Characteristics of International Trade Intermediaries and Their Location in the Supply Chain

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Abstract Wholesale trade firms and their role in international trade are examined using transaction and firm level data sets from Denmark for the period 1998–2006. Compared to internationally trading manufacturing firms, wholesale firms trading internationally are found to focus on fewer countries with more products and lower unit values, and their involvement in international trade transactions differ significantly across industries. Manufacturing industries with more competitive structure, lower firm size, lower capital intensity, higher production fragmentation and lower export/import intensities are found to have higher wholesale share of export. The analysis shows that export and import premia also exist among wholesale trade firms, which is in line with the idea that these premia result from fixed costs of exporting/importing. Systematic differences between wholesale trade firms in intermediate goods markets versus in consumption goods markets are also documented and found critical in understanding the role of intermediaries in international trade. While in intermediate goods export wholesale trade firms' unit prices are found to be significantly higher than manufacturers unit prices of the same good, the opposite holds true for consumption goods export. Wholesale trade firms that specialize in export of intermediate goods are found to be more skill intensive and pay more in comparison to other exporting wholesale trade firms. The wage premium for exporters of intermediate goods for professional level occupations is robust to controlling for detailed firm and worker characteristics. The results suggest that theories highlighting the potential roles of intermediaries should take the intermediaries' location in the supply chain into account.

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1 Introduction

Studies show that the export and import behavior of manufacturing firms are important factors in improving industrial productivity as well as in technology and knowledge transfer between firms and countries (Bernard et al. 2007). In this light, the significant presence of intermediaries in manufacturing trade revealed by recently available customs data has received well deserved academic attention. While previous economics and management literature on intermediaries emphasizes the potential roles of intermediaries in facilitating trade between manufacturers and final consumers, recent literature that makes use of transaction-level international trade data focus on the fixed costs saving nature of trade intermediaries in export.

So far this literature treats the intermediation between two suppliers within the supply chain and intermediation between producer and final consumer uniformly. This paper documents empirical regularities in the role and significance of intermediaries in international trade from a small, open, and advanced country and provides insight into the determinants of intermediation in relation to product and industry characteristics in international trade. It is also shown that characteristics of trade firms differ systematically depending on the location of intermediation in the supply chain. To do that, transaction-level data from Danish customs, which include detailed information on all export and import transactions, are matched with firm-level accounting data that includes detailed business activity, sales, employment, capital, investment and other firm-level expenditures for the years 1998–2006.

Wholesale trade firms sell any type of goods. They simplify flow of goods, payments and information by acting as intermediaries between the manufacturer and the customer. The share of trade transacted via the manufacturer or a wholesale trade company varies substantially between different product groups or industries. Between 1993 and 2006, wholesale trade firms' and manufacturers' average share of imports are 57 and 31 % respectively, while their respective shares of export are 32 and 54 % in Denmark.[1] Intermediaries are found to be more active in import than in export, but in both export and import there is substantial heterogeneity in their involvement across industries. While the wholesale trade share is found to be on average 90 % in leather export, its share is 20 % in plastics export in Denmark.[2] Crude analysis of the data shows that the room for intermediaries is bigger in non-manufactured products, such as farm products, as would be expected. But even in the

[1]These numbers are higher in comparison to the similar numbers from the US as reported by Bernard et al. (2010) and China as reported by Ahn et al. (2011). For the year 2002, Bernard et al. (2010) reports the value share of intermediaries in export as 10 % and in import as 42 %. The value share of intermediaries in export for the year 2002 for China is reported as 29 % in Ahn et al. (2011).

[2]These statistics are average of data between 1993 and 2006.

manufacturing sector intermediaries, and wholesale trade firms in particular, play a significant role in export and import.[3]

To understand the relative concentration of wholesalers across manufacturing sectors in international trade, manufacturing sector characteristics are linked with the wholesale trade shares in those industries. Manufacturing industries with higher median firm size and capital intensity exhibit higher export share of wholesale trade firms. The results are in line with theories that relate fixed costs of exporting to the presence of wholesale trade firms.

Manufacturing industries with more competitive structure are found to have higher wholesale share of export. More specifically, controlling for firm and industry size, the wholesale trade share in export is negatively associated with firms' age and industry concentrations indices, as measured by the Herfindahl-Hirschman index and the 4-firm concentration index, and it is positively associated with entry and exit rates. The wholesale trade share in export is also found to be higher in manufacturing industries where the degree of production fragmentation is higher. In general the wholesale trade shares in export and import at the industry level are found to be negatively correlated with the export and import intensities of manufacturing firms. This finding points to the role of intermediaries as trade facilitators.

Wholesale trade firms trading internationally are found to focus on fewer countries with more products and lower unit values, confirming that the Danish data exhibit stylized facts similar to what has recently been highlighted on the role of wholesale trade firms in export and import.

But this paper also highlights a number of new and interesting features about the wholesale trade firms. First it shows that similar to manufacturing firms, wholesale trade firms that export are bigger, more productive and more capital-intensive; they pay more and employ more educated employees in comparison to non-exporters. Importing wholesale trade firms also share most of these features, showing that both export and import premia exist also among wholesale trade firms. These findings are in line with the idea that these premia result from fixed costs associated with exporting/importing (Bernard et al. 2007).

Second, there are important differences among wholesale trade firms in their involvement in international trade depending on the distance in the supply chain to the final consumers. In consumption goods markets, wholesale trade firms are found to focus on fewer countries with relatively more products in comparison to manufacturing firms. In intermediate goods markets, on the other hand, they are found to focus on products as well as countries. Comparing unit prices after controlling for detailed products and country fixed effects reveal that, while in consumption goods export wholesale trade firms' unit prices are significantly lower in comparison to manufacturers', their prices are significantly higher than manufacturers' in intermediate goods export. Similarly, in consumption goods

[3]The analysis focuses on wholesale trade firms, including export and import agents but excluding the retail sector. Because of this focus, the terms "intermediary" and "wholesale" trade firms are used interchangeably throughout the paper.

import wholesale trade firms' unit prices found to be significantly lower but this is not the case in intermediate goods import.

Firm-level data also show that wholesale trade firms specializing in export of intermediate goods are bigger than other exporting wholesale trade firms. Controlling for size, wholesale trade firms that specialize in export of intermediate goods are found to be more skill intensive and pay more in comparison to other exporting wholesale trade firms. They are not found to be significantly different in terms of capital-labor ratio, investment and labor productivity. The wage premium for exporters of intermediate goods for professional level occupations is robust to controlling for detailed firm and worker-level characteristics as well as intensity of high-tech goods sales. Wholesale trade firms in intermediate goods markets may be developing product specific knowledge. More demanding firm to firm communication required in global production chains may be one reason behind this wage premium. These results indicate that in order to understand the role of wholesale trade firms in international trade it is important to consider their distance in the supply chain to the final consumers.

The presence of middlemen or intermediaries in markets, in general, is motivated by several possible factors including adverse selection and moral hazard (Biglaiser 1993; Biglaiser and Friedman 1994), and the existence of search and information frictions (Rubinstein and Wolinsky 1987). Biglaiser (1993) and Biglaiser and Friedman (1994) predict that intermediaries sell higher quality products by acting as quality guarantor. The results presented here suggest that such quality sorting may be more relevant considerations in explaining intermediaries role in intermediate goods market compared to consumption goods markets.

Among the recent studies that use transaction level trade data, Bernard et al. (2010) highlight a number of stylized facts about intermediaries engaging in international trade in the US using data from 2002. This paper complements theirs by providing additional detail to the understanding of the nature of intermediaries in international trade.

Ahn et al. (2011) and Akerman (2010) extend the heterogeneous trade model with intermediation technology. Their models predict that the share of trade handled through intermediaries increases with fixed costs of exporting. Similarly Bernard et al. (2011) provide empirical regularities on the relationship between intermediaries' involvement in export and country specific fixed and variable costs using Italian data. Using Colombian and Chilean matched transaction data Blum et al. (2009) document that in a majority of exporter and importer matches at least one of the parties is a large international trader and that more than half of the Chilean exporters sell to a single Colombian importer. The authors then develop a model with matching frictions that replicate these findings. Felbermayr and Jung (2011) and Tang and Zhang (2012) on the other hand focus on hold-up problems to relate the country and product characteristics to the presence of export intermediaries. Except for Felbermayr and Jung (2011) and Tang and Zhang (2012), these papers do not look at the extent of intermediaries' involvement across industries and products,

which is the focus of this paper.[4] But all of these papers, including Felbermayr and Jung (2011) and Tang and Zhang (2012) uniquely treat intermediation between two suppliers and intermediation between producer and final consumer/retailers. The results presented in this paper show that empirical regularities may show contrast depending on the location of intermediation in the supply chain. The theories that highlight one or the other potential role of intermediaries should take these differences into account.

The paper is organized as follows. Data sets used in this study are described in the next section. Empirical analyses are presented in Sects. 3–5 followed by concluding remarks.

2 Data

The main data sets used in this study are transaction-level custom records and firm-level accounting data sets from Denmark, but other supplemental micro and macro data sets are also used, such as labor market surveys. This section summarizes the main data sets while details e.g. variable constructions, information on the additional data sets, are presented in the Appendix.

The firm-level data set (business statistics data) is compiled from survey results of firms that take part in an annual financial survey as well as from the annual tax reports, vat reports, and annual reports from incorporated companies. Wholesale trade firms are included in this data set starting from 1998. So the sample period used in this study is 1998–2006. The general business statistics include only firms that employ at least 0.5 FTE (full-time equivalent employment) and/or have had an estimated earnings of a certain size. Earning sizes are estimated differently for different industries. In the wholesale trade sectors, the lower limit of earnings is typically 500,000 Danish Kroner, while in the manufacturing industry, it ranges

[4]Felbermayr and Jung (2011) approaches the presence of trade intermediaries in export as a firm boundary problem. As in the spirit of Helpman et al. (2014) manufacturing firms face a trade off in their decision to choose an export mode due to the lack of enforceable cross-country contracts. They can use their own wholesale affiliate in the foreign country to avoid distortion due to hold up problem and incur fixed costs of distribution or that they use a trade intermediary but then face lower export revenues. Their model predicts productivity/quality sorting within industries similar to Ahn et al. (2011) and Akerman (2010). While their focus is still on the country specific costs, their model predicts firms producing high quality products with strong brand reputation are more likely to invest in distribution channels in foreign markets. Similarly Tang and Zhang (2012) consider a hold up problem in a heterogenous firm framework where intermediaries provide fixed cost saving technology. Distortions caused by the hold up problem in quality verification efforts necessary for foreign buyers drives the relationship between quality differentiation and the propensity to use an export intermediary. Their model predicts that the propensity to export via an intermediary decreases with vertical differentiation while it increases with horizontal differentiation of the products.

between 150,000 and 200,000 Danish Kroner. Table 14 in the Appendix provide summary statistics for the wholesale trade firms.

International trade data are available at the transaction-level starting from 1993. They contain firm id, the type of transaction (whether it is export or import), the value of transaction in Danish Kroner, the name and the code of the partner country, the amount of the transacted good, the unit of the amount, the name and the 8-digit combined nomenclature (CN) code of the good as well as the year of the transaction. The details of this data set is given in Pedersen (2009). For the years 1993–2006, firm id's in the transactions data sets are matched with the main industry affiliation of firms using supplemental data sets within Statistics Denmark. As a result of this match 89 % of the firm ids' in the export data and 94 % of the firm ids' in the import data are matched with industry affiliations.

As wholesale firms specialize in logistics, marketing and distribution, they can be expected to employ fewer employees than manufacturing firms. Figure 1 shows the distribution of size (the logarithm of employment and the logarithm of capital assets) among manufacturing firms and among wholesale firms for the year 2000. From the figure it is apparent that wholesale firms employ fewer employees in general and have lower level of capital assets.

Figure 2 shows that wholesale trade firms on average sell more in comparison to the manufacturing firms, but, as one expects, their rate of value-added over sales is on average much lower compared to manufacturing firms.

While wholesale trade firms employ less people, they pay more on average than manufacturing firms as indicated by Table 1 and they also employ more educated employees.

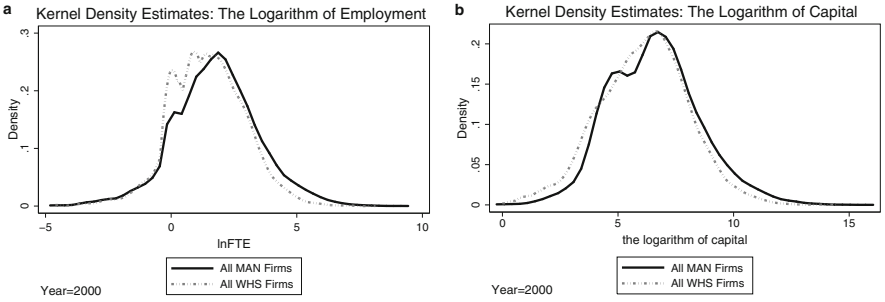

Fig. 1 Distribution of employment and capital among manufacturing and wholesale firms (values are expressed in constant 2000 prices in thousand Danish Kroner. *Source*: Statistics Denmark)

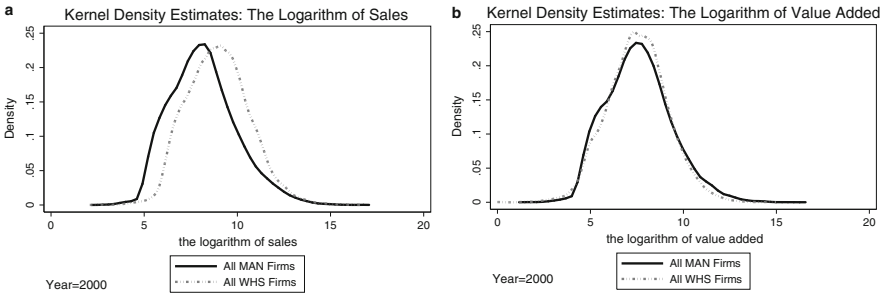

Fig. 2 Distribution of sales and value added among manufacturing and wholesale firms (values are expressed in constant 2000 prices in thousand Danish Kroner. *Source*: Statistics Denmark)

Table 1 Wholesale and manufacturing firms' characteristics

	WHS firms		MAN firms	
	Mean	# of obs	Mean	# of obs
Value added	8190.492	133,527	14,669.377	151,770
FTE	10.980	133,527	22.623	151,770
Average hourly wage	0.182	106,462	0.160	108,185
Professional occupation rate	0.184	128,862	0.094	145,879
College rate	0.171	106,462	0.125	108,185

The sample period is 1998–2006. Values are expressed in thousand 2000 Danish Kroner. FTE is the full-time equivalent number of employees. Professional Occupation Rate is the ratio of employees with at least mid-level occupations over the total number of employees. College Rate is the ratio of employees with at least some college education over the total number of employees

3 Understanding Across Industry Distribution of Wholesale Share

The share of trade transacted via manufacturers or wholesale trade companies varies substantially between different product groups or industries. Figure 3 presents the average shares of export/import transacted directly by manufacturers across broad product categories (CN chapters) between 1993 and 2006. Figure 4 presents the average shares of trade transacted via wholesale trade firms.[5] In the Appendix, Table 15 presents the respective shares across all broad product categories. Intermediaries are found to be more active in import than in export (except vegetable products, fats and oils, leather, footwear, and arms and arts) but on both sides there is also substantial heterogeneity across broad product categories. A higher share of wholesale trade in import compared to export is expected as wholesaler involvement

[5]Most of the trade is conducted via manufacturer and wholesale trade firms, but retail firms as well as other service firms are also present in international trade.

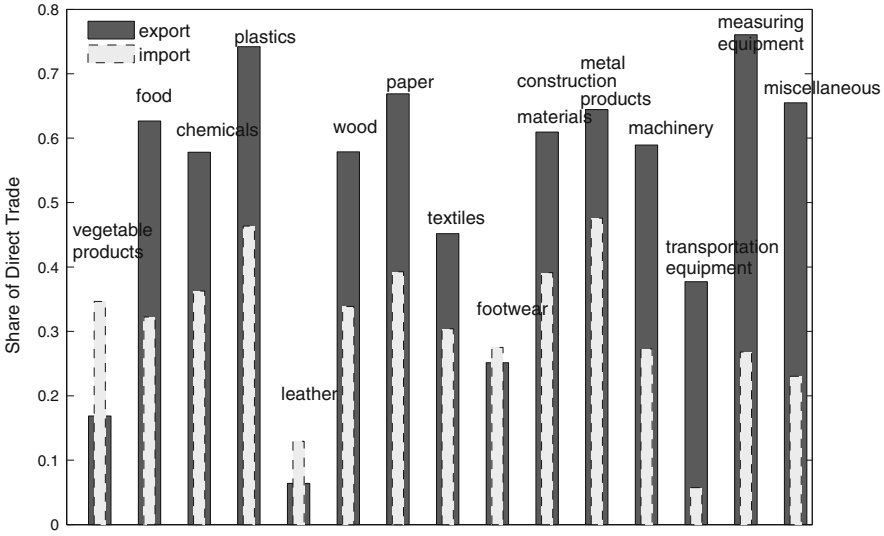

Fig. 3 Shares of manufacturing trade across broad product groups (*Source*: Statistics Denmark)

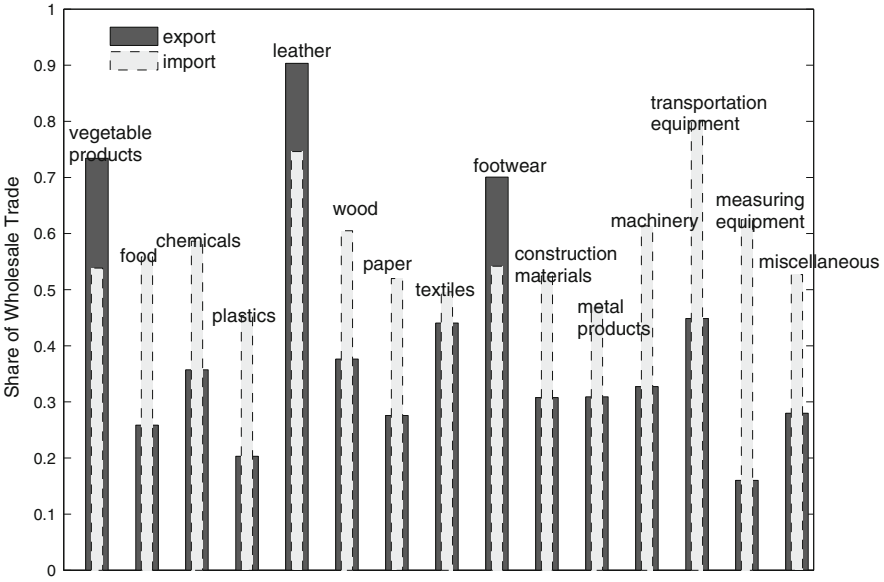

Fig. 4 Shares of wholesale trade across broad product groups (*Source*: Statistics Denmark)

at the later stages of the value chain is more likely due to the distribution and logistics services they provide.

Very low shares of direct manufacturing export are observed in vegetable products and leather coupled with proportionately high shares of wholesale trade

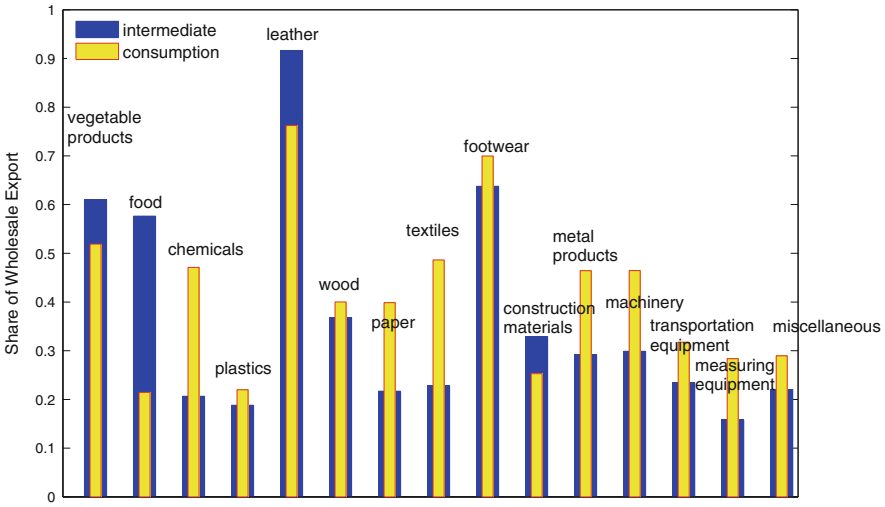

Fig. 5 Shares of export by wholesale traders across intermediate and consumption goods within industries (*Source*: Statistics Denmark)

in those product categories. This is most probably because these categories contain non-manufactured products mostly produced by farmers. What is most interesting is intermediaries' significant involvement in export of manufactured products (as also documented in Ahn et al. (2011) for China or Bernard et al. (2010) for the US). Part of their involvement in export could be due to the firm boundary issue that manufacturers of final products may prefer to outsource distribution services and hence intermediaries export as part of their service in the distribution of the products domestically and internationally. In Fig. 5, the wholesale shares in export are shown separately for intermediate and consumption or final goods across broad product categories. The figure shows that intermediaries are more involved in final goods' export except in vegetable products, food, leather and construction materials all of which largely contain non-manufactured goods (farming and mining).

In order to relate (manufacturing) industry characteristics to the wholesale export and import shares in that industry, the following industry-level equations are estimated[6]:

$$WHS_{jt} = \beta_0 + \beta_1^a IndustryCharacteristic_{jt} + \sum_t \delta_t^Y Year_t + \epsilon_{jt} \quad (1)$$

[6]Since the dependent variable is a share, the results are obtained using fractional logit model with robust standard errors as suggested by Papke and Wooldridge (1996). The results are robust to transforming the share variable as a log-odds ratio and are available upon request.

$$WHS_{jt} = \beta_0 + \beta_1^b IndustryCharacteristic_{jt} + \beta_2 FirmSize_{jt} + \sum_t \delta_t^Y Year_t + \epsilon_{jt} \quad (2)$$

$$WHS_{jt} = \beta_0 + \beta_1^c IndustryCharacteristic_{jt} + \beta_2 FirmSize_{jt} + \beta_3 NumberOfFirms_{jt} + \sum_t \delta_t^Y Year_t + \epsilon_{jt} \quad (3)$$

On the left hand side, there is the wholesale export/import share within manufacturing industry j (2-digit NACE) at year t.[7] On the right hand side, there are an industry characteristic and year fixed effects. Equation (2) controls for firms' size, $FirmSize_{jt}$, as measured by the logarithm of the median firm's employment within manufacturing sector j. Equation (3) additionally controls for industry size, $NumberOfFirms_{jt}$, which is the logarithm of the number of manufacturing firms in industry j at year t.

The industry characteristics are technology, openness, market structure and product type indicators for the corresponding manufacturing industries. Technology indicators are the median capital intensity as measured by the ratio of total fixed assets over total revenue (Capital Intensity), and production defragmentation as measured by the median of the ratio of the value-added over the value of production (Production Defragmentation). Openness indicators are export/import intensity defined as the median of the ratio of the export/import value over the total revenue (Export/Import Intensity). Market structure indicators are the logarithm of the median firm's age (Log Firm Age), 4 Firm Concentration Rate, Herfindahl-Hirschman Index (HHI), and finally Entry and Exit Rates.[8]

Table 2 reports estimates of β_1^a, β_1^b, and β_1^c in Eqs. (1) to (3) for export and Table 3 reports the same estimates for import.

The results on export as reported in Table 2 show that the wholesale share in export is negatively correlated with the number of manufacturing firms and the median firm-level employment in that industry. These findings are intuitive: Bigger firms or firms in industries with higher comparative advantage (as indicated by the number of producing firms) are more likely to pay the sunk entry costs of exporting a la Melitz (2003) and export directly rather than through wholesale trade firms.[9] In relatively big industries manufacturing firms may also have more opportunity to learn from each other about potential export opportunities.

[7] CN product codes are matched with 2-digit industry (NACE) codes using correspondence tables between prodcom and CN provided by EuroStat RAMON.

[8] The median industry characteristics are calculated using firm-level data on the manufacturing industry between 1998 and 2006. Herfindahl-Hirschman Indices and 4-firm concentration indices are calculated by taking both domestic and foreign sales into account.

[9] Recent studies emphasize a role of intermediaries as reducing fixed costs of exporting, e.g. Akerman (2010), Ahn et al. (2011), and Tang and Zhang (2012).

Table 2 Wholesale share in export and industry characteristics

	$\hat{\beta}_1^a$	$\hat{\beta}_1^b$	$\hat{\beta}_1^c$
NumberOfFirms	−0.108*	−0.319***	
FirmSize	−0.239***		−0.471***
Capital intensity	−3.611***	−3.656***	−1.765**
Production defragmentation	−6.223***	−5.549***	−3.705***
Export intensity	−3.881***	−1.309	−4.837***
Import intensity	−3.830***	−0.696	−7.668***
Market structure			
Log Firm Age	−0.871**	−0.652*	−1.013***
4 firm concentration rate	0.007*	0.012***	−0.011**
Herfindahl-Hirschman index	−0.000	0.000	−0.000***
Entry rate	8.260***	6.655***	5.478***
Exit rate	7.768***	6.774***	4.035*

The results are obtained using the generalized linear model with binomial family, logit link and robust standard errors. The number of observations in all regressions is 195. The sample period is 1998–2006

*, ** and *** indicate significance at the 5 %, 1 % and 0.1 % levels respectively

Capital intensity, and production (de)fragmentation are found to be negatively associated with the wholesale share in export. This holds true even after controlling for the median (manufacturing) firm size and the number of (manufacturing) firms as well. Manufacturers may prefer to control distributional channels as a part of brand and product differentiation (Dent 2008) especially for industries that exhibit increasing returns to scale or industries with lower degree of production fragmentation.[10] Negative relationships between export and import intensities and wholesale trade share in export are in line with the trade facilitator role of traders where export and import are relatively rare activities.

The wholesale trade share in export is also found to be higher in more competitive industries as indicated by negative and significant coefficient estimates of the concentration indices (HHI and 4-firm) and firms' age and positive and significant coefficients of entry and exit rates of manufacturing firms. Lower entry barriers in more competitive industries must allow small and young firms to operate easily and these firms are more likely to export through intermediaries. Concentration of industries may also be driven by increasing returns at the firm level so firms may be less likely to outsource distribution services in less competitive industries.

Table 3 presents the results for import. As in export, the wholesale import share is negatively related with the number of manufacturing firms operating in

[10] A company with a high level of brand recognition may be hurt by using the same distribution channels as used for cheaper generic products. Consider a product with a highly advertised specific function sold together with a cheaper alternative. The distributors may extract higher profit margin from the cheaper alternative by selling it together with the expensive one so that they can get a price which is close to the price of the expensive one.

Table 3 Wholesale share in import and industry characteristics

	$\hat{\beta}_1^a$	$\hat{\beta}_1^b$	$\hat{\beta}_1^c$
NumberOfFirms	−0.089*	−0.139***	
FirmSize	−0.005		−0.114*
Capital intensity	−1.409*	−1.408*	−0.663
Production defragmentation	−2.998***	−3.237***	−2.598**
Export intensity	−2.086***	−3.165***	−4.762***
Import intensity	−1.078	−1.875	−5.264**
Market structure			
Log firm age	0.126	0.144	−0.017
4 firm concentration rate	0.002	0.003	−0.012**
Herfindahl-Hirschman index	0.000	0.000	−0.000*
Entry rate	1.511	1.829	1.603
Exit rate	2.051	2.637*	1.532

The results are obtained using the generalized linear model with binomial family, logit link and robust standard errors. The number of observations in all regressions is 195. The sample period is 1998–2006

*, ** and *** indicate significance at the 5 %, 1 % and 0.1 % levels respectively

the industry and the median firm size, although the size effect is not found to be as important as in export. While all other characteristics have the same signs as in export, some such as median capital intensity, median firm's age, entry and exit rates are not found to be significantly correlated with the wholesale import share. A weaker relationship between the share of wholesale import and manufacturing characteristics is expected since the manufacturing industry constitutes only part of the customers of the import traders as the import traders also import for retail and service sectors.

4 Comparing Manufacturing and Wholesale Trade Firms in International Trade

4.1 Firm-Level Differences

Table 4 reports that on average wholesale trade firms export ten 8-digit products, while manufacturing firms export eight products during the 1998–2006 period. Wholesale trade firms export to on average 4.5 countries while manufacturing firms export to 7.4 countries. That is, wholesale exporters export more products to less countries in comparison to manufacturing firms. This also holds true for imports, but to a lesser extent.

To examine differences between wholesale intermediaries and manufacturing firms engaging in international trade within broad product categories, Eq. (4) is

Table 4 Manufacturing and wholesale trade firms in international trade

	WHS firms		MAN firms	
	Mean	# of obs	Mean	# of obs
Number of exported products	10.005	63,794	8.013	45,147
Number of export countries	4.547	63,794	7.413	45147
Number of imported products	18.130	83,783	15.032	44,596
Number of import countries	5.013	83,783	6.113	44,596

International trade data set that is matched with industry classifications is used. The sample period is 1998–2006. Products are defined at the 8-digit CN level

estimated separately with export and import transaction data aggregated at the firm-level.

$$x_{it} = \beta_0^{WH} + \beta_1^{WH} I(WH_{it}) + \sum_t \delta_t Year_t + \sum_{it} \gamma_{it} Industry_{it} + \epsilon_{it} \quad (4)$$

where $I(WH_{it})$ is an indicator whether firm i is an wholesale trade firm, and x_{it} denotes characteristics (in logarithm) of firm i at period t: value of export/import, average price of exports/imports, the number of products exported/imported, the number of countries, the number of export/import transactions, and the number of years in the export/import market. The sample only includes firms that are identified by manufacturer or wholesale trade firms so the estimates of β_1^{WH} indicate the percentage difference in the characteristics for wholesale trade firms in comparison to manufacturing firms after controlling for industry and year fixed effects.[11]

The results for export and import are presented in column (a) and in column (b) of Table 5 respectively. Starting from export, the results show that wholesale trade firms' export is about 80 % less in comparison to manufacturing firms' exports, they sell to a smaller number of countries (relative country focus); on the other hand they sell about 6.3 % more products and they are shorter lived in the export market. Wholesale trade firms do not seem to have significant price differences at the firm level in comparison to manufacturing firms. In column (b) the results show that the value of import is about 28 % more than the manufacturers' imports, they import more products (about 9 %), their prices are lower, and they buy from a smaller number of countries (13.8 %). Finally wholesale importers are also found to be 8.3 % less tenured in the import market in comparison to manufacturer importers. The results indicate focus on country more than product as well as shorter tenure in the international markets are common properties of both export and import traders.

In order to gain insights into potentially distinct roles of intermediaries in consumption and intermediate goods markets, Eq. (4) is also estimated separately

[11] In Eq. (4) industry fixed effects are broad product category (CN Chapter) affiliations of firms. They do not indicate whether a firm is a manufacturer or trader of these products. CN Chapters are listed in Table 15 in the Appendix.

Table 5 Firm characteristics in international trade

	(a) Export	(b) Import
Firm characteristics	β_1^{WH}	β_1^{WH}
Log export-import value	−0.806***	0.281***
Log weighted average price	0.010	−0.101***
Log number of products	0.063***	0.091***
Log number of countries	−0.304***	−0.138***
Log number of transactions	−0.158***	0.083***
Log number of years export/import	−0.104***	−0.083***
Number of observations (min/max)	108,272/108,855	127,541/128,375
Intermediate goods trade		
Log export-import value	−0.961***	−0.224***
Log weighted average price	0.076**	0.005
Log number of products	−0.037*	−0.046*
Log number of countries	−0.330***	−0.152***
Log number of transactions	−0.252***	−0.043*
Log number of years export/import	−0.112***	−0.077***
Number of observations (min/max)	76,030/ 76,040	97,933/97,939
Consumption goods trade		
Log export-import value	−0.504***	−0.044
Log weighted average price	−0.014	−0.021
Log number of products	0.150***	0.101***
Log number of countries	−0.208***	−0.151***
Log number of transactions	−0.039	0.011
Log number of years export/import	−0.084***	−0.102***
Number of observations (min/max)	61,810/63,513	90,030/93,003

Robust standard errors, that are clustered for firms, are reported in parentheses. A constant term is included but not reported. All regressions include industry and year fixed effects. Industry is defined as a broad product category (CN Chapter) of a firm's activity. The sample only includes wholesale trade firms and manufacturers between 1998 and 2006. Value shares are used as weights in calculating firm-level average prices

*, **, and *** indicate significance at the 5 %, 1%, and 0.1% levels respectively

among intermediate and consumption goods.[12] To do that, before aggregating the transaction data at the firm-level, only transactions with either intermediate or consumption goods are kept in the sample. The results are presented at the lower panels of Table 5.

The result show that relative country focus among wholesale traders holds true whether we look at intermediate goods or consumption goods trade. But the number of exported/imported intermediate products is found to be smaller among traders

[12]Intermediate and consumption goods classification is based on BEC Rev. 3. See the Appendix for details.

in both export and import compared to manufacturers, indicating that intermediate goods traders may be building product specific knowledge. This seems not to be the case for consumption goods traders. The average price of intermediate goods exporters is found to be higher (9.2 %) in comparison to manufacturer exporters' prices. There is no statistically significant difference found between wholesalers and manufacturers' prices in consumption goods export. Only broad product categories are controlled for in these regressions so the price differences are expected to contain differences in the type and quality of the products as well. This will be taken into account in the next analysis below.

4.2 Unit Price Differences

This section presents an analysis to understand if there is any systematic differences in the unit prices of goods transacted by intermediaries versus manufacturers. On the one hand, manufacturing firms may be able to extract more surplus and so charge a higher price by controlling distributional channels.[13] Models with productivity sorting with fixed costs of exporting on the other hand, predict higher unit prices for wholesale trade exporters. Intermediation, in general, may result in double marginalization if the markets are not competitive or intermediaries may have a value creating role by providing additional services.[14]

$$ln(p_{ifc}) = \gamma_0 + \gamma_1 I(W) + \gamma_2 I(R) + \sum_{ic} \lambda_{ic}(Product_i \times Country_c) + \epsilon_{ifc} \tag{5}$$

Here p_{ifc} is the unit price of good i (at CN-8 digit) imported/exported from/to country c by firm f. $I(W)$ and $I(R)$ are wholesaler and retailer dummies respectively.

To see if there is any systematic difference for unit price differential between wholesaler and manufacturer depending on the type of goods they transact, the wholesaler dummy is also interacted with an intermediate good indicator, $I(IG)$, as below.

$$ln(p_{ifc}) = \gamma_0 + \gamma_1 I(W) + \gamma_2 I(R) + \gamma_3 * I(W) * I(IG) + \sum_{ic} \lambda_{ic}(Product_i \times Country_c) + \epsilon_{ifc} \tag{6}$$

Tables 6 and 7 show unit price differentials between intermediaries and manufacturers for the period 1998 through 2006 for export and import respectively.

[13] Dent (2008) emphasizes that routes to market may involve product/brand differentiation. Models of hold-up predict that manufacturing firms producing higher quality choose to export directly. See for example, Tang and Zhang (2012).

[14] The models with adverse selection (e.g. Biglaiser 1993) predict that intermediaries on average sell higher quality products, and their average prices are higher.

Table 6 Unit price differences-export

Year	1998	1998	1999	1999	2000	2000	2001	2001	2002
Variables	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price
Wholesaler dummy (I(W))	−0.029**	−0.093***	−0.012	−0.074***	−0.013	−0.077***	0.007	−0.065***	−0.015
	(0.011)	(0.016)	(0.011)	(0.016)	(0.010)	(0.014)	(0.009)	(0.012)	(0.008)
Retailer dummy (I(R))	−0.036	−0.065	−0.054	−0.083*	−0.032	−0.062	0.046	0.014	−0.128***
	(0.033)	(0.035)	(0.039)	(0.041)	(0.033)	(0.034)	(0.030)	(0.031)	(0.023)
Wholesaler*intermediate good		0.161***		0.158***		0.169***		0.186***	
		(0.021)		(0.020)		(0.019)		(0.018)	
Product by market fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observation	188,618	188,618	199,497	199,497	214,210	214,210	240,978	240,978	311,288
Number of clusters	77,636	77,636	80,017	80,017	82,738	82,738	88,459	88,459	105,627
F	3.8	23.6	1.0	21.7	0.9	28.4	1.2	44.4	17.6

Year	2002	2003	2003	2004	2004	2005	2005	2006	2006
Variables	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price
Wholesaler dummy (I(W))	−0.062***	−0.069***	−0.142***	−0.081***	−0.153***	−0.132***	−0.214***	−0.092***	−0.201***
	(0.011)	(0.008)	(0.010)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.009)
Retailer dummy (I(R))	−0.145***	−0.129***	−0.153***	−0.048**	−0.075***	−0.417***	−0.451***	−0.220***	−0.273***
	(0.024)	(0.018)	(0.019)	(0.016)	(0.016)	(0.013)	(0.013)	(0.016)	(0.016)
Wholesaler*intermediate good	0.111***		0.174***		0.173***		0.196***		0.236***
	(0.014)		(0.014)		(0.013)		(0.012)		(0.014)
Product by market fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observation	311,288	337,461	337,461	339,485	339,485	452,254	452,254	355,370	355,370
Number of clusters	105,627	109,908	109,908	110,801	110,801	138,614	138,614	111,285	111,285
F	23.2	40.6	70.7	70.6	118.9	532.1	466.3	120.6	198.6

Robust standard errors are reported in parentheses. They are clustered for each CN-8 digit product and country pair. A constant term is included but not reported
*, **, and *** indicate significance at the 5 %, 1%, and 0.1% levels respectively

Table 7 Unit price differences-import

Year	1998	1998	1999	1999	2000	2000	2001	2001	2002
Variables	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price
Wholesaler dummy (I(W))	−0.029***	−0.056***	−0.053***	−0.068***	−0.038***	−0.059***	−0.025**	−0.055***	−0.039***
	(0.009)	(0.015)	(0.009)	(0.017)	(0.009)	(0.016)	(0.009)	(0.015)	(0.008)
Retailer dummy (I(R))	0.061***	0.046**	0.075***	0.067***	0.049***	0.036*	0.044**	0.027	0.003
	(0.013)	(0.015)	(0.014)	(0.018)	(0.013)	(0.017)	(0.013)	(0.016)	(0.011)
Wholesaler*intermediate good		0.046**		0.025		0.037*		0.052**	
		(0.017)		(0.018)		(0.017)		(0.017)	
Product by market fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observation	329,085	329,085	336,968	336,968	353,146	353,146	374,009	374,009	461,178
Number of clusters	76,640	76,640	78,425	78,425	80,313	80,313	84,352	84,352	97,949
F	47.0	33.1	109.5	72.9	53.3	36.8	32.3	25.8	19.1sss

Year	2002	2003	2003	2004	2004	2005	2005	2006	2006
Variables	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price	Log price
Wholesaler dummy (I(W))	−0.075***	−0.055***	−0.088***	−0.076***	−0.155***	−0.090***	−0.178***	−0.104***	−0.184***
	(0.014)	(0.008)	(0.013)	(0.009)	(0.014)	(0.009)	(0.014)	(0.010)	(0.016)
Retailer dummy (I(R))	−0.017	−0.016	−0.033**	−0.051***	−0.092***	−0.067***	−0.115***	−0.070***	−0.115***
	(0.013)	(0.011)	(0.012)	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)	(0.016)
Wholesaler*intermediate good	0.067***		0.063***		0.142***		0.153***		0.139***
	(0.016)		(0.015)		(0.015)		(0.015)		(0.016)
Product by market fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observation	461,178	473,536	473,536	483,382	483,382	457,186	457,186	526,599	526,599
Number of clusters	97,949	98,941	98,941	99,433	99,433	94,218	94,218	101,158	101,158
F	14.5	28.7	19.1	42.4	45.0	58.2	59.5	70.6	57.6

Robust standard errors are reported in parentheses. They are clustered for each CN-8 digit product and country pair. A constant term is included but not reported

*, **, and *** indicate significance at the 5 %, 1%, and 0.1% levels respectively

In these regressions the sample only includes transactions that are conducted via either manufacturing, wholesale or retailer companies excluding other types of firms such as business service firms. So the estimate of γ_1 in Eq. (5) indicates a unit price differential for wholesalers in comparison to manufacturing companies after controlling for 8-digit product by country fixed effects in a given year.

The results show that wholesalers' price is on average lower compared to manufacturers, both in export and in import after controlling for detailed product (CN-8 digit) by country fixed effects. In export, the difference is not always significant and the F statistics are low before 2002. However, when the intermediate good dummy is interacted with the wholesale dummy, F statistics grow sizably and estimates of γ_1 become significant at the 1 % level. Estimates of γ_3, on the other hand are always positive and significant at the 1 % level. In 1998 wholesale prices are found to be on average about 2.9 % lower than manufacturers' prices regardless of the type of goods. But when one controls for intermediate goods, wholesalers' prices are found to be 9.3 % lower, while prices of intermediate goods of wholesalers are found to be about 7 % higher than manufacturers' intermediate goods' prices.[15] The findings are very similar across all the years, suggesting that wholesalers' involvement in export in intermediate and consumption goods markets respectively have important distinctions. These results are quite different from Ahn et al. (2011) where intermediaries' unit prices are shown to be higher than manufacturers' in China.[16] Bernard et al. (2010), on the other hand, show wholesale traders' unit prices on average lower than manufacturers. The results presented here for Denmark are in line with Bernard et al. (2010). But none of these studies look at the intermediate and consumption goods markets separately. Doing that, results show that the unit price differential between wholesalers and manufacturers in general depend on the type of goods, intermediate versus consumption. While unit prices of exporting wholesale companies are found to be lower in general compared to manufacturers' prices, their prices are found to be significantly higher for intermediate goods.

The results for import presented in Table 7 show that retailers' unit prices are significantly higher in comparison to manufacturers, probably indicating their closer distance to the final customers. The prices of wholesalers are also found to be lower in general. Wholesalers that import intermediate goods on the other hand are not found to have significantly lower prices in comparison to manufacturers' unit prices.

[15] Separate estimation of Eq. (5) among intermediate and consumption goods also confirm these findings. They are available upon request.

[16] Ahn et al. (2011) control for the size as measured by employment when analyzing unit price differences between manufacturers and intermediaries. Since wholesale trade firms are significantly smaller in terms of employment than manufacturers, one expects upward bias on the coefficients for unit prices of intermediaries they find. The different results obtained with Denmark as opposed to China may also be due to (potentially) higher share of intermediate goods in Chinese export data.

The models with adverse selection (Biglaiser 1993) predict that intermediaries on average sell higher quality products, and their average prices are higher. The results here suggest a possibility of adverse selection problems in the intermediate goods markets. The differences in market structure of intermediaries in intermediate and consumption goods markets may also result in differences in prices as the possibility of double marginalization depends on competitiveness of the markets. Tables 17 to 18 show that concentration patterns are also different for wholesalers and manufacturers across these two different types of products. While concentration patterns of wholesale trade firms and manufacturers are similar in general (Table 16); wholesale trade firms' concentration is higher in intermediate goods while manufacturers concentration is especially higher in consumption goods.

These results suggest hold-up problems that give rise to quality sorting of goods traded between manufacturers and wholesale traders may be more relevant in the consumption goods markets, while information frictions that give rise to adverse selection may be more important in the intermediate goods markets. These results overall suggest that in understanding the role of intermediaries in international trade it is critical to explicitly consider their location in the supply chain.

5 Export and Import Premia Among Wholesale Traders

International trade literature emphasizes the importance of export and import behavior in manufacturing firms' performances (Bernard et al. 2007). There is a large literature on the sources of export premia among manufacturing firms. The two competing hypotheses are whether export premia are due to self-selection of more productive firms into export markets or whether they are due to learning by exporting, which is often thought to happen via the buyer supplier link that foreign buyers actively or passively channel knowledge to the local suppliers. One implicit assumption mostly made to motivate the learning by exporting hypothesis is that knowledge is channeled into manufacturing processes. To further this understanding it is important to see whether similar export and import premia also exist among wholesale trade firms as these firms do not manufacture, so no such learning can drive possible premia.

Table 8 show that 38 (47) % of wholesale firms export (import) during the sample period. Table 8 also indicates that more than 80 % of wholesale firms that export also import. Using business statistics data from 2000, Fig. 6 shows that both exporting wholesale firms and importing wholesale firms are on average larger (employment and capital) than non-exporting and non-importing wholesale firms respectively. It also indicates that exporting wholesale firms are on average larger than importing wholesale firms.

Table 8 Percentage of exporters and importers

Year	WHS firms		
	Exporters	Importers	Exporter-importers
1998	0.342	0.445	0.279
2000	0.362	0.451	0.289
2002	0.404	0.489	0.332
2004	0.393	0.498	0.326
2006	0.388	0.498	0.330
1998–2006	0.379	0.474	0.311

Sample: Wholesale Trade Firms, 1998–2006. The sample excludes agents (NACE 5111–5119). *Source*: Statistics Denmark

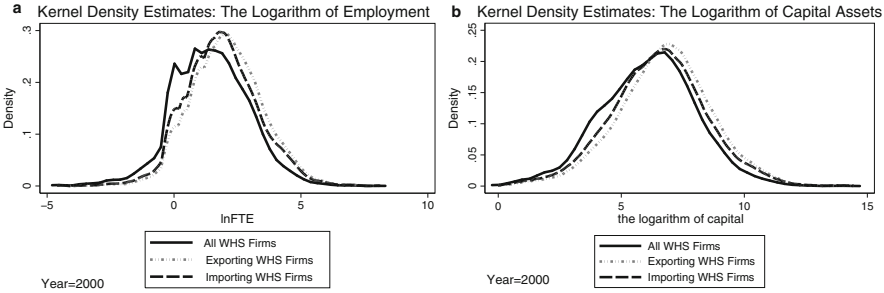

Fig. 6 Size distribution among wholesale firms (*Source*: Statistics Denmark)

To quantify possible export and import premia, Eqs. (7) and (8) are estimated using business statistics data for the wholesale trade firms for 1998–2006.

$$x_{ijt} = \beta_0^X + \beta_1^X I(XP_{ijt}) + \beta_2^X lnFTE_{ijt} + \sum_j \eta_j Industry_j + \sum_t \delta_t Year_t + \epsilon_{ijt} \quad (7)$$

$$x_{ijt} = \beta_0^M + \beta_1^M I(MP_{ijt}) + \beta_2^M lnFTE_{ijt} + \sum_j \eta_j Industry_j + \sum_t \delta_t Year_t + \epsilon_{ijt} \quad (8)$$

In these equations x_{ijt} denotes characteristics of wholesale trade firm i at period t in industry j in logarithm, *lnFTE* is the logarithm of the full-time equivalent number of employees, $I(XP_{ijt})$ is an export dummy and $I(MP_{ijt})$ is an import dummy. 4-digit industry and year dummies are also included. The coefficient β_1 indicates the percentage differences in the relevant firm characteristics controlling for size (measured by the number of employees), industry and time effects. The first column of Table 9 reports the differences between exporters and non-exporters among wholesale trade firms and the second column reports the differences between importers and non-importers among wholesale trade firms.

Table 9 Export and import premia

Firm characteristics	(a) β_1^X	(b) β_1^M
FTE (employment)	1.157***	1.077***
Value added per worker	0.277***	0.288***
Capital per worker	0.076***	0.017
Investment per worker	0.096***	0.040**
Average hourly wage	0.080***	0.109***
Average hourly wage of base level	0.046***	0.074***
Average hourly wage of professional level	0.070***	0.100***
$\frac{CollegeEducated}{TotalNumberofEmployees}$	0.087***	0.101***
$\frac{ProfessionalLevel}{TotalNumberofEmployees}$	0.106***	0.126***
Number of observations (max/min)	116,231/57,077	116,231/57,077

All regressions include the logarithm of employment except for the employment regression. Employment is measured as the full-time equivalent number of employees (FTE). All dependent variables are in logarithm. All monetary variables are deflated by the appropriate deflator. Standard errors are clustered for firms. *Source*: Business, Labor and Trade Statistics, 1998–2006, Statistics Denmark

*, **, and *** indicate significance at the 5 %, 1 %, and 0.1 % levels respectively.

The results show that both export and import premia exist among wholesale trade firms. More specifically exporting wholesale trade firms are larger, they pay higher wages (8 %), and invest more (9.6 %). Their technology is relatively more capital intensive (7.6 %) and they have higher labor productivity (27.7 %) and employ more skill intensive employees. Similar differences also hold between importers and non-importers except for the capital intensity. These results are in line with the sunk costs driven self-selection hypothesis.

The previous analysis revealed that export intermediaries that focus on intermediate goods charge higher prices on average in comparison to manufacturers. To see if export premia also change depending on the location of the intermediaries in the supply chain, Eqs. (9) and (10) are estimated among wholesale trade exporters.

$$x_{ijt} = \beta_0^I + \beta_1^I IGIntensity_{ijt} + \beta_2^I lnFTE_{ijt} + \sum_j \eta_j Industry_j + \sum_t \delta_t Year_t + \epsilon_{ijt} \quad (9)$$

$$x_{ijt} = \beta_0^C + \beta_1^C CGIntensity_{ijt} + \beta_2^C lnFTE_{ijt} + \sum_j \eta_j Industry_j + \sum_t \delta_t Year_t + \epsilon_{ijt} \quad (10)$$

Table 10 Intermediate goods premium among wholesale trade exporters. Robust standard errors are reported in parentheses. The dependent variables in columns a–d are the logarithm of FTE, the logarithm of the value added over FTE, the logarithm of the value of capital assets over FTE and the logarithm of the value of total investment over FTE respectively

Dependent variable	(a) lnFTE	(b) lnLabor Productivity	(c) lnCapital PerWorker	(d) lnInvestment PerWorker
IGIntensity	0.167***	0.014	−0.020	−0.034
	(0.034)	(0.013)	(0.030)	(0.028)
lnFTE		−0.105***	−0.133***	−0.163***
		(0.005)	(0.009)	(0.008)
Industry (4-digit) fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Adjusted R^2	0.065	0.087	0.064	0.043
F	11.843	21.758	18.216	15.166
Number of observations	49,950	49,656	48,934	46,174
Number of clusters	11,684	11,659	11,518	11,310
Consumption goods premium among wholesale trade exporters				
CGIntensity	−0.116***	0.002	−0.052	−0.056
	(0.037)	(0.014)	(0.033)	(0.030)
lnFTE		−0.105***	−0.134***	−0.164***
		(0.005)	(0.009)	(0.008)
Industry (4-digit) fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Adjusted R^2	0.064	0.087	0.064	0.044
F	11.592	21.645	18.218	15.204
Number of observations	49,950	49,656	48,934	46,174
Number of clusters	11,684	11,659	11,518	11,310

Source: Business, Labor and Trade Statistics, 1998–2006, Statistics Denmark
*, **, and *** indicate significance at the 5 %, 1 %, and 0.1 % levels respectively

$IGIntensity_{ijt}$ is the ratio of exported intermediate goods over the total number of exported goods by wholesale trade firm i in industry j at year t. Similarly, $CGIntensity_{ijt}$ is the ratio of exported consumption goods over the total number of exported goods by wholesale trade firm i in industry j at year t.[17]

[17]The sets of intermediate and consumption goods are not exhaustive. First, the definition of intermediate goods do not include fuels and lubricants, second there are also capital and non-classified goods. Hence two equations, one with intermediate goods intensity and the other with consumption goods intensity are estimated instead of one.

The results in Table 10 show that wholesale trade exporters that specialize in exporting intermediate goods instead of consumption goods are larger on average. But after controlling for size, there are no significant differences found between wholesale exporters in intermediate goods versus in consumption goods in terms of labor productivity, capital labor ratios and investment intensity.

Table 11 reports intermediate goods premia in employee wages and characteristics. After controlling for firm employment, there are significant differences in employee characteristics and wages between wholesale trade exporters depending on their location in the supply chain. Wholesale firms that export intermediate goods employ significantly more skill-intensive employees. This is manifested in a significantly higher ratio of employees with college education as well as a higher ratio of employees with professional level of occupations. They also pay higher wages. The coefficients in columns 2 and 3 in Table 11 indicate that one standard deviation increase in the intermediate goods intensity is associated with 0.030 and 0.053 standard deviation increases in average hourly wages of basic level employees and of professional level employees respectively.

To see if the wage premium can be explained by firm and labor characteristics, firm controls and worker characteristics at the firm level are added. The firm controls are whether a firm is single-plant, whether it is a proprietorship and firm's age. The worker characteristics are female employee ratio, college rate, average tenure of employees and a quadratic term of average tenure of employees.[18] The results in Table 12 show that the premium of the overall average hourly wage and the average hourly wage of basic level employees can be explained by firm and worker characteristics. The average hourly wage of professional employees is still found to be significantly higher with the intensity of intermediate goods. High-tech good intensity is added as an additional control in Table 13 but the results are not affected. The coefficients of high-tech good intensity are found to be positive and significant indicating an additional wage premium associated with high tech goods.

So wholesale trade firms that export intermediate goods employ more educated employees and pay them proportionately more. The higher average hourly wages of basic level employees can be explained by firm and employee characteristics. But even after controlling for these factors as well as intensity of high-tech goods sales, average hourly wages of professional level employees are still found to be positively associated with the intermediate goods intensity. This could be due to communication requirements for intermediate goods which increases the need for professional level functions.

[18]Empirical studies analyzing the impact of tenure on earnings usually find positive effect at a diminishing rate.

Table 11 Intermediate goods premium among wholesale trade exporters. Robust standard errors are reported in parentheses. The dependent variables in columns (a)–(e) are the logarithm of the average hourly salary, the logarithm of the average hourly salary of employees who do jobs that require basic-level skills, the logarithm of the average hourly salary of employees with professional and technical skill required occupations, the logarithm of the share of the college educated employees over the total number of employees, and the logarithm of the share of the employees with professional and technical occupations over the total number of employees respectively. Hourly wages do not include the benefits

	(a)	(b) lnAvgHourlyWage	(c) lnAvgHourlyWage	(d)	(e)
Dependent variable	lnAvgHourlyWage	Base level	Professional level	lnCollegeRate	lnProfessionalRate
IGIntensity	0.040***	0.028***	0.052***	0.135***	0.077***
	(0.008)	(0.008)	(0.009)	(0.020)	(0.018)
lnFTE	0.033***	0.019***	0.064***	−0.291***	−0.074***
	(0.002)	(0.003)	(0.003)	(0.007)	(0.006)
Industry (4-digit) fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
Adjusted R^2	0.103	0.048	0.094	0.375	0.140
F	29.005	15.660	18.706	60.820	25.624
Number of observations	49,015	37,359	34,994	32,870	35,016
Number of clusters	11,418	9250	8820	8037	8827

(continued)

Table 11 (continued)

Dependent variable	(a) lnAvgHourlyWage	(b) lnAvgHourlyWage Base level	(c) lnAvgHourlyWage Professional level	(d) lnCollegeRate	(e) lnProfessionalRate
Consumption goods premium among wholesale trade exporters					
CGIntensity	−0.047***	−0.033***	−0.054***	−0.102***	−0.068***
	0.008	(0.009)	(0.010)	(0.022)	(0.020)
lnFTE	0.033***	0.019***	0.064***	−0.290***	−0.073***
	(0.002)	(0.003)	(0.003)	(0.007)	(0.006)
Industry (4-digit) fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
Adjusted R^2	0.104	0.048	0.094	0.374	0.139
F	28.721	15.639	18.685	59.200	24.759
Number of observations	49,015	37,359	34,994	32,870	35,016
Number of clusters	11,418	9250	8820	8037	8827

Source: Business, Labor and Trade Statistics, 1998–2006, Statistics Denmark
*, **, and *** indicate significance at the 5 %, 1 %, and 0.1 % levels respectively

Table 12 Intermediate goods premium, controlling for firm and worker characteristics

Dependent variable	lnAvgHourlyWage	lnAvgHourlyWage among base level occupations	lnAvgHourlyWage among professional level occupations
IGIntensity	0.009	−0.001	0.032***
	(0.007)	(0.008)	(0.009)
lnFTE	0.022***	0.008*	0.065***
	(0.003)	(0.003)	(0.004)
Singleplant	−0.006	−0.011	0.009
	(0.006)	(0.006)	(0.007)
lnFirmAge	−0.010***	−0.007*	0.002
	(0.003)	(0.003)	(0.003)
Proprietorship	−0.127***	−0.035**	−0.150***
	(0.011)	(0.013)	(0.019)
FemaleRatio	−0.091***	−0.143***	−0.039*
	(0.013)	(0.015)	(0.017)
AvgTenure	0.048***	0.034***	0.030***
	(0.004)	(0.005)	(0.005)
$AvgTenure^2$	−0.001***	−0.000**	−0.000**
	(0.000)	(0.000)	(0.000)
CollegeRate	0.255***	0.211***	0.169***
	(0.015)	(0.016)	(0.017)
Industry (4-digit) fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓
Adjusted R^2	0.227	0.117	0.139
F	114.518	69.247	68.716
Number of observations	47,548	36,338	33,964
Number of clusters	10,925	8892	8437

Robust standard errors are reported in parentheses. IGIntensity is the number of intermediate goods that are exported over the total number of exported goods. Singleplant is a dummy variable indicating single plant firms. logFirmAge is the logarithm of a firm's age. Proprietorship is a dummy variable indicating the ownership type. FemaleRatio is the number of female employees over the total number of employees. AvgTenure is the average tenure of employees in a firm. $AvgTenure^2$ is the square of the average tenure of employees in a firm. CollegeRate is the number of employees with at least some college education over the total number. *Source*: Business, Labor and Trade Statistics, 1998–2006, Statistics Denmark

*, **, and *** indicate significance at the 5 %, 1 %, and 0.1 % levels respectively

Table 13 Intermediate goods premium, controlling for firm and worker characteristics and high-tech intensity

Dependent variable	lnAvgHourlyWage	lnAvgHourlyWage among base level occupations	lnAvgHourlyWage among professional level occupations
IGIntensity	0.009	−0.001	0.032***
	(0.007)	(0.008)	(0.009)
HTechIntensity	0.037***	0.042***	0.032***
	(0.008)	(0.008)	(0.010)
lnFTE	0.022***	0.008*	0.065***
	(0.003)	(0.003)	(0.004)
Singleplant	−0.006	−0.011	0.009
	(0.006)	(0.006)	(0.007)
lnFirmAge	−0.010***	−0.007*	0.002
	(0.003)	(0.003)	(0.003)
Proprietorship	−0.126***	−0.034**	−0.150***
	(0.011)	(0.013)	(0.019)
FemaleRatio	−0.088***	−0.139***	−0.036*
	(0.013)	(0.015)	(0.017)
AvgTenure	0.048***	0.034***	0.030***
	(0.004)	(0.005)	(0.005)
$AvgTenure^2$	−0.001***	−0.000**	−0.000**
	(0.000)	(0.000)	(0.000)
CollegeRate	0.252***	0.206***	0.165***
	(0.015)	(0.016)	(0.017)
Industry (4-digit) fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓
Adjusted R^2	0.228	0.118	0.139
F	109.889	68.732	66.815
Number of observations	47,548	36,338	33,964
Number of clusters	10,925	8892	8437

Robust standard errors are reported in parentheses. HTechIntensity is the number of high tech goods that are exported over the total number of exported goods. For definitions of other variables see Table 12. *Source*: Business, Labor and Trade Statistics, 1998–2006, Statistics Denmark
*, **, and *** indicate significance at the 5 %, 1 %, and 0.1 % levels respectively

6 Concluding Remarks

I examine the presence of intermediaries in international trade using data from a small, open and advanced country, Denmark. A number of stylized facts about the wholesale trade firms are highlighted to understand the role of these firms and distribution channels in international trade in general.

Wholesale trade firms are found to employ fewer but more educated employees than manufacturing firms. They sell more but generate lower value-added. They are

more likely to engage in import than in export but those wholesale trade firms that import are more likely to export as well. In general, they are found to focus on fewer countries with more products in comparison to manufacturing firms. Their share of export and import are found to be higher in manufacturing industries with lower export and import intensities and with higher degree of production fragmentation. Manufacturing industries with less market concentration, higher entry and exit rates and lower median firm age are found to exhibit higher export share of wholesale trade firms. Manufacturing industries with lower firm size and capital intensity are also found to have higher export share of wholesale trade firms, confirming theories that relate fixed costs of exporting to the presence of export intermediaries.

Characteristics of wholesale trade firms in international trade are shown to differ depending on whether they trade consumption goods or intermediate goods, trade in the latter of which has been growing steadily over the last decades due to internationalization of production and increasing outsourcing. Particularly, while wholesale traders in general command lower unit prices in international trade than manufacturers, exporting wholesale traders of intermediate goods command higher unit prices.

Both export and import premia exist also among wholesale trade firms. The results show that exporting wholesale firms are significantly larger, more capital and skill intensive in comparison to non-exporting wholesale trade firms, they pay higher wages and they are more productive. Similar differences also exist between importers and non-importers. Among trade exporters, firms that specialize in intermediate goods are found to have additional premia. They are found to be bigger, more skill-intensive both in terms of employees' education levels and in occupation characteristics and pay higher wages in comparison to other exporting wholesale traders. The wage premium for professional occupations remains even after controlling for detailed firm and worker level characteristics.

In existing literature intermediaries are treated uniformly regardless of their location in the supply chain. In this paper I show that wholesale trade exporters differ systematically depending on whether they function in intermediate or consumption goods markets. The results suggest that when analyzing the role of intermediaries, attention should be given to whether the goods in question are consumption goods or intermediate goods.

Appendix 1: Additional Tables

See Tables 14, 15, 16, 17, and 18.

Table 14 Summary statistics for WHS firms

	Mean	Median	Standard deviation	N
1998				
Employment	9	1	50	15,125
Total revenue	34,046	4753	203,006	15,125
Value added	7009	1293	37,996	15,125
Capital	2916	346	41,714	15,125
Investment	746	73	6197	15,125
Total Assets	15,745	2143	151,078	15,125
Average Wage	340	335	124	11,164
2000				
Employment	11	3	53	15,911
Total revenue	38,714	7105	232,682	15,911
Value added	7686	1738	44,705	15,911
Capital	3018	402	29,100	15,911
Investment	958	92.000	8001	15,911
Total assets	18,616	3201	195,725	15,911
Average wage	308	300	161	13,135
2002				
Employment	11	3	51	15,491
Total revenue	39,163	6917	220,882	15,491
Value added	8278	1991	41,469	15,491
Capital	2976	446	27,041	15,491
Investment	772	109	6310	15,491
Total assets	18,415	3093	225,051	15,491
Average wage	329	307	747	12,977
2004				
Employment	10	2	52	16,181
Total revenue	37,513	6591	224,294	16,181
Value added	7914	1725	41,687	16,181
Capital	3120	424	30,562	16,181
Investment	809	96	7237	16,181
Total assets	17,438	3045	159,774	16,181
Average wage	323	325	158	13,239
2006				
Employment	11	2	53	16,567
Total revenue	43,569	6694	303,968	16,567
Value added	8607	1723	52,732	16,567
Capital	3339	410	37,778	16,567
Investment	964	68	10,153	16,567
Total assets	21,632	3197	321,283	16,567
Average wage	341	321	415	13,539

Sample: Wholesale Trade Firms, 1998–2006. Values are expressed in constant 2000 prices in thousand Danish kroner. *Source*: Statistics Denmark

Table 15 Share of wholesalers across CN product categories (average between 1993–2006)

	Import		Export	
CN product categories	Wholesale	Manufacture	Wholesale	Manufacture
CN 1: Live animals; animal products	0.612	0.302	0.423	0.553
CN 2: Vegetable products	0.539	0.346	0.734	0.169
CN 3: Animal and vegetable fats and oils	0.266	0.688	0.505	0.483
CN 4: Prepared foodstuffs; beverages,..	0.559	0.322	0.259	0.627
CN 5: Mineral products	0.487	0.309	0.087	0.140
CN 6: Products of the chemical or allied industries	0.586	0.363	0.357	0.578
CN 7: Plastics, rubber and articles thereof	0.454	0.464	0.203	0.742
CN 8: Raw hides and skins, leather, furskins and articles thereof	0.746	0.129	0.903	0.064
CN 9: Wood and articles of wood	0.605	0.339	0.376	0.579
CN 10: Pulp of wood or of other fibrous cellulosic material	0.520	0.392	0.276	0.669
CN 11: Textiles and textile articles	0.496	0.304	0.441	0.452
CN 12: Footwear, headgear, umbrellas, sun umbrellas, walking sticks, seat-sticks,...	0.542	0.275	0.701	0.251
CN 13: Articles of stone, plaster, cement, asbestos, mica and similar materials; ...	0.525	0.391	0.308	0.609
CN 14: Natural or cultured pearls, precious or semi-precious stones, precious metals, ...	0.673	0.206	0.413	0.503
CN 15: Base metals and articles of base metal	0.469	0.476	0.309	0.644
CN 16: Machinery and mechanical appliances; electrical equipment; parts thereof; ...	0.614	0.273	0.327	0.589
CN 17: Vehicles, aircraft, vessels and associated transport equipment	0.802	0.057	0.449	0.377
CN 18: Optical, photographic, measuring, checking, precision, medical instruments	0.625	0.268	0.160	0.761
CN 19: Arms and ammunition; parts and accessories thereof	0.619	0.038	0.698	0.249
CN 20: Miscellaneous manufactured articles	0.527	0.230	0.280	0.655
CN 21: Works of art, collectors' pieces, and antiques	0.298	0.031	0.598	0.025
CN 22: Other products	0.000	0.055	0.481	0.190

Table 16 Concentration in export market by type of firms

	All	Matched	Manufacturing	Wholesale
Top 1	0.562	0.515	0.426	0.470
Top 5	0.808	0.786	0.710	0.759
Top 10	0.900	0.886	0.834	0.866
Top 25	0.978	0.974	0.954	0.966
Top 50	0.998	0.997	0.995	0.995
Top 100	1.000	1.000	1.000	1.000

Table reports the share of export values accounted by participating firms. "All", "Matched" and "Manufacturing" and "Wholesale" refer to all export, export data that are matched with industry affiliations, export accounted by manufacturing firms and export accounted by wholesale trade firms respectively. *Source*: Statistics Denmark, International Trade, Export Data Set, Year 2002

Table 17 Concentration in export market by type of goods

	All	Consumption	Intermediate
Top 1	0.562	0.625	0.528
Top 5	0.808	0.864	0.805
Top 10	0.900	0.938	0.899
Top 25	0.978	0.990	0.979
Top 50	0.998	0.999	0.997
Top 100	1.000	1.000	1.000

Table reports the share of export values accounted by participating firms. "All", "Consumption" and "Intermediate" refer to all export, consumption goods export and intermediated goods export respectively. Consumption and intermediate goods definitions follow BEC. Intermediate goods do not include fuels and lubricants. *Source*: Statistics Denmark, International Trade, Export Data Set, Year 2002

Table 18 Concentration in export market by type of firms and type of goods

	WHS		MAN	
	Consumption	Intermediate	Consumption	Intermediate
Top 1	0.453	0.556	0.456	0.352
Top 5	0.779	0.805	0.781	0.700
Top 10	0.889	0.894	0.894	0.826
Top 25	0.979	0.975	0.982	0.954
Top 50	0.997	0.996	0.998	0.995
Top 100	1.000	1.000	1.000	1.000

Table reports the share of export values accounted by participating firms by type of goods and type of firms. *Source*: Denmark Statistics, International Trade, Export Data Set, Year 2002

Appendix 2: Data

Foreign Trade Data

The foreign trade data sets are compiled from the Danish Customs records. Each shipment record includes the date of the shipment, the value of shipment, the product code (CN-8 digit), and the name of the product, weight of the shipment, type of the weight and sometimes quantity information as well as the unique firm identifier. Statistics Denmark aggregated this data into annual shipments for each product (CN-8 digit), country and firm triplet. As provided by Statistics Denmark, the international transaction data set covers the universe of Danish firms' transactions for the period 1993–2007. However, only product shipments of 10,000 kr (approx. 1800 us $) or above are included in the data set for the transactions with the EU countries.

Business Statistics Data

Business statistics data are compiled from survey results of firms that take part in a yearly financial survey as well as from tax reports, vat reports, and annual reports from incorporated companies. The general business statistics include only firms that employ at least a 0.5 FTE (full-time equivalent number of employees) and/or have had an estimated earnings of a certain size. Earning sizes are estimated differently for different industries. In the wholesale trade sectors, the limit of earnings is typically over 500,000 Danish Kroner, while in the manufacturing industry, it ranges between 150,000 and 200,000 Danish Kroner. Some of the data for very small firms may be subject to imputation. This data set is available starting from 1995, but only manufacturing, construction and retail sectors are included until 1998. In 1998, the wholesale trade sector is included and starting from 1999 it covers almost all sectors including mining, and all business service sectors.[19] This data set is supplemented with the labor surveys (IDA) that provide information on wages, education and occupation characteristics for each individual in the labor force. In the labor (IDA) data set, for each employed person there is a unique firm identifier provided for the employer. Using this firm identifier, extracted information from IDA is merged with the Firm Accounting Data Set for each year. Only a couple of observations in firm accounting data were left unmatched from this matching.[20]

[19]Starting from 1999, the data set includes hospitality, transportation, telecommunication, real estate, rental services, information technology services, research and development services, and other consultancy and business services. It does not include agriculture, financial sector, public, education and medical service sectors.

[20]For the details of labor data set as well as other data sets used in this study see Utar (2014).

Intermediaries are defined as firms with their main economic activity in 2-digit Danish Industrial Classification 51 (wholesale except of motor vehicles) as well as 6-digit industry classifications equal to 501010, 501020, 501030, 503010, 503020, and 504000 which are sale of motor vehicles, parts and accessories.

Matching Foreign Trade Data with Firm-Level Data Sets

Foreign trade as compiled from the custom records contain firm id's but not a main business/industry affiliation, so it is not possible to identify the type of firms whether wholesale trade, retailer, manufacturer or service etc. from the foreign trade data alone. The analysis in this paper is carried out by matching the foreign trade data with the business statistics as well as other available data sets from Statistics Denmark such as tax data, and industry sales data. Between 1993 and 2007, most of the foreign data in the import side (94 % of firms) can be matched, less so in export (89 % of firms). A significant part of the transactions cannot be matched in the export side, probably due to reporting errors. Nevertheless during 1998 and 2006 which is the sample period used in the empirical analysis, 91 % of the exporting firms in custom data were matched with their corresponding industry affiliations.

Product Detail

Products description is based on the Combined Nomenclature (CN) 8 digit categories. The first 6 digits of the CN corresponds to the HS-6 digit classification. For example, 852812 product code refers to color television receivers with built-in picture tubes. In the CN-8 classification there are 19 different kinds of color television receivers depending on different characteristics such as display width, diagonal screen size, and lines of resolution.

Broad Product Classification

Product classification of the products as consumption, intermediate, or industrial good is based on BEC Rev. 3. Consumption goods are defined as (BEC=112, 122, 522, >=600). The rest are defined as industrial goods. Intermediate goods definition does not include fuels and lubricants and is defined as (BEC=111, 121, 210, 220, 420, 530).

CN Chapters are used as broad product classifications and they are listed in Table 15. CN codes are matched with the corresponding manufacturing industries using PRODCOM. Prodcom provides statistics on the production of manufactured goods. Prodcom uses the product codes specified on the Prodcom List, which contains about 4500 different types of manufactured products. Products are identified

by an 8-digit code: the first four digits are the classification of the producing enterprise given by the Statistical Classification of Economic Activities in the European Community (NACE). Most product codes correspond to one or more Combined Nomenclature (CN) codes, but some (mostly industrial services) do not. The matching between CN and PRODCOM are provided by EUROSTAT RAMON. The matches are executed for every year separately.

Rauch (1999) classification is used to classify products as homogenous, reference and differentiated goods. Classifications in Rauch (1999) are based on SITC codes. Correspondence tables between CN 8-digit and SITC 4-digit (provided by EUROSTAT RAMON) are used to link the classification with the Danish data.

High tech goods definitions follow OECD nomenclature (Loschky 2008). High-technology classification is based on both direct and indirect R&D intensities in relation to the production output or to the valued added. The indirect R&D intensity is defined as the R&D expenditures embodied in the intermediate products used in the production in another economic sector. See Loschky (2008) for more details.

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