_i + f_l + \varepsilon_{il} \quad (50)$$

$$N_{W,il} + N_{X,il} = \alpha + \beta_1 GDP_i + \beta_2 distance_{SWE,i} + POP_i + f_l + \varepsilon_{il} \quad (51)$$

where, again, GDP_i is the gross domestic product of market i , $distance_{SWE,i}$ is the distance from Sweden and POP_i is the population. Fixed effects at the SITC4 level are included as f_l . Two different dependant variables will be used. First, the measure will be total exports to each country, $V_{W,il} + V_{X,il}$, and, second, it will be the number of (HS8) products, $N_{W,il} + N_{X,il}$, that are exported to each country. Note also that by including both GDP and population I implicitly control for GDP per capita. In this way, I control for items that affect the export behaviour through market size and variable trade costs. This leaves a vector of residuals, $\hat{\varepsilon}_{il}$, which will be interpreted as an implicit measure of the fixed cost (a higher $\hat{\varepsilon}_{il}$ means a lower fixed cost). This is due to the fact that they are the residuals of a regression where both market size (as GDP or GDP per capita) as well as the variable cost (distance) have been controlled for. What is left could be interpreted as something correlated with the fixed cost of entry; it is backed out by controlling for other observable variables that affect the variables concerned.

Table 4 reports the results from this “first stage” regression. The coefficients support the standard predictions of the gravity model for a setting with heterogeneous firms.

The measure $\hat{\varepsilon}_{il}$ can then be used in a regression where these three key predictions of the

Table 4

VARIABLES	(1) Export volume (values)	(2) Export products (HS8)
GDP	1.001*** (0.00896)	0.284*** (0.00219)
Distance	-1.158*** (0.0123)	-0.380*** (0.00301)
Population	-0.259*** (0.00999)	-0.112*** (0.00244)
Observations	43512	43553
R-squared	0.540	0.631

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

model are tested (predictions 2 to 4):

$$\left(\frac{V_W}{V_W + V_X}\right)_{il} = \alpha + \beta_1 \hat{\varepsilon}_{il} + \beta_2 GDP_i + \beta_3 distance_{SWE,i} + \beta_4 POP_i + v_{il} \quad (52)$$

$$\left(\frac{N_W}{N_W + N_X}\right)_{il} = \alpha + \beta_1 \hat{\varepsilon}_{il} + \beta_2 GDP_i + \beta_3 distance_{SWE,i} + \beta_4 POP_i + v_{il}. \quad (53)$$

where the dependant variables will be the following two: (i) the share of total exports, in values, that are handled by wholesalers and (ii) the share of products that are sold by wholesalers. Note that $\hat{\varepsilon}_{il}$ is negatively correlated to the fixed cost so the model will predict that these two variables should be *negatively* correlated with $\hat{\varepsilon}_{il}$. Table 5 reports the results.

Table 5 shows that if the methodology regarding the usage of gravity model residuals as an inverse proxy for fixed costs is correct, wholesalers do indeed seem to be more important for destinations with higher fixed costs. For both first stage regressions, the residuals are negatively correlated with the share of wholesalers in aggregate export volumes and number of products.

The analysis therefore concludes that by backing out a proxy of fixed costs which consists of the residual from a gravity model that takes market size and variable trade costs into account, there is support for the model. Wholesalers are shown to be more important in markets with larger fixed costs, or at least costs that the gravity model does not account for. Wholesalers are more important in both the sense that they control a larger share of the aggregate value of exports and a larger share of the type of goods that are exported.

Table 5

A

VARIABLES	(1a) Share of total exports handled by wholesalers	(1b) Share of total exports handled by wholesalers	(2a) Share of number of goods handled by wholesalers	(2b) Share of number of goods handled by wholesalers
First stage variable: values of export volume				
Residuals from first stage	-0.0390*** (0.00102)	-0.0394*** (0.000950)	-0.0268*** (0.000660)	-0.0271*** (0.000618)
GDP		-0.0793*** (0.00169)		-0.0519*** (0.00110)
Distance		0.0316*** (0.00219)		0.0155*** (0.00142)
Population		0.0263*** (0.00186)		0.0194*** (0.00121)
Sector fixed effects (SITC4)	YES	YES	YES	YES
Observations	23099	23099	23108	23108
R-squared	0.463	0.533	0.471	0.537

B

VARIABLES	(1a) Share of total exports handled by wholesalers	(1b) Share of total exports handled by wholesalers	(2a) Share of number of goods handled by wholesalers	(2b) Share of number of goods handled by wholesalers
First stage variable: number of export goods				
Residuals from first stage	-0.159*** (0.00405)	-0.169*** (0.00377)	-0.145*** (0.00254)	-0.152*** (0.00236)
GDP		-0.0803*** (0.00168)		-0.0527*** (0.00105)
Distance		0.0344*** (0.00217)		0.0181*** (0.00136)
Population		0.0249*** (0.00185)		0.0176*** (0.00116)
Sector fixed effects (SITC4)	YES	YES	YES	YES
Observations	23099	23099	23129	23129
R-squared	0.464	0.539	0.505	0.577

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

4 Conclusion

The paper presents a model that gives a rationale for the presence of wholesalers and intermediaries in international trade. Wholesalers possess a technology that allows them to use their international distribution network to handle more than one good (although the fixed cost increases in the number of goods they handle), while the producers of these goods (manufacturing firms) can only export their own good. In order to cover the fixed cost of exporting, wholesalers need to charge a markup between the price at which they procure the good and the final price in the foreign country. This markup causes manufacturing firms to export on their own as long as they are productive enough to cover the fixed cost of doing so. However, if they are not productive enough, they will try to sell their good to the foreign market through a wholesaler's distribution network. This process results in productivity sorting as regards export mode: the most productive firms export on their own while less productive firms export through wholesalers. The least productive firms do not export at all.

I also find new results for what affects the importance played by wholesalers in international trade, especially for the share of exports as well as the share of products that are shipped through wholesalers' networks. Market size and variable "iceberg" trade costs do not matter. Instead, the fixed cost of exporting plays an important role: the higher the fixed cost of exporting, the more important are wholesalers. This is the case since wholesalers can spread the fixed cost over several goods, as opposed to manufacturing firms, which need to incur one fixed cost for their single good. As fixed costs become more important, firms shift to export through wholesalers (which expand the number of goods they handle) such that they can benefit from lower fixed costs per good exported.

The microfoundation is then used to derive equilibrium price indices in a multicountry framework. It is found that the presence of wholesalers lowers price indices in countries with which they trade. Therefore, wholesalers increase welfare and increase competition in these countries. Finally, the presence of wholesalers mitigates the effect of fixed costs on price levels.

The empirical section supports the main predictions of the model. First, it shows that wholesalers export smaller amounts of each product, even when the effect of which particular sector it concerns or which country the good is exported to is controlled for. Second, it is found that wholesalers are more important, both in quantity and scope, for markets characterised by high fixed costs. This is found both by using institutional measures linked to fixed costs and by using the residuals from a gravity model. The empirical analysis therefore supports the notion that wholesalers play a larger role in exporting to countries characterised by larger fixed costs of entry.

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A Appendix

A.1 Remaining equilibrium conditions in section 2.4

The domestic cutoff conditions in the two countries are, as before

$$\varphi_D^{\sigma-1} = \frac{P^{1-\sigma} F_D w^{\sigma-1}}{\mu Y} \quad (54)$$

$$(\varphi_D^F)^{\sigma-1} = \frac{(P^F)^{1-\sigma} F_D (w^F)^{\sigma-1}}{\mu Y^F} \quad (55)$$

and also the export cutoffs

$$\varphi_X^{\sigma-1} = w^{\sigma-1} \frac{(P^F)^{1-\sigma} F_X}{\phi \mu Y^F} \frac{1}{\left(1 - \left(\frac{\sigma-1}{\sigma}\right)^\sigma\right)} \quad (56)$$

$$(\varphi_X^F)^{\sigma-1} = (w^F)^{\sigma-1} \frac{P^{1-\sigma} F_X}{\phi \mu Y} \frac{1}{\left(1 - \left(\frac{\sigma-1}{\sigma}\right)^\sigma\right)} \quad (57)$$

where $\rho \equiv \frac{1}{\left(1 - \left(\frac{\sigma-1}{\sigma}\right)^\sigma\right)} > 1$ (the difference for the export cutoff from the “standard model” without wholesalers). The price equations can then be written

$$\begin{aligned} P^{1-\sigma} &= wL \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} w^{1-\sigma} b^k \varphi_D^{(\sigma-1)-k} + w^F L^F \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} (w^F)^{1-\sigma} \phi (\varphi_X^F)^{(\sigma-1)-k} \\ &\quad + w^F L^F \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{2(1-\sigma)} \phi (w^F)^{1-\sigma} \left((\varphi_W^F)^{(\sigma-1)-k} - (\varphi_X^F)^{(\sigma-1)-k} \right) \\ (P^F)^{1-\sigma} &= w^F L^F \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} (w^F)^{1-\sigma} b^k (\varphi_D^*)^{(\sigma-1)-k} + wL \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} w^{1-\sigma} \phi \varphi_X^{(\sigma-1)-k} \\ &\quad + wL \frac{\beta}{\beta-1} \left(\frac{\sigma}{\sigma-1}\right)^{2(1-\sigma)} \phi w^{1-\sigma} \left(\varphi_W^{(\sigma-1)-k} - \varphi_X^{(\sigma-1)-k} \right). \end{aligned} \quad (58)$$

There are two equilibrium conditions, per country, for the wholesale sector:

$$\frac{1}{\left(\varphi_W^{-k} - \varphi_X^{-k}\right)} \phi \frac{\mu Y^F}{(P^F)^{1-\sigma}} \left(\left(\frac{\sigma}{\sigma-1}\right)^2 \right)^{1-\sigma} \frac{\beta}{\beta-1} w^{1-\sigma} \left(\varphi_W^{(\sigma-1)-k} - \varphi_X^{(\sigma-1)-k} \right) = F_X^{\frac{\gamma-1}{\gamma}} \left(\frac{\gamma}{\gamma-1} \right)^{\frac{\gamma-1}{\gamma}} \quad (60)$$

$$\frac{wL}{M^W} b^k \left(\varphi_W^{-k} - \varphi_X^{-k} \right) = F_X^{\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma-1} \right)^{\frac{1}{\gamma}} \quad (61)$$

$$\frac{1}{\left((\varphi_W^F)^{-k} - (\varphi_X^F)^{-k} \right)} \phi \frac{\mu Y}{P^{1-\sigma}} \left(\left(\frac{\sigma}{\sigma-1}\right)^2 \right)^{1-\sigma} \frac{\beta}{\beta-1} (w^F)^{1-\sigma} \left((\varphi_W^F)^{(\sigma-1)-k} - (\varphi_X^F)^{(\sigma-1)-k} \right) = F_X^{\frac{\gamma-1}{\gamma}} \left(\frac{\gamma}{\gamma-1} \right)^{\frac{\gamma-1}{\gamma}}$$

$$\frac{w^F L^F}{M^{WF}} b^k \left((\varphi_W^F)^{-k} - (\varphi_X^F)^{-k} \right) = F_X^{\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma-1} \right)^{\frac{1}{\gamma}}$$