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Wholesalers in international trade

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ABSTRACT

Recent empirical research in international trade has revealed overwhelming evidence that, in all countries, a remarkably small proportion of firms report exports in Customs statistics. However, a large share of these are wholesalers. This suggests that the number of producers selling their products abroad might be much greater than that suggested by a simple count of the firms directly reporting their exports. This paper sheds light on the role of wholesalers in international trade. Our model uses very general assumptions to show that intermediated exporters may contribute significantly to the extension of countries' export opportunities. The model predicts a twofold role in international trade. First, wholesalers alleviate the difficulty of reaching less-accessible markets. Second, they help less-efficient firms to supply foreign markets, thus increasing the number of exported varieties at the aggregate level. We use French firm-level export data to provide empirical support for these two predictions.

1. Introduction

There is now well-accepted empirical evidence that internationalization is only for the few (Mayer and Ottaviano, 2007). Only a handful of producers report exports in Customs statistics. In France, about 17% of manufacturing firms export (Eaton et al., 2004), and Bernard et al. (2007) find an analogous figure of 15% in US data. Economists are thus inclined to think of the process whereby firms engage in international trade as being extremely selective. In the seminal model of Melitz (2003), selectivity results from the requirement that prospective exporters build their own distribution network abroad. But recent evidence on the role of intermediary firms in trade may in fact suggest that selectivity has to date been overestimated. Indeed, a considerable proportion of the firms filling in export declarations are not producers of goods. This indicates that many more firms than those appearing in official Customs statistics supply their products to foreign consumers.

Bernard et al. (2010) calculate that wholesale and retail firms account for approximately 10% of US exports. The share is 22% of total exports from China (Ahn et al., 2011), 11% of total exports from Italy (Bernard et al., 2011) and 35% of Chilean imports (Blum et al., 2010). In France, the country we focus on here, intermediaries account for 20% of total exports. Two main stylized facts emerge from the examination of these particular exporters. First trade intermediaries are more prevalent in difficult markets. For instance, Ahn et al. (2011) find that in China the share of exports via intermediates is greater in countries with smaller market size and higher variable trade costs. Bernard et al. (2011) further note in Italian data that intermediary exports are less sensitive to proxies for market-entry costs (import barriers and a governance indicator) than are direct exports. Second, the few existing datasets providing information on firms that export indirectly

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reveal that these are on average less efficient than direct exporters. McCann (forthcoming) uses survey data for a large number of Eastern European countries[1] to show that firms which export directly perform better than either those using an intermediary or domestic firms. His finding holds for many different proxy measures of firm performance.[2] It has been confirmed by Lu et al. (2011)[3] who find for 29 developing economies that the most productive firms export directly while the least productive resort to intermediaries for exporting. Abel-Koch (2011) also observes a negative correlation between firm size and the relative importance of intermediated exportsin Turkey.[4]

We propose and empirically test a very simple model that predicts the two stylized facts discussed above: (1) intermediaries are relatively more present in markets that are more difficult to penetrate (i.e. smaller, further away, more protected, etc.); and (2) intermediaries channel exports from less-efficient firms which otherwise would not be able to pay the fixed cost of exporting directly.

Recent models extending Melitz (2003) to account for intermediary activity[5] assume an intermediation technology, which allows wholesalers to exploit some kind of advantage (such as economies of scope or better knowledge) in exporting over small exporting producers (Ahn et al., 2011; Åkerman, 2010; Blum et al., 2011; Bernard et al., 2011; Felbermayr and Jung, 2011). Domestic producers are modeled as facing a choice of how to export: by exporting directly to foreign markets, and incurring the fixed costs of exports and trade costs, or via a specialized firm (the trade intermediary). Intermediaries are typically supposed to charge their clients (indirect exporters) an intermediary fixed cost, which is lower than the fixed cost of direct exports, and an additional marginal cost. The intermediation technology thus provides a mechanism by which firms can access export markets even if they are not productive enough to establish their own direct export network.[6] All these models predict an efficiency-ordering of firms into three categories (non-exporters, intermediated exporters and direct exporters): non-exporters are less efficient than those using an intermediary, while the latter are less efficient than firms which export directly. This assumption of wholesalers acting as a trade vehicle for less-efficient firms has so far remained largely untested.

Along the same lines as the theoretical work noted above, our model assumes an intermediation technology that reduces the fixed cost of exporting in exchange for a higher marginal cost. Our model differs from the existing literature in two ways however. First, the prediction (1) relating the prevalence of intermediary exports to the accessibility of the foreign market is obtained in a very simplistic and intuitive framework, and does not involve any restrictive hypotheses regarding the intermediary technology. We simply introduce a specific (i.e. non-ad-valorem) trade cost into a very standard trade model. This fairly reasonable assumption suffices to show that the share of bilateral exports handled by wholesalers is negatively correlated with all possible determinants of foreign-market accessibility. Åkerman (2010), Felbermayr and Jung (2011) and Ahn et al. (2011) have proposed theoretical contributions leading to similar conclusions. In Felbermayr and Jung (2011) and Åkerman (2010), however, not all of the determinants of market accessibility influence the export share. Only the severity of contractual problems and the fixed cost of exporting play a role in these models; foreign-market size and variable trade cost have similar effects on both direct and indirect exports. Ahn et al. (2011) do show that all of the determinants of market accessibility influence the extent of indirect exports, but at the cost of a somewhat controversial hypothesis: they assume that once a firm pays to use an intermediary, it will supply all export markets. In our model, the fixed cost of intermediation is destination-specific so that firms are not systematically present on all foreign markets. Our second theoretical contribution is related to the prediction (2). While the existing literature supposes that the firms' decision to export directly or indirectly is only driven by productivity, we also introduce an efficiency-ordering of firms based on the quality of their variety. We consider two polar cases. In the first, the sorting of firms into export markets depends upon individual productivity (or marginal cost) draws; in the second, firms with higher marginal costs produce higher quality. This yields a novel prediction regarding the price of wholesalers' exports relative to that of direct exporters. In the productivity-sorting setting, we predict that intermediates will export more expensive varieties, as they export on the behalf of relatively higher-cost manufacturers. In the quality-sorting setting, by way of contrast, they export the least expensive varieties corresponding to lower-quality manufacturers. These contrasting predictions will be exploited to test the hypothesis that direct exporters are more efficient on average than indirect exporters.

We use French firm-level data to test the two main predictions of the model. Our estimates confirm prediction (1), i.e. wholesalers channel a greater share of total exports in more difficult markets. The analysis of prediction (2) – that intermediaries channel exports from less-efficient firms – is conducted using export unit prices. Only two pieces of work

[1] The data comes from the Business Environment and Enterprise Performance Survey (BEEPS), which is collected by the European Bank for Reconstruction and Development (EBRD) and the World Bank.

[2] The performance premium is estimated based on the probability that firms participate in the following activities: importing, having a foreign owner, licensing of foreign technology, research and development and multi-product sales.

[3] The data comes from Private Entreprise Survey of Productivity and the Investment Climate developed at the World Bank.

[4] The survey data here is from the World Bank Enterprise Survey conducted in Turkey in 2008.

[5] Initial models viewed intermediaries as agents who facilitate matching between sellers/exporters and foreign buyers (Rauch and Watson, 2004; Petropoulou, 2011; Antràs and Costinot, 2011).

[6] Debaere et al. (forthcoming) develop a fairly similar approach to model the sourcing decisions of firms in a Melitz and Ottaviano (2008) setting. Firms consider two ways of obtaining the intermediation services required to source inputs: (1) use a service provider, which involves an iceberg-type cost; or (2) internalize the provision of services, which incurs a fixed cost. Their empirical evidence suggests that more productive firms are more likely to internalize the production of services.

have provided empirical evidence on the price difference between direct and indirect exporters, and they disagree. Ahn et al. (2011) find for China that export prices by intermediaries are about 6% higher than those of direct exporters, while Bernard et al. (2010) conclude that wholesalers in the US have lower (by 14%) unit values than do pure producers. Our model and our empirical results, reconcile these apparently contrasting findings. Our model predicts that the average price charged by wholesalers is higher than the average price of direct exports when firms' export performance is mainly driven by their productivity. But when quality sorting prevails, our model shows that this price premium is smaller and even negative for some parameter values. This prediction is supported by our empirical analysis.

The remainder of the paper is structured as follows. In Section 2, we present our model and the two propositions (in terms of the prevalence and the prices of intermediaries) that we will test empirically. Section 3 describes the data, and Section 4 presents our empirical results. We conclude in Section 5.

2. The model

This section presents a very simple international trade model with intermediaries. We do not model explicitly a wholesale sector, but simply assume that intermediaries might purchase some varieties of manufacturing goods in the home country and resale them abroad. Nevertheless, this extremely basic framework includes a non-iceberg transportation cost and considers the case of vertical differentiation and quality sorting of the firms into the export markets.

2.1. Technology and preferences

Our model builds on Melitz (2003) and Baldwin and Harrigan (2011). It also takes from Martin (2012) the assumption of per unit freight costs in addition to the standard ad-valorem (so-called iceberg) cost. We assume only one factor, labor, which is inelastically supplied in each country. We focus on a given industry, characterized by the standard Dixit-Stiglitz assumption of monopolistic competition. There is a continuum of firms in this industry, each producing a single differentiated variety. As in Melitz (2003), firms are supposed to have heterogeneous marginal costs. To keep the model simple, we impose that the marginal costs for firms in the industry we focus on are exogenous. To obtain this result, we simply assume that all countries are engaged in the production of a numeraire good, homogeneous, freely traded and produced under constant returns to scale and perfect competition. This production offsets all potential trade imbalances in the other industries and establishes wages (and thus aggregate incomes) in all countries.

We consider the set of firms producing differentiated varieties of a specific good, in a given country. We denote by q_{kj} the demand for a variety produced by firm k in destination country j. This demand will be satisfied only if it generates enough revenues to overcome the destination-specific fixed cost of exporting incurred by firm k. All consumers in the world have the same CES sub-utility function, yielding the following demand for each variety k in country j:

$$q_{kj} = \frac{E_j}{P_j^{1-\sigma}} s_k^{\sigma-1} (p_{kj}^{CIF})^{-\sigma}, \tag{1}$$

where p_{kj}^{CIF} is the trade-cost inclusive price (CIF) of variety k in destination market j. This naturally is an increasing function of firm k's marginal cost, c_k. E_j is expenditure in country j on the good we consider,[7] P_j the CES price index on that market and $\sigma > 1$ the elasticity of substitution between varieties. The parameter $s_k > 0$ reflects the quality of variety k, which shifts consumers' CES utility. We consider that firms choose quality subject to an upgrading cost. Following Baldwin and Harrigan (2011), Hallak and Sivadasan (2009), Johnson (2012) and Crozet et al. (2012) we assume that this relationship between the marginal cost and quality takes the form of a power-function: $s_k = c_k^b$. This parametrization is useful because the utility only depends on the marginal cost of the firms, which allows to interpret s_k either as a quality or a productivity draw. To keep things simple, we consider two polar cases. The first case assumes $b=0$. All firms produce the same quality and firm-level demand is a negative function of firm's marginal cost c_k. Then, the sorting of firms into export markets depends upon individual marginal cost (or productivity) draws only. The second case assumes $b=1$ and exhibits quality sorting rather than productivity sorting. Indeed, if $b=1$, firms with higher marginal cost produce higher quality. While they charge a higher price, they will also face greater demand for their variety.[8]

With positive international trade costs the CIF price paid by foreign consumers (p_{kj}^{CIF}) differs from the free on board (FOB) price charged by the exporter (p_{kj}). Denoting by T_j the per unit trade cost and τ_j the ad-valorem trade cost, the CIF price is

$$p_{kj}^{CIF} = p_{kj}\tau_j + T_j. \tag{2}$$

[7] With a two-tier utility function leading to constant expenditure shares by product, the aggregate expenditure on a given good in country j is proportional to the exogenous population in this country.

[8] Denoting the cumulative distribution function of the marginal-cost distribution function by $G(c)$, and its probability density function by $f(c)$, we have to assume that $xg(x)/G(x)$ is decreasing in the productivity-sorting setting and that $xg(x)/(1-G(x))$ is increasing in the quality-sorting case. This is a regularity condition and holds for most of the usual distributions, including the Pareto distribution.

The ad-valorem trade cost, τ_j, captures tariffs applied by the importing country and all ad-valorem sources of transport costs such as insurance and packaging. The trade cost T_j includes all of the components of transport costs, which do not vary with the value of the good.

Considering their expected profit in each destination country, firms must decide whether or not to export. There are two export modes. Firms can export directly to country j, incurring a sunk cost F_j. Alternatively, they may find it more profitable to do so through a domestic wholesaler. Wholesalers provide an intermediation service that reduces the sunk cost of exporting. Firms exporting to country j through a wholesaler thus incur a lower sunk cost, $F_j^w = \alpha F_j$ where $\alpha \in (0,1)$. This seems reasonable, as it is certainly easier to find foreign customers through the intermediary, but also because the intermediate firm takes care of some aspects of the fixed cost of exporting, such as filling in customs declarations and organizing the logistic chains to transport the goods.

2.2. Direct exports

Profit maximization and Eqs. (1) and (2) yield the optimal mill (FOB) price charged by direct exporters: $p_{kj} = p_{kj}^d = (1/(\sigma-1))(T_j/\tau_j) + (\sigma/(\sigma-1))c_k$. Without a per unit transport cost ($T_j = 0$), firms do not have a pricing-to-market behavior. The FOB price is the same for all destinations, and is a constant mark-up over marginal cost. But if $T_j > 0$, the FOB price varies, and increases in T_j. Given Eq. (2), the CIF price, which is paid by the final consumer in country j is $p_{kj}^{CIF} = p_{kj}^{CIF,d} = (\sigma/(\sigma-1))[T_j + \tau_j c_k]$. The profit obtained by a direct exporter on market j is

$$\pi_j^d(c_k) = \Theta[E_j/P_j^{1-\sigma}]\tau_j^{-\sigma}(c_k)^{b(\sigma-1)}[T_j/\tau_j + c_k]^{1-\sigma} - F_j, \tag{3}$$

where $\Theta = [1/(\sigma-1)][\sigma/(\sigma-1)]^{-\sigma}$.

2.3. Indirect exports

Instead of exporting directly a producer may decide to use the services of a wholesaler located in his country. We assume that intermediaries incur a fixed entry cost. But to keep things simple, there is no marginal cost of channeling a variety abroad, besides the cost of buying the variety itself. Intermediaries can exploit the market power resulting from the differentiation of the varieties they sell, and mark up the producer mill price. Finally, we further assume that free entry in this sector drives profits of intermediaries to zero.

To obtain the optimal price charged by a producer exporting through a wholesaler, we solve the model backward. We first derive the optimal price the wholesaler sets when selling a given variety on a foreign market, as a function of the mill price charged by the indirect exporter, p_{kj}^i. In a second step, we solve for this optimal mill price, knowing the optimal pricing behavior of the wholesaler that sells the good on the foreign market. Combining Eqs. (1) and (2), we get the profit that a wholesaler obtains by shipping the goods of a producer k to market j, $(E_j/P_j^{1-\sigma})c_k^{b(\sigma-1)}(p_{kj}^w\tau_j + T_j)^{-\sigma}(p_{kj}^w - p_{kj}^i)$, where p_{kj}^w is the FOB price charged by the wholesaler. This price is

$$p_{kj}^w = \frac{1}{\sigma-1}\frac{T_j}{\tau_j} + \frac{\sigma}{\sigma-1}(p_{kj}^i)$$

and the corresponding CIF price paid by the consumers in country j is $p_{kj}^{CIF,w} = (\sigma/(\sigma-1))[T_j + \tau_j p_{kj}^i]$.

Given this pricing behavior of the wholesaler, the producer maximizes its revenues on market j:

$$(E_j/P_j^{1-\sigma})c_k^{b(\sigma-1)}\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma}[T_j + \tau_j p_{kj}^i]^{-\sigma}(p_{kj}^i - c_k).$$

This leads the producer to set a FOB price equal to

$$p_{kj}^i = \frac{1}{\sigma-1}(T_j/\tau_j) + \frac{\sigma}{\sigma-1}c_k,$$

so that the CIF price is $p_{kj}^{CIF,w} = (\sigma/(\sigma-1))^2[T_j + \tau_j c_k]$. Finally, using demand from Eq. (1), we get the profits obtained by a producer on market j when exporting through a wholesaler:

$$\pi_j^i(c_k) = \Theta[E_j/P_j^{1-\sigma}]\tau_j^{-\sigma}(c_k)^{b(\sigma-1)}[T_j/\tau_j + c_k]^{1-\sigma}\delta - \alpha F_j, \tag{4}$$

where $\delta = [\sigma/(\sigma-1)]^{-\sigma}$; $\delta \in (0,1)\forall\sigma > 1$.

2.4. Choice of the export mode

Firms' indirect export profits are less sensitive to marginal cost than are their direct export profits,[9] and there are two cutoff points. When firms produce identical qualities ($b=0$), the profits from both direct and indirect exporting fall

[9] $\partial\pi_j^d(c_k)/\partial c_k = \Theta[E_j/P_j^{1-\sigma}]\tau_j^{-\sigma}c_k^{b(\sigma-1)}(\sigma-1)(T_j/\tau_j + c_k)^{1-\sigma}[b/c_k - 1/(T_j/\tau_j + c_k)]$ and $\partial\pi_j^i(c_k)/\partial c_k = \delta\Theta[E_j/P_j^{1-\sigma}]\tau_j^{-\sigma}c_k^{b(\sigma-1)}(\sigma-1)(T_j/\tau_j + c_k)^{1-\sigma}[b/c_k - 1/(T_j/\tau_j + c_k)]$. Recalling that $\sigma > 1$, $T_j/\tau_j > 0$ and $c_k > 0$, these two derivatives are positive when $b=0$ and negative when $b=1$. Moreover, $\partial\pi_j^d(c_k)/\partial c_k < \partial\pi_j^i(c_k)/\partial c_k < 0$ for $b=0$ and $\partial\pi_j^d(c_k)/\partial c_k > \partial\pi_j^i(c_k)/\partial c_k > 0$ for $b=1$.

monotonically with marginal cost. All firms with $c_k < \overline{c_j}^i$, such that $\pi_j^i(\overline{c_j}^i) = 0$, find it profitable to export indirectly. Amongst these, firms with $c_k < \overline{c_j}^d$, such that $\pi_j^d(\overline{c_j}^d) = \pi_j^i(\overline{c_j}^d)$, have higher profits than do indirect exporters and will not use the intermediation service. Conversely, in the quality-sorting model ($b=1$), firms with higher marginal cost propose better quality and face greater demand. Profit functions are positively sloped, and the hierarchy of cut-offs is inverted. Firms with $c_k > \overline{c_j}^d$ export directly, while firms with $c_k \in [\overline{c_j}^i, \overline{c_j}^d]$ export via a wholesaler. Firms with $c_k < \overline{c_j}^i$ do not export to country j.

Our model sheds light on the role of wholesalers in international trade, which is twofold. First, they help firms to reach relatively difficult markets, where firms' expected sales are low relative to the fixed cost of exporting. As a consequence, the role of wholesalers is particularly important in more difficult markets. They should handle a greater share of total trade to these destinations compared to the more accessible ones where more firms export directly. Indeed, comparative statics analysis shows that the share of total exports handled by wholesalers is larger in destination markets that are smaller and characterized by higher trade costs. This is summarized in Proposition 1.

Proposition 1. *The share of exports channeled through wholesalers is falling in country size and increasing in all trade costs: ad-valorem, per unit and fixed entry costs.*[10]

Proof. See Appendix.

Second, as in Ahn et al. (2011) and Åkerman (2010), wholesalers help relatively less efficient firms to export. We cannot test this theoretical finding directly as we do not observe in our data the composition of the basket of varieties exported by wholesalers on each market. However, since firms' efficiency is reflected in their prices, this conjecture can be tested resorting to the comparison of the FOB export prices, which are reported in the custom data.

Let us note $\tilde{c^i}_{jg}$ the average marginal cost of firms exporting indirectly a given good g to a given market j. The average FOB price charged by the wholesalers is

$$\tilde{p^w}_{jg} = \frac{1}{\sigma-1}\frac{T_j}{\tau_j}\left(1+\frac{\sigma}{\sigma-1}\right)+\left(\frac{\sigma}{\sigma-1}\right)^2\tilde{c^i}_{jg}.$$

On the same market, the average FOB price charged by direct exporters is

$$\tilde{p^d}_{jg} = \frac{T_j}{\tau_j}\frac{1}{\sigma-1}+\frac{1}{\sigma-1}\tilde{c^d}_{jg},$$

where $\tilde{c^d}_{jg}$ is the average marginal cost of firms exporting directly the good g to country j. The average price premium of wholesalers over direct exporters is

$$(\tilde{p^w}_{jg}-\tilde{p^d}_{jg}) = \frac{\sigma}{\sigma-1}\frac{1}{\sigma-1}\frac{T_j}{\tau_j}+\frac{\sigma}{\sigma-1}\left(\frac{\sigma}{\sigma-1}\tilde{c^i}_{jg}-\tilde{c^d}_{jg}\right).$$

Two effects influence this price difference between indirect and directs exports. On the one hand, double marginalization ($\sigma/(\sigma-1)$) magnifies the impact of transport cost and marginal production cost on prices and unambiguously increases the price of indirect exports. But on the other hand, the selection effect determines whether the bundle of varieties channeled by wholesalers is produced at relatively low or relatively high cost.

In the productivity-sorting case, the best-performing firms are those with the lowest marginal cost. These firms export directly and $\tilde{c^i}_{jg} > \tilde{c^d}_{jg}$. In this case, $(\tilde{p^w}_{jg}-\tilde{p^d}_{jg})$ is unambiguously positive. Indeed, the two effects work in the same direction, and the model predicts a higher price of indirect exports relative to direct exports. In the quality-sorting case, the two effects work in the opposite direction. As for the productivity-sorting case, the first term in the expression of $(\tilde{p^w}_{jg}-\tilde{p^d}_{jg})$ is positive. But, since wholesalers now channel the varieties with the lowest quality, $\tilde{c^i}_{jg} < \tilde{c^d}_{jg}$. Then, for quality-sorting products, whether the FOB price charged by wholesalers is, on average, lower or higher than the one of direct exports depends on the size of the double mark-up, the structure of trade costs (T_j/τ_j), the cutoff values and the distribution of marginal costs across firms. It remains however that the sorting effect dampens the influence of double marginalization for quality-sorting goods and magnifies it for productivity-sorting ones. As a consequence, if the elasticity of substitution (σ) and the structure of variable transport costs (T_j/τ_j) are the same for all products, $(\tilde{p^w}_{jg}-\tilde{p^d}_{jg})$ is lower for quality-sorting products than for productivity-sorting ones. We can enounce our second testable prediction as follows:

Proposition 2. *In the case of products for which sorting into export markets is driven by productivity, the varieties exported by wholesalers on a given market exhibit a positive price premium over the direct export prices. In the case of quality-sorting products, the price premium can be either positive or negative, but it is lower than the one observed for productivity-sorting products, everything else being equal.*

[10] This prediction is also found in alternative (and sometimes more explicit) models of trade intermediation, such as Blum et al. (2011) and Ahn et al. (2011). In our model, the necessary condition to obtain this result is the presence of the per unit trade cost (T_j). Models based on CES preferences that assume iceberg transport cost only obtain extremely simple export equations, where each component (expenditure, price index, trade cost and firm's marginal cost) enter in a log linear expression. As a consequence, the relative export flows of two firms only depend on the relative marginal cost of these firms. With per unit transport cost, the export functions are not anymore linear in logs. All the characteristics of the destination market are reintroduced in the expression of relative exports.

Table 1
Export values and firms.

	Value	Value non-EU27	Value Homog. goods	Quantity	# of firms	# of markets
Total	349.2	12.6	23	193.1	95,108	338,706
Wholesalers	68.2	20.8	10.8	60.2	30,237	188,641
Direct exporters	281	105.7	12.2	133	64,871	284,196
Share of wholesalers	0.20	0.20	0.47	0.31	0.32	0.56

Values are in billions of Euros, quantities are in billions of tonnes. A market is defined as a product-country pair. Homogeneous goods are defined as goods traded on an organized exchange according to Rauch (1999). Source: Authors' calculations from the French customs data.

3. Data and stylized facts

3.1. Export data

We use firm-level export declarations submitted to French Customs for the year 2007. The customs dataset is an almost complete record of annual shipments by destination at the eight-digit (nc8) product level for each French exporting firm. Firms located in France must declare all export flows to non-EU countries exceeding 1000 Euros or 1000 kg per destination. For intra-EU trade, reporting of export flows by destination country is compulsory for firms with export values above 150,000 Euros within the EU.[11] Since this discrepancy in terms of declaration threshold between EU27 and non-EU27 countries may introduce a bias in our estimations, our results are systematically reported on the whole sample of destination countries[12] and on the subsample of non-EU27 partners.

For each individual trade flow, we have both the quantity exported and the corresponding FOB value. Then, we can compute the unit value of exports for each firm, product and destination. Because values are free on board, the unit values (i.e. the ratio value/quantity) proxy the seller prices, net of all transportation costs. When the exporter is a wholesale or retail firm, the unit value includes the intermediary margin.

We merge the customs dataset with BRN (Bénéfices Réels Normaux) data. The latter provide us with balance sheet data for almost all French firms, and also record the firm's main activity. Wholesalers are identified as firms whose main activity is 'Wholesale trade and commission trade, except of motor vehicles and motorcycles'. As it is difficult to distinguish wholesalers from direct exporters of 'motor vehicles, motorcycles and related parts', we drop all firms from our sample whose main activity is the 'Sale of motor vehicles' or 'Sale, maintenance and repair of motorcycles and related parts and accessories'. To be consistent, we also exclude the export flows concerning products related to these activities. Our final sample consists of 2,047,087 observations on 95,108 firms accounting for 349 billion Euros of exports in 2007. This corresponds to a fraction of 87.5% of total exports (in value terms) and 87% of the total number of exporters.

Table 1 shows some of the stylized facts in our dataset. We find that 32% of exporters are wholesalers in 2007. These firms seem to export less on average than do direct exporters; wholesalers account for only 20% of French exports in value terms and 31% in volume terms. Their share in export value rises to 47% for homogeneous goods, which are defined as goods traded on an organized exchange according to Rauch (1999).[13] The final column of Table 1 shows that indirect exports are concentrated on a relatively small number of markets: wholesalers are active in 56% (188,641/338,706) of the active country-product trade pairs (i.e. in which we observe strictly positive French exports), compared to a figure of 84% for direct exporters.

Following Bernard et al. (2010), we investigate wholesalers' "premia" relative to direct exporters. Table 2 presents the results from OLS regressions of different variables on a dummy variable for wholesalers. Results are provided for the whole sample of destination countries as well as for the subsample restricted to non-EU27 countries. The left panel of the table investigates two firm-specific attributes. These regressions include firm major product (nc8) fixed effects and use export-value decile dummies to control for firm size. We look in turn at the number of countries and the number of exported products. The right panel compares direct and wholesaler exporters with respect to three characteristics of export flows. Within product-country cells and firm size deciles, we compare export value, export quantity and the unit price.

In the left-hand panel, we can see that, relative to direct exporters, wholesalers export more products to more countries. In the right-hand panel, wholesalers export significantly lower values and volumes of a given good to a given destination country; they also charge relatively low unit values. On average, the unit value for a given product-country in 2007 is 10% lower for wholesalers. This figure is virtually the same when all destination countries are considered or whether EU27 countries are excluded. It is in line with the 14% figure found by Bernard et al. (2010) in USA; it however

[11] Note that the threshold is not binding and the customs database reports a substantial number of export flows below the threshold: about 43% of firms that export to at least one EU member in 2007 export less than 150,000 Euros to the European Union.

[12] Table 8 in Appendix reports the list of the 166 destination countries in our sample with the corresponding share of wholesalers.

[13] Rauch (1999) categorizes SITC Rev. 2 industries into three types: differentiated products, reference priced, or homogeneous goods. We convert SITC to 6-digit Harmonized System (HS) customs nomenclature following Lall (2000).

Table 2
Wholesalers' premia relative to direct exporters.

	Firm level		Firm-product-country level		
	Number of countries	Number of products	Value	Quantity	Unit value
All destinations					
Wholesaler	0.027[a]	0.187[a]	−0.42[a]	−0.31[a]	−0.10[a]
	(0.007)	(0.009)	(0.005)	(0.005)	(0.002)
Fixed effects	Firm major product		Product-country		
Observations number	95,108		2,047,087		
Non-EU27 destinations					
Wholesaler	0.033[a]	0.179[a]	−0.10[a]	−0.005	−0.096[a]
	(0.007)	(0.009)	(0.006)	(0.007)	(0.005)
Fixed effects	Firm major product		Product-country		
Observations number	81,879		852,418		

All dependent variables are in logs. All regressions include export value-decile dummies to control for firm size. Values are in Billions of Euros and quantities are in Billions of tonnes. Unit values are in Euros. Heteroscedasticity-robust standard errors clustered according to the fixed effects are shown in parentheses.

[a] Indicates significance at the 1% confidence level and the absence of superscript indicates absence of significance at the 10% level. Source: Authors' calculations from French Customs data.

contrasts with Ahn et al. (2011) finding that in China, export prices of intermediaries are about 5% higher than those of direct exporters.

3.2. Accessibility indicators

Our model predicts that intermediaries are relatively more present in markets that are more difficult to penetrate. Our empirical strategy uses several traditional measures of market accessibility and cost of entry.

We resort first to traditional gravity proxies of market accessibility. GDP measures economic size (E_j).[14] Per unit (T_j) and ad-valorem (τ_j) trade costs are measured using three bilateral variables to capture the particular links between France and its partner countries: distance, contiguity and common language.[15] To account specifically for ad-valorem trade barriers (τ_j), we take trade protection information from MacMap 2007. This dataset comes from the International Trade Center (ITC) and CEPII.[16] The sunk cost of exporting to a partner is apprehended by the cost of import procedures as measured by the World Bank's Doing Business Report (Djankov et al., 2006).

All these usual gravity variables, but trade protection, are country-specific and do not vary across industries. Then, we also compute measures of market accessibility and fixed cost of entry, with a product and country dimension. These are estimated directly from the French firm-level dataset. Following Crozet et al. (2012), the procedure to compute the accessibility indicator consists in estimating a Tobit model for each product relating the value of exports to firm total factor productivity[17] and country fixed effects. These fixed effects provide a comprehensive measure of all determinants of market accessibility. They capture, in an inclusive manner, all country and product characteristics which affect trade flows to each specific market (such as demand, aggregate prices, and trade costs). We also use the firm-level data to construct a variable measuring the fixed cost of exporting at the product-country level. As Eaton and Kortum (2001), we consider the lowest value of exports per product-country pair as a reasonable proxy of this fixed cost of exporting.

4. Empirical results

4.1. Prediction 1: the share of wholesalers in exports

This section investigates the determinants of the share of wholesalers in export value. Proposition 1 of our model suggests that resorting to wholesalers rather than direct exporting is more likely when markets are difficult to reach.

Fig. 1 proposes a visual inspection of the relationship between the share of wholesalers in export value in 2007 and the determinants of importing countries' accessibility. For the sake of readability, we present the results for the 100 main destinations and indicate countries with circles sized proportionately to the value of French exports to that destination. Dark and light circles represent EU27 and non-EU27 countries respectively; the lines are fitted linear relations.

[14] GDP data come from the World Development Indicators (World Bank).

[15] We use GeoDist dataset (Mayer and Zignago, 2011), available at http://www.cepii.fr/francgraph/bdd/distances.htm.

[16] This dataset provides ad valorem equivalent measures of bilateral trade barriers (tariff duties and tariff rate quotas), at the six-digit level of the Harmonized System, for the year 2004. It is available at http://www.cepii.fr/francgraph/bdd/macmap.htm.

[17] For each industry, we regress value added on capital stock and employment at the firm level. Total Factor Productivity is computed as the residual from this regression. Value added, capital and employment come from the BRN dataset. Greater details are provided in Appendix.

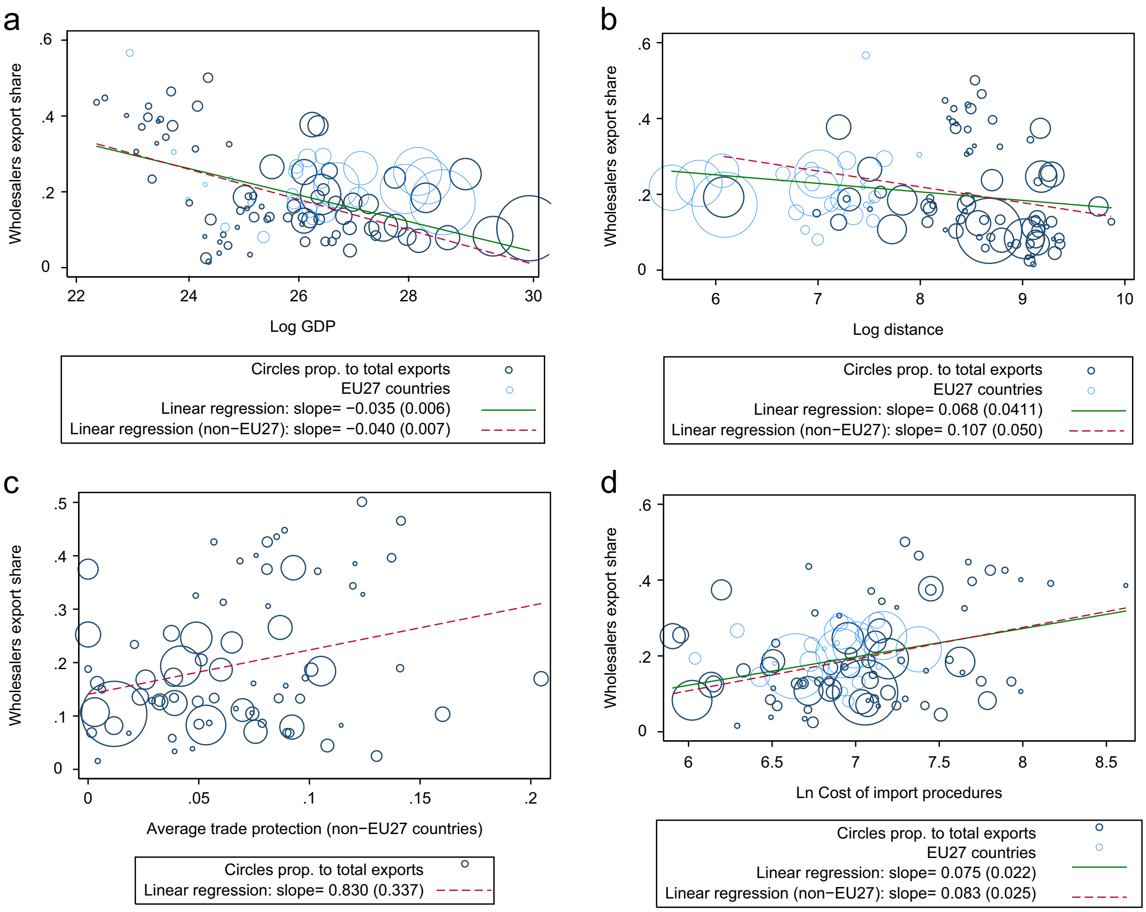

Fig. 1. Share of indirect exports and market accessibility (100 main destinations). (a) GDP, (b) distance, (c) tariff and non-tariff protection (non-EU countries), (d) cost of import procedures.

In panel a of Fig. 1 we find the expected negative and significant relationship between the share of wholesaler exporters and GDP in the destination market. Exports to smaller markets are thus more likely to be handled by wholesalers. Slopes are slightly steeper for non-EU27 countries. Panel b fails to indicate a significant association between wholesalers' presence and distance. In the econometric analysis of the wholesaler share carried just below however, distance to the partner country enters with the expected positive sign, which is significant at the 1% confidence level. Panel *c* plots the wholesalers' export share against the average tariff and non-tariff protection (for non-EU27 countries only).[18] In line with Proposition 1 of the model, it shows a positive association between the wholesalers' presence and the ad-valorem trade barriers (τ_j). Finally, panel d looks at the relationship between wholesaler presence and the cost of import procedures in the destination market. Following Helpman et al. (2008), Bernard et al. (2011), and Ahn et al. (2011), this plot takes this measure to be a proxy of the fixed costs of exporting to a market. As expected, it is positively and significantly associated with wholesaler export share.

Table 3 shows the econometric results on the determinants of the share of wholesalers by product. We retain all product-country pairs where the share of wholesalers in total exports is strictly positive and less than 100%.

In the top panel of Table 3 we rely on six indicators of market accessibility: GDP, distance, contiguity, common language, cost of import procedures required by the country's customs authorities and ad-valorem trade protection. These regressions include product-level fixed-effects. Results displayed in column 1 confirm the negative and significant association between wholesaler share and economic size of the destination country. GDP enters significantly with the expected negative sign. The three traditional gravity bilateral variables that proxy for geographical and linguistic distance (distance, common border and common language) attract the expected signs, positive for distance and negative for the other two respectively. The coefficient on French language fails to be significant possibly because francophone countries are highly heterogeneous. They indeed include very accessible and rich countries such as Belgium and Switzerland as well as highly protected and poor countries in sub-Saharan Africa. The two proxies for ad-valorem and fixed trade costs (trade

[18] We re-aggregate product-level protection using weights based on the product-level share in French export value in 2007.

Table 3
Determinants of the share of wholesalers.

Dependent variable: Share of wholesalers in exports (by product and country)								
Restrictions	All countries				Non-EU27 countries			
		Wholesaler share		No Homog. goods		Wholesaler share		No Homog. goods
	(1)	1–99% (2)	5–95% (3)	(4)	(5)	1–99% (6)	5–95% (7)	(8)
Panel A								
ln GDP	−0.032*	−0.030*	−0.024*	−0.032*	−0.035*	−0.032*	−0.025*	−0.035*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln distance	0.023*	0.019*	0.016*	0.022*	0.007*	0.009*	0.009*	0.007*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
French border	−0.006**	−0.015*	−0.015*	−0.008*	−0.095*	−0.087*	−0.069*	−0.094*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.007)	(0.008)	(0.008)	(0.007)
French language	0.001	−0.008**	−0.011*	0.002	0.000	−0.002	−0.003	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
ln cost of import procedures	0.047*	0.046*	0.037*	0.047*	0.052*	0.051*	0.041*	0.052*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Trade protection	0.021*	0.019*	0.014*	0.021*	0.016*	0.016*	0.012*	0.015*
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Fixed effects	Product				Product			
Observations	121,088	104,351	82,186	118,042	51,122	47,630	39,397	50,283
R^2	0.052	0.047	0.036	0.053	0.084	0.072	0.049	0.084
Panel B								
ln accessibility	−0.001*	−0.001*	−0.001*	−0.001*	−0.001*	−0.001*	−0.001*	−0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln fixed cost	0.005*	0.003*	0.002**	0.005*	0.011*	0.008*	0.004**	0.012*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Fixed effects	Product and country				Product and country			
Observations	126,873	109,605	86,439	123,789	54,886	51,087	42,228	54,040
R^2	0.066	0.060	0.047	0.068	0.104	0.092	0.066	0.105

Notes: Heteroscedasticity-robust standard errors are in parentheses. * and ** indicate significance at the 1% and 5% levels respectively, the absence of superscript denotes non-statistically significant coefficients. Columns 5–8 exclude EU27 countries. Columns 1, 4, 5 and 8 retain all product-country pairs where the share of wholesalers in total exports is strictly positive and less than 100%. Columns 2 and 6 retain product-country pairs with a share of wholesalers between 1% and 99%; columns 3 and 7 retain product-country pairs with a share of wholesalers between 5% and 95%. Columns 4 and 8 exclude homogeneous goods traded on an organized exchange as defined by Rauch (1999).

protection and cost of import procedures) are as expected associated positively and significantly with the share of wholesalers in exports.

Columns 2–8 check that the results hold in more restrictive samples. Precisely, they ensure that they are not driven by outliers and by a selection bias in terms of product or partner characteristics. As explained above, reporting of trade flows is not mandatory for firms with trade values below 150,000 Euros within the EU. We might worry that this selection effect may bias our estimates. While columns 1– 4 show results based on the whole sample of countries, columns 5–8 check that our results hold when we exclude EU27 countries. Columns 2 and 6 retain product-country pairs with wholesaler shares strictly above 1% and below 99% while columns 3 and 7 keep those with shares strictly above 5% and below 95%. In columns 4 and 8 we exclude homogeneous products (defined using Rauch's, 1999, classification), for which producers are more likely to resort to wholesalers. All these regressions comfort the theoretical predictions: wholesalers are especially present in product-country pairs that are characterized by high trade impediments (geographic and linguistic distance, import procedures and trade protection) and small size (GDP). As shown in columns 5–8, the results continue to hold when excluding EU27 countries. Despite the sharp reduction in the number of observations, the coefficients remain virtually unaffected, showing that the optimal organizational mode for exports is not driven by France's unique integration with neighboring EU partners.

In panel B, we replace our various proxies of market accessibility by the comprehensive measures of market accessibility and fixed entry cost presented in Section 3.2. Both indicators are specific to country-product pairs, hence allowing to include product fixed effects as well as country-level fixed effects. The presence of fixed effects in the two dimensions of the data ensures that these results are not driven by any systematic bias at the country or product level that might affect the presence of wholesalers.

As expected, the accessibility indicator enters with a negative and significant sign while the coefficient on the fixed cost of entry is positive and significant. The results again confirm that intermediary use is a preferred way of exporting in more difficult markets. These results continue to hold when the sample of product-country pairs is successively restricted to wholesaler shares strictly above 1% and below 99% (columns 2 and 6) and strictly above 5% and below 95% (columns 3 and 7). Findings that the share of exports channeled by wholesalers rises with our measure of market accessibility and declines with that of fixed cost are robust to excluding homogeneous goods in columns 4 and 8. Again, despite the sharp decline in the number of observations, our results are virtually unaffected when excluding EU27 countries (column 5–8).

These results then confirm that product-country pairs with low accessibility and high fixed cost of entry are more likely to be channeled via intermediaries than directly. We can calculate the extent to which the share of wholesalers in exports depends on these two variables. From the estimated coefficients in column 1 of panel *B*, a 10% increase in market accessibility yields a 1% fall in the share of wholesalers. The marginal effect of fixed cost is larger: a 10% increase in fixed cost produces a 5% rise in the share of wholesalers in exports.

4.2. Prediction 2: the sorting process of firms

We now turn to Proposition 2 of our model and ask whether wholesalers systematically channel the exports of the least efficient firms. As noted above, our data do not provide information on producers who export indirectly. But, following our model, we compare the prices charged by wholesalers and direct exporters on each market to identify the firm-sorting process. If wholesalers export the goods of the least efficient firms, we expect their prices to be higher than those of direct exporters for productivity-sorting products. This premium should be lower (and possibly negative) for quality-sorting goods.

Our empirical approach is to regress the log of unit value charged by firms at the product and country level on a wholesaler dummy. We then allow the coefficient on the latter to depend on whether the product is identified as being of the productivity- or quality-sorting type. We use firm-level export data to distinguish quality- from productivity-sorting products, following a procedure suggested by Baldwin and Harrigan (2011).[19] Under quality sorting, only high-quality varieties are exported to difficult markets, and these are sold at a high price. Under quality sorting, there is thus a negative correlation between export unit values and destination-market accessibility. Under productivity sorting, however, only the most productive firms with the lowest marginal costs manage to export to difficult markets. Since these firms charge lower prices, there is a positive correlation between export prices and destination-market accessibility. We appeal to these contrasting predictions to classify all of the eight-digit products in our sample into those for which firm selection into export markets is driven by productivity and those for which quality sorting prevails. For each product separately, we thus regress the unit value by destination country on our comprehensive measure of country's accessibility described in Section 3.2.[20] If the resulting estimated coefficient is positive and significant at the 10% level, we classify the product as of the productivity-sorting type; if the estimated coefficient is negative and significant at the 10% level, the product is considered to be of the quality-sorting type.

Table 4 shows that out of the 8986 eight-digit products present in our sample, a majority (65.5%) are associated with a negative (although not always significant) association between price and market accessibility. Focusing only on the significant results (at the 10% level), we identify 1878 products for which firms are selected based on quality and 480 for which firm selection is based on their productivity.

The test of Proposition 2 is conducted on this restricted sample of 2458 (i.e. 1878+480) products for which firm selection was explicitly identified as being of either the productivity or quality type.

Table 5 reports the results of regressing the log of unit value charged by firms at the product and country level on a wholesaler dummy separately for quality-sorting and productivity-sorting products. Our regressions include product-country fixed effects to account for unobserved factors, including any systematic difference between quality-sorting and productivity-sorting products. The estimations also use export-value decile dummies to control for firm size. Moulton (1990) has shown that regressing individual variables on aggregate variables can lead to downward-biased standard errors. In all regressions, standard errors are thus clustered at the firm level. Columns 4–6 reproduce results from columns 1–3 on the subsample of destinations that excludes EU27 countries. Results in columns 1 and 4 are obtained using ordinary least squares. As shown by the Wald test at the bottom of columns 1 and 4, we reject the null hypothesis of homoscedasticity of the regression error term at the 1% confidence level. Because our price data correspond to the traditional grouped-data case in which we do know the form of the heteroscedasticity, we can rely on weighted least squares to obtain efficient estimates. Indeed, we do not observe transaction-level prices, but only the average unit value charged by firms over all their transactions that took place for that product-country market in 2007. It follows, as detailed in Wooldridge (2012) that the standard error of the observed unit value is greater than the standard error of the transaction unit value by a factor equal to the squared root of the number of transactions on each market. Conjecturing that the number of transactions on a given market is proportional to market size, our weighted least squares give a greater weight to observations corresponding to bigger markets. We propose two alternative proxies for market size, the number of competing firms and the contribution to France's total exports. In column 2 of Table 5, the weight (I) is the number of French exporters in the product-country group. In column 3, we weight the observations by the country-product share in total French exports (weight II). As weighted least squares using the number of French exporters maximize the explanatory power, it becomes our preferred specification and is used to run the various robustness checks that follow.

[19] The procedure is presented in greater detail in Appendix.

[20] We carry out some basic cleaning of the price data. We exclude observations for which unit price is less than 1/10th or greater than 10 times the average unit value for the product-country pair. Our benchmark regressions further exclude product-country pairs for which wholesalers represent less than 1% or more than 99% of exports.

Table 4
Discriminating between quality and productivity sorting.

Products with	< 0 coefficient on A_{jg} (quality sorting)		> 0 coefficient on A_{jg} (productivity sorting)	
	Number	Of which signif. at 10%	Number	Of which signif. at 10%
Number	5878	1878	3100	480
Share (%)	65.5	20.9	34.5	5.3

Table 5
How do wholesalers compare in terms of pricing?

Dependent variable: Ln unit value product-country level						
Countries: weights	All countries			Non-EU27 countries		
	No (1)	I (2)	II (3)	No (4)	I (5)	II (6)
Wholesaler quality-good	−0.095*	−0.108*	−0.060*	−0.101*	−0.345*	0.004
	(0.014)	(0.039)	(0.021)	(0.020)	(0.085)	(0.030)
Wholesaler productivity-good	−0.011	0.196**	0.422*	−0.007	0.409*	0.126**
	(0.024)	(0.084)	(0.105)	(0.027)	(0.089)	(0.053)
Fixed effects	Firm-size deciles and Product-country pairs			Firm-size deciles and Product-country pairs		
Observations	676,767	676,767	676,767	256,018	256,018	256,018
R^2	0.004	0.054	0.013	0.002	0.014	0.001
Wald test χ^2	2.0e+36			9.5e+40		
Proba > χ^2	0.001			0.001		
F-Test $\beta_Q=\beta_P$	12.80*	10.52*	20.31*	9.57*	37.87*	4.20**
Proba > F	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.040)

Notes: Heteroscedasticity-robust standard errors clustered at the firm-level in parentheses. Regressions in columns 2 and 5 are weighted by the number of French exporters in the product-country group. Regressions in columns 3 and 6 are weighted by the share of the product-country group in total French exports. * and ** indicate significance at the 1% and 5% levels respectively, the absence of superscript denotes non-statistically significant coefficients. All regressions exclude observations for which the unit price is less than 1/10th or greater than 10 times the average unit value for the product-country pair, and product-country pairs for which wholesalers make up less than 1% or more than 99% of exports. All regressions include dummies for firm size deciles and product-country fixed effects. Columns 4-6 exclude EU27 countries. The χ^2-test at the foot of columns 1 and 4 tests the null hypothesis of homoscedasticity of the error term. The low probabilities indicate that heteroscedasticity is present. The F-test shown at the foot of each column tests the equality of the estimated coefficients on the wholesaler dummy for both types of products. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

Results in Table 5 indicate a negative effect of wholesalers on prices that is significant for quality-sorting products. For productivity-sorting products, the coefficient is insignificant using ordinary least squares. It is significant and positive however, as predicted by the model, when weighted least squares are used. The F-test at the foot of each column indicates that one rejects (at the 5% confidence level) the null hypothesis that the coefficients on the wholesaler dummy are equal for the two goods categories. Columns 4–6 indicate that findings of lower wholesaler prices in the case of quality-sorting products and higher ones in the case of productivity-sorting products globally hold when excluding EU27 countries.

Overall, our findings are in line with Proposition 2 that the varieties handled by wholesalers are produced by firms which are less efficient than direct exporters. They confirm a positive premium of wholesaler prices in the case of products for which productivity sorting drives firm selection into export markets and a lower (in fact negative) premium of indirect export prices over direct export prices in the case of quality-sorting products.

Table 6 checks that these results are robust to a variety of tests. As in Table 5, results in Table 6 are reported on the whole sample of destinations (columns 1–4) and after the exclusion of the EU27 countries (columns 5–8). In columns 1 and 5, we add firm's share in the French product-level exports to proxy for firm size in addition to export-value decile dummies. It reveals a negative association between size and unit value. It however fails to be significant when all countries are considered and is significant at the 5% confidence level when EU27 countries are excluded. Findings of a negative effect of wholesalers on prices under quality-sorting and of a positive effect under productivity-sorting hold when the sample is restricted to product-country pairs for which the wholesaler share is strictly above 5% and below 95% (columns 2 and 6) and for which the wholesaler share is strictly above 10% and below 90% (column 3 and 7). Finally, in columns 4 and 8, we verify that results remain once homogeneous goods are excluded. Interestingly, excluding EU27 countries appears to magnify the magnitude of the effect of wholesalers on prices. The negative premium observed for quality-sorting goods is doubled while the positive premium for productivity-sorting goods is tripled.

Table 6
How do wholesalers compare in terms of pricing? Robustness checks.

Dependent variable: Ln unit value product-country level								
Weights	Number of French exporters in the product-country group							
	All countries				Non-EU27 countries			
Restrictions		Wholesaler share		No Homog. goods		Wholesaler share		No Homog. goods
	(1)	5–95% (2)	10–90% (3)	(4)	(5)	5–95% (6)	10–90% (7)	(8)
Wholesaler quality-good	−0.117*	−0.109*	−0.111*	−0.108*	−0.365*	−0.350*	−0.373*	−0.345*
	(0.040)	(0.039)	(0.041)	(0.039)	(0.085)	(0.086)	(0.101)	(0.085)
Wholesaler productivity-good	0.202**	0.197**	0.204**	0.196**	0.455*	0.410*	0.430*	0.409*
	(0.085)	(0.085)	(0.086)	(0.084)	(0.091)	(0.090)	(0.093)	(0.089)
Firm's product market share	−0.008				−0.045**			
	(0.007)				(0.019)			
Fixed effects	Firm size deciles & Product-country				Firm size deciles & Product-country			
Observations	676,767	540,298	429,569	660,397	256,018	208,281	166,614	252,542
R^2	0.054	0.054	0.058	0.054	0.017	0.014	0.019	0.014
F-Test $\beta_Q = \beta_P$	11.34*	10.56*	10.63*	10.53*	43.10*	37.91*	34.61*	37.93*
Proba > F	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Notes: Heteroscedasticity-robust standard errors clustered at the firm-level in parentheses. * and ** indicate significance at the 1% and 5% levels respectively, the absence of superscript denotes non-statistically significant coefficients. All regressions exclude observations for which the unit price is less than 1/10th or greater than 10 times the average unit value for the product-country pair, and product-country pairs for which wholesalers make up less than 1% or more than 99% of exports. All regressions include dummies for firm size deciles. All regressions are weighted by the number of French exporters in the product-country group. Columns 2 and 6 exclude product-country pairs for which wholesalers make up less than 5% or more than 95% of exports. Columns 3 and 7 exclude product-country pairs for which wholesalers make up less than 10% or more than 90% of exports. Columns 4 and 8 exclude homogeneous goods traded on an organized exchange as defined by Rauch (1999). The F-test shown at the foot of each column tests the equality of the estimated coefficients on the wholesaler dummy for both types of products. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

Table 7 in Appendix reproduces Table 6 but excluding product-country pairs with less than 10 active exporting firms (whether wholesaler or not). Despite the sharp decline in the number of observations, the main results are unchanged.

5. Conclusion

In this paper, we contribute to the analysis of the role of intermediary exporting firms. We propose a simple model allowing for quality differentiation, and show that intermediate exporters may help to extend export opportunities. The model predicts a twofold role in international trade. First, wholesalers reduce the difficulty of reaching less accessible markets. Second, they also help the least efficient firms to supply the foreign markets, thus increasing the number of exported varieties at the aggregate level. We use French firm-level customs data to provide empirical support for these two predictions. We confirm that the share of exports channeled by wholesalers is larger in less accessible markets, i.e. in countries with smaller market size and higher trade costs. As far as prices are concerned, our model reconciles previous contradictory results by discriminating between productivity- and quality-sorting versions of the Melitz model. Consistently with the fact that wholesalers export the goods of the least efficient firms, we find that their prices are higher than those of direct exporters for productivity-sorting products. We measure that this premium is lower (and in fact negative) for quality-sorting goods.

Appendix A. Proof of Proposition 1

This appendix provides the proofs of Proposition 1. It presents comparative statics exercises aiming to show how the share of indirect exports to a given market j is influenced by the key exogenous characteristics of the importing country. More precisely, we show the influence of market size (E_j) and ad-valorem, non-ad-valorem and fixed trade costs (respectively, τ_j, T_j and F_j) on the share of exports channeled by wholesalers on total bilateral exports. Because we assume that wages are pinned down by the existence of an outside good and that the exporting country is too small to affect foreign price indices, E_j and P_j are considered as exogenous variables.

Profit functions (3) and (4) give two cutoff values, $\overline{c_j}^i$ and $\overline{c_j}^d$, defined respectively by $\pi_j^i(\overline{c_j}^i) = 0$, and $\pi_j^d(\overline{c_j}^d) = \pi_j^i(\overline{c_j}^d)$. We assume that the marginal cost distribution function, G, is such that $xg(x)/G(x)$ is decreasing in productivity-sorting industries and $xg(x)/(1-G(x))$ is increasing in quality-sorting industries.

It is convenient at this stage to define the following aggregates:

$$\Delta_j = \left[\frac{E_j}{P_j^{1-\sigma}}\tau_j^{-\sigma}\frac{1-\delta}{(1-\alpha)F_j}\right]^{1/(\sigma-1)},$$

$$\Lambda_j = \left[\frac{E_j}{P_j^{1-\sigma}}\tau_j^{-\sigma}\frac{\delta}{\alpha F_j}\right]^{1/(\sigma-1)}.$$

Note that both Δ_j and Λ_j increase with E_j and P_j and decrease with the ad-valorem and fixed trade costs τ_j and F_j.

A.1. Productivity sorting, $b=0$

In the case of a productivity-sorting industry, the explicit expressions for $\overline{c_j}^d$ and $\overline{c_j}^i$ are

$$\left.\begin{array}{l}\overline{c_j}^i = \Lambda_j - T_j/\tau_j \\ \overline{c_j}^d = \Delta_j - T_j/\tau_j\end{array}\right\} \text{ if } b=0 \text{ (Productivity sorting).}$$

Under productivity sorting, firms with a low marginal cost are more likely to export. Those with $c_k < \overline{c_j}^i$ can make positive profits on market j, exporting through a wholesaler. But the firms with a marginal cost such that $c_k < \overline{c_j}^d$ will decide to export directly.

A necessary condition to observe indirect exporters is $\overline{c_j}^d < \overline{c_j}^i$. This condition is equivalent to $\Delta_j < \Lambda_j \Leftrightarrow \alpha < \delta$. In words, the cost of intermediation (represented by the inverse of δ) must be relatively small compared to the advantage provided by wholesalers (represented by the inverse of α). We assume that this condition is always satisfied. Some firms will decide to export directly if $\overline{c_j}^d > 0 \Rightarrow \Delta > T_j/\tau_j$. This condition is more likely to be satisfied if country j is more accessible, i.e. if E_j is large and the trade costs τ_j, T_j and F_j are low.

Now, let us consider the case where both direct and indirect exporters are active on market j, i.e. $0 < \overline{c_j}^d < \overline{c_j}^i \Rightarrow 0 < T_j/\tau_j < \Delta_j < \Lambda_j$.

Under productivity sorting, firms' exports decrease monotonously with firms' marginal cost. Since direct exporters have strictly lower marginal cost than indirect exporters, and considering the assumptions on the distribution function of marginal costs, the share of direct exporters in the total population of exporters and the share of direct exports on total exports are strictly positive functions of the ratio of the two cutoffs, $\overline{c_j}^d/\overline{c_j}^i$. Then, it is sufficient to show that $\overline{c_j}^i/\overline{c_j}^d$ decreases with E_j and increases with τ_j, T_j and F_j to prove our Proposition 1. The corresponding derivatives are

$$\left.\begin{array}{l}(a)\ \partial[\overline{c_j}^i/\overline{c_j}^d]/\partial E_j = \dfrac{T_j/\tau_j}{(\sigma-1)E_j(\Delta_j - T_j/\tau_j)^2}[\Delta_j - \Lambda_j] < 0 \\ (b)\ \partial[\overline{c_j}^i/\overline{c_j}^d]/\partial \tau_j = \dfrac{T_j/\tau_j}{(\sigma-1)\tau_j(\Delta_j - T_j/\tau_j)^2}[\Lambda_j - \Delta_j] > 0 \\ (c)\ \partial[\overline{c_j}^i/\overline{c_j}^d]/\partial T_j = \dfrac{1}{\tau_j(\Delta_j - T_j/\tau_j)^2}[\Lambda_j - \Delta_j] > 0 \\ (d)\ \partial[\overline{c_j}^i/\overline{c_j}^d]/\partial F_j = \dfrac{T_j/\tau_j}{(\sigma-1)F_j(\Delta_j - T_j/\tau_j)^2}[\Lambda_j - \Delta_j] > 0\end{array}\right\} \text{ if } \frac{T_j}{\tau_j} < \Delta_j < \Lambda_j.$$

A.2. Quality sorting, $b=1$

In a quality-sorting industry, the two cutoffs are

$$\left.\begin{array}{l}\overline{c_j}^i = (T_j/\tau_j)/(\Lambda_j - 1) \\ \overline{c_j}^d = (T_j/\tau_j)/(\Delta_j - 1)\end{array}\right\} \text{ if } b=1 \text{ (Quality sorting).}$$

Under quality sorting, firms with $c_k > \overline{c_j}^i$ have positive profits when exporting through a wholesaler. Those with $c_k > \overline{c_j}^d$ will prefer exporting directly.

Here, a necessary condition to observe both direct and indirect exporters on market j is $0 < \overline{c_j}^i < \overline{c_j}^d$. Given the definition of the cutoffs, this conditions implies $1 < \Delta_j < \Lambda_j \Leftrightarrow \alpha < \delta$, as in the productivity-sorting case.

Let us now assume this condition is satisfied and thus consider that both direct and indirect exporters are active on market j. Again, the share of trade channeled by wholesalers is given by a simple combination of the two cutoffs. It is a strictly positive function of $(\overline{c_j}^d - \overline{c_j}^i)/(\overline{c} - \overline{c_j}^i)$, where $\overline{c}$ is the upper bound of the distribution of marginal costs. The numerator of this ratio determines the number of firms choosing to export indirectly, while the denominator determines the total number of exporters. It is sufficient to show that $(\overline{c_j}^d - \overline{c_j}^i)/(\overline{c} - \overline{c_j}^i)$ decreases with E_j and increases with trade costs

(τ_j, T_j and F_j) to prove our Proposition 1. We can compute:

$$(a')\ \frac{\partial(\overline{c_j}^d-\overline{c_j}^i)/(\overline{c}-\overline{c_j}^i)}{\partial E_j}=\frac{1}{(\sigma-1)E_j(\overline{c}-\overline{c_j}^i)}\left\{\left[\overline{c_j}^i\frac{\Lambda_j}{\Lambda_j-1}-\overline{c_j}^d\frac{\Delta_j}{\Delta_j-1}\right]-\left[\frac{(\overline{c_j}^d-\overline{c_j}^i)\Lambda_j\overline{c_j}^i}{(\overline{c}-\overline{c_j}^i)(\Lambda_j-1)^2}\right]\right\}<0,$$

$$(b')\ \frac{\partial(\overline{c_j}^d-\overline{c_j}^i)/(\overline{c}-\overline{c_j}^i)}{\partial \tau_j}=\frac{1}{\tau_j(\overline{c_j}-\overline{c_j}^i)}\left\{\left[\frac{\sigma}{\sigma-1}\left(\overline{c_j}^d\frac{\Delta_j}{\Delta_j-1}-\overline{c_j}^i\frac{\Lambda_j}{\Lambda_j-1}\right)-(\overline{c_j}^d-\overline{c_j}^i)\right]\right.$$
$$\left.+\frac{1}{\overline{c}-\overline{c_j}^i}\left[(\overline{c_j}^d-\overline{c_j}^i)\overline{c_j}^i\left(\frac{\sigma}{\sigma-1}\frac{\Lambda_j}{\Lambda_j-1}-1\right)\right]\right\}>0,$$

$$(c')\ \frac{\partial(\overline{c_j}^d-\overline{c_j}^i)/(\overline{c}-\overline{c_j}^i)}{\partial T_j}=\frac{1}{\tau_j(\overline{c_j}-\overline{c_j}^i)}\left\{\left[\frac{1}{\Delta_j-1}-\frac{1}{\Lambda_j-1}\right]+\left[\frac{\overline{c_j}^d-\overline{c_j}^i}{(\overline{c_j}-\overline{c_j}^i)(\Lambda_j-1)}\right]\right\}>0,$$

$$(d')\ \frac{\partial(\overline{c_j}^d-\overline{c_j}^i)/(\overline{c}-\overline{c_j}^i)}{\partial F_j}=\frac{1}{F_j(\sigma-1)(\overline{c_j}-\overline{c_j}^i)}\left\{\left[\overline{c_j}^d\frac{\Delta_j}{\Delta_j-1}-\overline{c_j}^i\frac{\Lambda_j}{\Lambda_j-1}\right]+\left[(\overline{c_j}^d-\overline{c_j}^i)\frac{\Lambda_j}{\Lambda_j-1}\right]\right\}>0.$$

With $0<\overline{c_j}^i<\overline{c_j}^d<\overline{c}\Rightarrow 1<\Delta_j<\Lambda_j$, (a') is unambiguously negative and (b'), (c') and (d') are positive, which proves our Proposition 1.

Appendix B. Estimation of the accessibility indicator

We measure the accessibility of country j's market for good g as the country-specific export value fixed effects, $\widehat{XFE_{jg}}$, obtained from the following equation:

$$\ln(x_{kjg})=XFE_{jg}+\gamma_g\ln(TFP_k)+v_{kjg},$$

where x_{kjg} is the firm k's FOB-valued exports of product g to the country j and TFP_k is the firm total factor productivity. This equation is estimated separately for each product g using a Tobit estimator to control for the existence of zero export flows. Productivity is computed as the residual of a regression of firm-level value-added on its capital stock and employment run separately for each industry (NAF 600). Firm-level information on value added, capital and employment come from the BRN dataset. The country-level fixed effects, $\widehat{XFE_{jg}}$, integrate, in an inclusive manner, all product and destination country-specific characteristics which affect trade flows. Moreover, because we consider French exports only and estimate a specific set of fixed effect for each product, it also captures the exact demand, the price index, the transport costs, and customs related impediments.

Appendix C. The classification procedure of products into productivity or quality-sorting type

To identify productivity or quality-sorting type products, we follow a procedure suggested by Baldwin and Harrigan (2011). Under quality sorting, only high-quality varieties are exported to difficult markets, and these are sold at a high price. Under quality sorting, there is thus a positive correlation between export unit values and destination-market accessibility. Under productivity sorting, however, only the most productive firms with the lowest marginal costs manage to export to difficult markets. Since these firms charge lower prices, there will be a negative correlation between export prices and destination-market accessibility. We appeal to these contrasting predictions to classify all of the 8986 eight-digit products in our sample into those for which firm selection into export markets is driven by productivity and quality sorting. For each product g separately, we thus regress the firm-level unit value of exports to country j on our measure of accessibility, $\widehat{XFE_{jg}}$.

We estimate the following equation for each product g:

$$\ln(UV_{kjg})=\alpha_g+\beta_g\widehat{XFE_{jg}}+\varepsilon_{kjg},$$

where UV_{kjg} is the firm k's unit value for the product g and the country j. It is computed as the ratio of total export value over total quantity for the product g to the destination j at the firm level.[21] We use firm-level export declarations (value and quantity) submitted to French Customs for the year 2007.

Estimates of β_g allow identifying the sorting type of products.[22] We identify 1878 products for which β_g is positive and significant at the 10% level, indicating that firms are selected based on quality. The coefficient β_g is negative and significant at the 10% level for 480 products. These are considered to be of the quality-sorting type.

[21] As explained in the paper, we carry out some basic cleaning of the price data. We exclude observations for which unit price is less than 1/10th or greater than 10 times the average unit value for the product-country pair. Our benchmark regressions further exclude product-country pairs for which wholesalers represent less than 1% or more than 99% of exports.

[22] They are provided in an online appendix available on the first author's webpage.

Table 7
How do wholesalers compare in terms of pricing? Robustness checks (No. of firms > 10).

Dependent variable: Ln unit value product-country level								
Weights	Number of French exporters in the product-country group							
	All countries				Non-EU27 countries			
Restrictions		Wholesaler share		No Homog. goods		Wholesaler share		No Homog. goods
	(1)	5–95% (2)	10–90% (3)	(4)	(5)	5–95% (6)	10–90% (7)	(8)
Wholesaler quality-good	−0.117*	−0.109*	−0.111*	−0.108*	−0.365*	−0.350*	−0.373*	−0.345*
	(0.039)	(0.038)	(0.040)	(0.038)	(0.082)	(0.083)	(0.097)	(0.082)
Wholesaler productivity-good	0.202**	0.197**	0.204**	0.196**	0.455*	0.410*	0.430*	0.409*
	(0.083)	(0.083)	(0.085)	(0.083)	(0.088)	(0.087)	(0.090)	(0.087)
Firm's product market share	−0.008				−0.045**			
	(0.007)				(0.018)			
Fixed effects	Firm size deciles and Product-country				Firm size deciles & Product-country			
Observations	540,401	433,064	343,601	529,199	177,800	144,026	114,167	176598
R^2	0.054	0.054	0.058	0.054	0.017	0.014	0.019	0.014
F-Test $\beta_Q = \beta_P$	11.80*	10.98*	11.06*	10.94*	45.93*	40.49*	37.05*	40.36*
Proba > F	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Notes: Heteroscedasticity-robust standard errors clustered at the firm-level in parentheses. * and ** indicate significance at the 1%, and 5% levels respectively, the absence of superscript denotes non-statistically significant coefficients. All regressions exclude observations for which the unit price is less than 1/10th or greater than 10 times the average unit value for the product-country pair, and product-country pairs for which wholesalers make up less than 1% or more than 99% of exports. All regressions include dummies for firm size deciles. All regressions are weighted by the number of French exporters in the product-country group. Columns 2 and 6 exclude product-country pairs for which wholesalers make up less than 5% or more than 95% of exports. Columns 3 and 7 exclude product-country pairs for which wholesalers make up less than 10% or more than 90% of exports. Columns 4 and 8 exclude homogeneous goods traded on an organized exchange as defined by Rauch (1999). The F-test shown at the foot of each column tests the equality of the estimated coefficients on the wholesaler dummy for both types of products. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

Table 8
List of countries and share of wholesalers in exports.

Country code	Country name	Share	Country code	Country name	Share	Country code	Country name	Share
AGO	Angola	0.41	GHA	Ghana	0.37	NGA	Nigeria	0.34
ALB	Albania	0.25	GIN	Guinea	0.48	NIC	Nicaragua	0.21
ARE	UAE	0.23	GMB	Gambia	0.53	NLD	Netherlands	0.31
ARG	Argentina	0.14	GNB	Guinea-Bissau	0.35	NOR	Norway	0.20
ARM	Armenia	0.33	GNQ	Eq. Guinea	0.51	NPL	Nepal	0.21
ATG	Antigua & Barb.	0.27	GRC	Greece	0.33	NZL	New Zealand	0.18
AUS	Australia	0.16	GRD	Grenada	0.32	OMN	Oman	0.21
AUT	Austria	0.31	GTM	Guatemala	0.17	PAK	Pakistan	0.17
AZE	Azerbaijan	0.23	GUY	Guyana	0.22	PAN	Panama	0.21
BDI	Burundi	0.41	HKG	Hong Kong	0.20	PER	Peru	0.19
BEL	Belgium & Lux	0.34	HND	Honduras	0.13	PHL	Philippines	0.21
BEN	Benin	0.54	HRV	Croatia	0.21	PNG	Pap. New Guinea	0.07
BFA	Burkina Faso	0.50	HTI	Haiti	0.29	POL	Poland	0.25
BGD	Bangladesh	0.15	HUN	Hungary	0.26	PRT	Portugal	0.39
BGR	Bulgaria	0.24	IDN	Indonesia	0.16	PRY	Paraguay	0.16
BIH	Bosnia Herz.	0.32	IND	India	0.17	ROM	Romania	0.27
BLR	Belarus	0.20	IRL	Ireland	0.35	RUS	Russian Fed.	0.22
BLZ	Belize	0.31	IRN	Iran	0.15	RWA	Rwanda	0.54
BOL	Bolivia	0.25	ISL	Iceland	0.23	SAU	Saudi Arabia	0.21
BRA	Brazil	0.16	ISR	Israel	0.23	SDN	Sudan	0.32
BRN	Brunei	0.18	ITA	Italy	0.32	SEN	Senegal	0.47
BTN	Bhutan	0.00	JAM	Jamaica	0.29	SGP	Singapore	0.19
BWA	Botswana	0.13	JOR	Jordan	0.23	SLB	Solomon Is.	0.57
CAF	Central Af. R.	0.50	JPN	Japan	0.22	SLE	Sierra Leone	0.42
CAN	Canada	0.19	KAZ	Kazakstan	0.24	SLV	El Salvador	0.16
CHE	Switzerland	0.25	KEN	Kenya	0.22	SUR	Suriname	0.14
CHL	Chile	0.15	KGZ	Kyrgyzstan	0.27	SVK	Slovakia	0.24
CHN	China	0.18	KHM	Cambodia	0.36	SVN	Slovenia	0.35
CIV	Côte d'Ivoire	0.47	KIR	Kiribati	0.00	SWE	Sweden	0.30
CMR	Cameroon	0.55	KNA	St Kitts & N.	0.24	SWZ	Swaziland	0.12
COG	Congo	0.53	KOR	Korea	0.16	SYC	Seychelles	0.35
COL	Colombia	0.19	KWT	Kuwait	0.26	SYR	Syria	0.25
COM	Comoros	0.39	LAO	Laos	0.38	TCD	Chad	0.62

Table 8 (*continued*)

Country code	Country name	Share	Country code	Country name	Share	Country code	Country name	Share
CPV	Cape Verde	0.39	LBN	Lebanon	0.28	TGO	Togo	0.52
CRI	Costa Rica	0.17	LBR	Liberia	0.50	THA	Thailand	0.17
CYP	Cyprus	0.35	LCA	Saint Lucia	0.30	TJK	Tajikistan	0.43
CZE	Czech Rep	0.27	LKA	Sri Lanka	0.15	TON	Tonga	0.00
DEU	Germany	0.29	LSO	Lesotho	0.06	TTO	Trinidad & T.	0.15
DJI	Djibouti	0.54	LTU	Lithuania	0.31	TUN	Tunisia	0.31
DMA	Dominica	0.17	LVA	Latvia	0.33	TUR	Turkey	0.20
DNK	Denmark	0.33	MAC	Macao	0.28	TZA	Tanzania	0.29
DOM	Dominican Rep.	0.26	MAR	Morocco	0.33	UGA	Uganda	0.37
DZA	Algeria	0.45	MDA	Moldova	0.24	UKR	Ukraine	0.21
ECU	Ecuador	0.17	MDG	Madagascar	0.47	URY	Uruguay	0.15
EGY	Egypt	0.24	MEX	Mexico	0.16	USA	USA	0.17
ERI	Eritrea	0.28	MKD	Macedonia	0.25	UZB	Uzbekistan	0.25
ESP	Spain	0.33	MLI	Mali	0.52	VCT	Saint Vincent	0.36
EST	Estonia	0.31	MLT	Malta	0.31	VEN	Venezuela	0.18
ETH	Ethiopia	0.30	MNG	Mongolia	0.36	VNM	Vietnam	0.22
FIN	Finland	0.31	MOZ	Mozambique	0.17	VUT	Vanuatu	0.45
FJI	Fiji	0.26	MRT	Mauritania	0.52	WSM	Samoa	0.33
FSM	Micronesia	0.50	MUS	Mauritius	0.36	YEM	Yemen	0.20
GAB	Gabon	0.53	MWI	Malawi	0.30	YUG	Serbia Mont.	0.23
GBR	United Kingdom	0.29	MYS	Malaysia	0.17	ZAF	South Africa	0.18
GEO	Georgia	0.31	NAM	Namibia	0.15	ZMB	Zambia	0.30
			NER	Niger	0.53			

Note: The country-level share of wholesalers in exports is computed as the average of shares across products.

Appendix D. Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.radphyschem.2011.02.020.

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