Distance Sensitivity on Exported Products of the Swedish Manufacturing Sector

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Abstract

Distance increases transaction costs of firms engaging in export activities and the higher entry costs in turn affect the propensity to enter foreign markets. The type of products being exported, moreover, asserts different sensitivity towards distance due to relationship specificity required [24]. I estimate the product-level gravity equation by Heckman-type model on export propensity and volume of export, contrasting homogeneous and differentiated products. The analyses uses Swedish export data within the manufacturing sector from 1997-2006 to 165 destination countries. The main findings are in line with the hypothesis, suggesting that differentiated products assert higher sensitivity towards distance. However, the results are not evident in non-affiliated firms.

Keywords: distance sensitivity, export, transaction cost, gravity model, differentiated products
JEL Classification: F12, F14, F41

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1 Introduction

It is a well-known fact that distance affects trade. The effects are in two directions: the selection of firms into export and the volume for exported products, in a way that farther distance makes it less likely for firms to export and at less volume, if they do. Also, there are supporting arguments that this effect is more pronounced for differentiated products. Rauch [23, 24] provides an explanation by proposing a network/search view that the cost of search process to match buyers and sellers is higher for differentiated products, such as clothing or wristwatches, than homogeneous products with established organised exchange markets or referenced prices, such as oil and other primary inputs. The associated costs incurred by exporters include costs of relevant prices discovery and transaction negotiation and contractual costs [14]. These transaction costs, intuitively, should be higher for products that are non-standardised because exporters are required to have more interactions and a certain contractual discussion, which could make them bear the risk of contract default from the buyers. Such risk arises if the preference of the end consumers at the destination markets shifts, due to season or taste, and ultimately result in no purchase.

An alternative view can be that of Williamson [30], who clearly utilises the concept of *asset specificity* to distinguish market contracting of generic exchanged intermediate product market and bilateral dependency hierarchy of products with specific assets. The usual price mechanism is perfectly applicable for products with low asset specificity because all actors in the market know what the product characteristics are, while it is not the case for differentiated asset-specific products that require the buyers and sellers in establishing a formal costly relationship and processes.

Moreover, there are ample evidences across countries that, on average, only a fraction of firms in a given industry do engage in exports and account for small share of total sales [6, 12]. On average, 46% of active firms in Swedish manufacturing sector in 2006 were exporters and account for 24.92% of total sales (see Appendix). The heterogeneity of firms implies that only few firms do engage in export and those that export have higher productivity than non-exporters. This is because the fixed entry cost differs from market to market, and that the varying "productivity threshold" in each market limits a number of firms to enter. The model developed by Melitz [21] implies that firms select themselves into export as they can afford the fixed entry costs. Such fixed entry costs would affect the propensity of firms on the export decision as these are typically not recoverable upon exit. Upgrading product quality, packaging, and establishing marketing channels are examples of these "sunk" costs [25]. As shown in Baldwin [8] and Baldwin and Krugman [9], if there are shocks from exchange rates, the sunk costs will result in the hysteresis or persistent trade effect even though the shocks are reversed sometime later.

Because the non-dichotomous nature of the decision to export, meaning that firms do not only decide to export at full capacity or not at all. When they decide to export, firms do it at a certain volume. Then, what affects such intensity of export volume is termed the market penetration costs. The model by Arkolakis

[7] identifies these as the marketing costs to reach a certain amount of customers. Such marketing, or advertising spending, costs show a negative relationship with market size and marginally positive with the number of consumers reached. Since only productive firms afford to export, he argues further that relatively unproductive exporters, then, would be able to capture only a small amount of customers and result in small export volume.

The empirical studies on the distance sensitivity so far has been primitive at an aggregate level, e.g. Rauch [24]. The availability of detailed micro-data allows me to perform this study extensively by taking a closer look at each product a firm decides to export. In this paper I, thus, provide an empirical analysis to test whether distance and gravity variables have a significant impact on the propensity to export and export volume once firms decide to export, contrasting between homogeneous and differentiated products. The data comprises Swedish firm-level exports which details products and their associated category, volume, and destinations from period 1997-2006. The product classifications are obtained from Rauch [24]. Due to the presence of many zeros, which is a typical characteristic of trade data, several econometric methods are discussed in the methodology section to determine the appropriate estimation methods. The empirical strategy in use not only makes the analysis feasible in this paper, but also unlocks the potential of the investigation within the similar topic. Altogether with the results, I also discuss the implications and offer suggestions for future research.

2 Costs of International Trade

Firms engage in international trade with different reasons. One of them is to expand its domestic market abroad to realise economy of scale. Export is among the alternative mode of firm's entry besides licensing, joint venture, and direct investment. The relative speed and ease of entry are the advantages of export. But this comes at a cost, mainly the transport and trade barrier costs, both of which are exogeneous to firms. Moreover, firms also incur both market entry and market penetration costs to reach the consumers. These costs are specific to firm and market.

2.1 Market Entry costs

To enter foreign markets, firms must forgo one-time fixed costs. These costs arise from successive stages of searching for the right business partners, negotiating terms and conditions, and enforcing contractual agreements [29]. The first two are *ex ante* costs, while the enforcement cost involve *ex post* monitoring cost.

2.2 Market Penetration costs

In Arkolakis's paper [7], firms do not reach the market in its entirety, but instead reach the targeted consumers via marketing advertisements. The so-called *mar-*

ket penetration costs are costs of reaching individual potential consumers and comprise two properties. First, the cost to reach a certain amount of consumers decreases with population size. Second, its marginal cost increases with the number of consumers reached. In essence, firms have to pay more to get more consumers, but at lower rate to reach additional ones.

3 Methodology

3.1 Gravity Model of Trade

The analysis consists of two main problems —the decision to export and export volume once firms decide to engage in international trade. In estimating this, I employ the standard gravity model of trade. Despite being a main vehicle of analytical framework for empirical trade study, the theoretical foundation has been laid only not until recently. The formal derivation by Anderson and van Wincoop [3, 4] is constructed with constant elasticity of substitution (CES) preferences and differentiated products according to place of origin. In Helpman [16] and Bergstrand [11], product differentiation with Lancaster "ideal" preferences is incorporated. For the former, this Dixit-Stiglitz type of utility is less complicated in terms of model derivation yet still aligns well with the stylised facts that intra-industry bilateral trade exists.

The framework here follows the state dependence form of gravity model by Egger and Pfaffermayr [15]. This set-up incorporates the export status of a firm at time t, which will be estimated as the selection equation in the analysis section of this paper. This status of export is in line with Melitz-type self-select firms into export according to their productivity. Multi-product firms[1] are assumed here. Other assumptions are full employment, non-negative profits Cobb-Douglas production.

Total consumption, C, of product k in country j at time t is of Dixit-Stiglitz "love-for-variety" type,

$$C_{jkt} = \left[\sum_{i=1}^{I} n_{ikt} c_{ijkt}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} . \tag{1}$$

Number of varieties is written as n, and the elasticity of substitution between varieties, σ, is assumed constant (CES). The elasticity between varieties within products is higher than the elasticity across products.

[1] For illustration, suppose a firm produces different kinds of shoes. This would mean leather and sports shoes are two products, while different styles of snowboard boots are mere varieties of such sports footwear.

The consumption of one variety and the derived price index P_{jkt} is

$$\begin{aligned} c_{ijkt} &= \frac{p_{ijkt}^{-\sigma}}{P_{jkt}^{1-\sigma}} Y_{jkt} && (2) \\ p_{ikt} &= \frac{\sigma}{\sigma - 1} \frac{w_{ikt}}{\alpha_{ikt}} && (3) \\ P_{jkt}^{1-\sigma} &= \sum_{i=1}^{I} n_{ikt} p_{ijkt}^{1-\sigma} V_{ijkt}; p_{ikt} \geqslant p_{ijkt}. && (4) \end{aligned}$$

Also, the price consists of iceberg-type c.i.f. (cost, insurance, freight) transport costs.

$$p_{ijkt} = p_{ikt} \tau_{ijkt}; \tau_{ijkt} \geqslant 1. \quad (5)$$

The export is then expressed as price multiplied by consumption,

$$x_{ijkt} = p_{ikt} c_{ijkt} = \frac{p_{ikt}^{1-\sigma} \tau_{ijkt}^{-\sigma}}{P_{jkt}^{1-\sigma}} Y_{jkt} V_{ijkt}. \quad (6)$$

Aggregate export is therefore,

$$\begin{aligned} X_{ijkt} &= n_{ikt} p_{ikt} \tau_{ijkt} x_{ijkt} \\ &= n_{ikt} \left(\frac{p_{ikt}^{1-\sigma} \tau_{ijkt}^{1-\sigma}}{P_{jkt}^{1-\sigma}} \right) Y_{jkt} V_{ijkt}. && (7) \end{aligned}$$

Profit of firms, denoted by π, is non-negative, thus would mean that sales, expressed as total wage paid to labour in equilibrium, are greater than fixed costs,

$$\pi_{ijkt} = \frac{w_{ikt} x_{ijkt}}{\alpha_{ikt}(\sigma - 1)} - w_{ikt} f_{ijkt} e^{-\delta V_{ijk,t-1}}. \quad (8)$$

Here, w denote wage level, while α is labour share in production function, and f is total labour used in product set-up.

At equilibrium, total sales of all countries would add up to income, denoted by Y, which is expressed as,

$$Y_{ikt} = \sum_{j=1}^{J} X_{ijkt} = n_{ikt} p_{ikt}^{1-\sigma} \sum_{j=1}^{J} \left[\frac{\tau_{ijkt}^{1-\sigma} Y_{jkt}}{P_{jkt}^{1-\sigma}} V_{ijkt} \right]. \quad (9)$$

Solving for price and substitute back in aggregate export and we have

$$\begin{aligned} p_{ikt}^{1-\sigma} &= \frac{Y_{ikt}}{n_{ikt} \sum_{j=1}^{J} \tau_{ijkt}^{1-\sigma} \frac{Y_{jkt}}{P_{jkt}^{1-\sigma}} V_{ijkt}} \\ &= \frac{Y_{ikt}}{n_{ikt} \omega_{jkt}}; \omega_{jkt} = \sum_{j=1}^{J} \tau_{ijkt}^{1-\sigma} \frac{Y_{jkt}}{P_{jkt}^{1-\sigma}} V_{ijkt} && (10) \\ X_{ijkt} &= Y_{ikt} Y_{jkt} \tau_{ijkt}^{1-\sigma} \omega_{jkt} V_{ijkt}. && (11) \end{aligned}$$

From eq. 11, take logarithmic transformation to linearise the equation,

$$\ln X_{ijkt} = \begin{cases} \ln Y_{ikt} + \ln Y_{jkt} + \ln \tau_{ijkt}^{1-\sigma} + \ln \omega_{jkt} & ; \quad V_{ijkt} = 1 \\ unobserved & ; \quad V_{ijkt} = 0. \end{cases} \tag{12}$$

Basically, the export could be determined by the size of the origin and destination market, transport costs, and a combination of variables explaining resistance to trade.

3.2 Estimation

Since the empirical work to determine the effect of currency union using gravity model by Rose [26], there are many successive studies that point out the weaknesses of its econometric estimation, most notably by Baldwin [10]. The presence of many zeros in trade flows is proven to cause the biased results [20]. The logarithmic transformation to linearise the original gravity model renders zero trade flows undefined. Therefore, the standard ordinary least square (OLS) regression using either an ad-hoc replacement of zeros with tiny amounts or a truncated sample; or a censored tobit would rely on a restrictive exogeneity assumption or arbitrary censored value. Moreover, zero flows are also a result from an economic decision making about profitability and costs, so another estimation technique that use the full information is then needed.

The alternative methods recently proposed are poisson-type regression, e.g zero-inflated poisson (ZIP) [13] or poisson pseudo-maximum likelihood (PPML) [27], and heckman selection model [17]. The advantage of these techniques is that they utilise the full sample into estimation. However, ZIP assumes that the processes of generating zeros and non-zeros or, in this case, the probability of and the amount of export have to be independent of each other. This is contrary to the evidence. While PPML method still provide biased results when faced with excess zeros [22]. In this paper, I choose heckman selection, sometimes called *Type 2 Tobit* [2], model for the analysis.

The selection equation is as follows:

$$\begin{aligned} V^*_{ijkt} &= \beta_0 + \beta_1 \ln Y_{jkt} + \beta_2 \ln \tau_{jk} + \beta_3 \gamma_{jk} + \beta_4 \delta_{ikt} + \beta_5 \zeta_{ijk,t-1} + u_{ijkt}; \\ V_{ijkt} &= \begin{cases} 1 & : \quad V^*_{ijkt} > 0 \\ 0 & : \quad V^*_{ijkt} \leqslant 0 \end{cases} \end{aligned} \tag{13}$$

The outcome equation is formulated as

$$\ln X_{ijkt} = \begin{cases} \beta_0 + \beta_1 \ln Y_{jkt} + \beta_2 \ln \tau_{jk} + \beta_3 \gamma_{jk} + \varepsilon_{ijkt} & ; \quad V^*_{ijkt} > 0 \\ - & ; \quad V^*_{ijkt} \leqslant 0. \end{cases} \tag{14}$$

Both equations employ only one-sided gravity, meaning that the size of origin market is not included. This is because all observations are from Sweden, so there is no variation across firms.

According to Heckman [17], the error terms are assumed normally distributed with zero means, or written formally as

$$\begin{aligned} u_{ijkt} &\sim N(0,1) \\ \varepsilon_{ijkt} &\sim N(0,\sigma^2) \\ corr(u_{ijkt}, \varepsilon_{ijkt}) &= \rho. \end{aligned} \tag{15}$$

The estimation contains two steps. First, the probit "selection" equation is estimated by Maximum Likelihood Estimation method to obtain the coefficient estimates. For each observation, the inverse Mill's ratio is computed. Then, the second step is to estimate the coefficients of both independent and the inverse Mill's ratio variables by Ordinary Least Square. If the estimated coefficient of this ratio turns out significant, it means that there is selection bias.

3.3 Product classifications

The classification of products into a broad category of homogeneous and differentiated ones dates back to Rauch [24]. In the original paper, homogeneous products are also divided further to products on organised exchange and reference priced products. Three trade publications, in specific the *International Commodity Markets Handbook*, *The Knight-Ridder CRB Commodity Yearbook* and *Commodity Prices* are used to determine those belonging to the homogeneous group. This is done at the three- to four-digit Standard International Trade Classification (SITC) level, in which he aggregates the five-digit level up according to the large share between the groups.

4 Data

The micro-data in used is obtained from *Statistiska Centralbyrån* (SCB). The dataset is constructed from two separate database. The first one includes most of the firms' characteristics, e.g. sales, number of employees. This is matched by firm's unique identification number with the trade dataset, detailing imports and exports of products and destination countries. The period is ten years from 1997 to 2006.

In preparation of the dataset, I borrow much of the techniques from a paper on local export spillovers in France by Koenig, Mayneris, and Poncet [19], in which a focus is made on the within transformation of each of the firm's decisions in order to not exhaust the analyses with explosively large dataset. Here, I include only active firms which are observed all years with at least one export start during the period. This means that firms with zero or negative sales and value-added are excluded. Also excluded are persistent firms that export the same products to the same countries every year. The justification is that firms that already export would already pay the upfront fixed entry cost compared to the new entrants and the comparison between the two would render invalid. Furthermore, due to the log-linearised model, I also exclude those self-employed

firms, i.e. firms with zero employees. The extreme-valued observations at the top and bottom 1% are deleted, as suggested in Wagner [28]. The country data is obtained from *Centre d'Études Prospectives et d'Informations Internationales* (CEPII), which are listed in the appendix.

Each active firm in this dataset faces the following choice problem:

i) **Selection**: Each firm decides to export certain product to certain country each year. The set of possible products and countries is constructed from each respective firm's history throughout the period of study. An exemplary argument here is that a shoes company would not consider exporting auto parts to foreign nations where it never have any past contacts. This reduces the possibility set tremendously and allow me to make the analyses here feasible[2]. The firm's characteristics variables are included in order for their productivity to determine the self-selection decision into export. These variables are value-added per employee, human capital per employee, total number of firm's employees. Lastly, a dummy indicating a familiarity or established trade network with the destination country, i.e. a lagged import dummy, which takes a value of 1 if a firm did import any products a year before.

ii) **Intensity**: At any given year, each firm that decides to export a particular product to a particular country faces another economic decision, which is how much to export.

Next, there are two issues that need to be addressed, namely the service sector and intra-firm trade. Firstly, exporting firms in the service sector typically take the role of intermediaries, which is emphasised in Ahn, Khandelwal, and Wei [1] as they find that approximately 22 % of Chinese aggregate export in 2005 come from trading firms, which have a large share of the service sector in total. The main advantage for such trading firms is that they lower the market-specific fixed entry cost, which allows intermediate productive (usually small) firms to enter the foreign markets without having to incur similar fixed entry costs as those producing manufacturing firms. The ambiguity of the value added created by the service sector also underlies the questionable position the sector is located in the value chain. The production theory with capital and labour as factors of production cannot apply directly to the service sector, which makes a comparison with manufacturing sector in terms of entry cost rather difficult, if not impossible. Therefore, the sector under analysis is limited to the manufacturing sector, as indicated by two-digit NACE[3] rev.1.1 code 15-36.

Secondly, the intra-firm trade is another important issue that can result in (upward) bias of the estimation. Although it is prevalent in trade, no official statistics, as far as I am concerned, reports this separately from firm's trade transactions, due to its difficulty. Much of the intra-firm trade comes from vertically-integrated firms, so the final products of smaller firm in one country

[2]The possibility set explodes as we add more dimensions. Consider a set of only 500 firms with 100 products to 165 countries in 10-year period. The total number of every possible observations is 82.5 million.

[3]Abbreviated for *Nomenclature des Activités Économiques dans la Communauté Européenne* or Classification of Economic Activities in the European Community.

Table 1: Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Maximum	Minimum
Volume	57,078	30,038.05	198,991	167	4,615,599
GDP	1,222,194	752,317.20	1,953,479	92.18	13,201,819
Distance	1,234,880	2,493.41	3,143.58	450.08	17,389.62
GDP per capita	1,222,194	23,080.10	17,656.29	84.56	89,563.63
Value-Added	1,234,880	33,009.59	109,731.40	1	5,593,307
Human Capital	1,234,880	0.08	0.15	0	1
Employees	1,234,880	60.32	173.79	1	7,420
Contiguity	1,234,880	0.24*	0.42	0	1
Landlocked	1,234,880	0.10*	0.29	0	1
English	1,234,880	0.13*	0.34	0	1
Lag Import Dummy	1,111,392	0.70*	0.46	0	1

* The percentage of the total observations that takes the value of 1.

become intermediate products for assembly in another firm belonging to the same corporate group. Here I run separate regression for a sub-sample, which includes only non-affiliated firms, i.e. ones that do not belong to any corporate groups or multi-national firms. Although, I am aware that this does not completely guarantee solving the problem.

The list of variable description, source and expected sign can be found in the appendix. The descriptive statistics is provided in table 1.

5 Results and Discussion

The main results are presented in the accompanying tables. Notice that in nearly all cases, the coefficients (labelled as *lambda* in the tables) of the inverse Mill's ratios are statistically significant, suggesting that a selection bias is present.

Looking first at the regression results, we see that market size, as proxied by GDP, exhibits positive relationship in all regressions, except one case in non-affiliated sample, of both the selection and outcome equations, suggesting that the larger market attracts more exporters to enter. Since one of their main objectives is to serve foreign market, this positive relationship is what we expect.

Our main variable of interest, distance, has puzzling results that require some explanation. Regressing the selection equations, the estimated coefficient for distance shows expected negative relationship in all samples with high statistical significance, meaning that greater distance deters market entry. This is in line with the gravity explanation. However, when we turn to the outcome equations, distance does not equally affect volume of export across the two types of products. Only in a full sample of Rauch classification (table 2) does one find an expected result, that is the differentiated products are more sensitive to dis-

tance. However, this turns out to be insignificant for differentiated products in non-affiliated sample.

The variable for purchasing power, as proxied by GDP per capita, shows mixed results. It is positive and significant in the selection equation of the full sample but negative and insignificant in the outcome equation. In non-affiliated samples, it exhibits negative relationship with export volume, which means that export is greater between Sweden and countries with lower development.

Contiguity dummy indicating common border has a positive and significant estimated coefficient in the full sample with one exception in homogeneous products export volume where it is negative and insignificant. This is inverse in the non-affiliated sample. One explanation might be the competition of similar product offerings at neighbouring countries, while firms belonging to corporate group do not share similar fate as long-term contractual agreements between them assure constant supply.

Landlocked dummy shows negative and significant sign in many cases of both equations with greater magnitude for differentiated products, which is expected. More than half of world's import and one-third of world's export values of the international trade have come from sea transport [18] due to freight costs [5]. Therefore, it becomes an obstacle for landlocked countries to rely on other modes of transport or a transfer of goods from other country's ports. Export to these countries are less likely or at a lesser volume compared to open coastal ones as a result.

English dummy in many cases shows positively significant sign, suggesting that language familiarity increases trade. Although the official language in Sweden is not English, but it is spoken by the general population as a result of its being mandatory study in school.

Other firm's characteristics variables in the selection equation also reveal important findings. Value-added variable is always positive and is significant in many cases. So better performed firms are more likely to export, which is in line with Melitz-type trade model.

Human capital as determined by a fraction of university-graduated employees of a firm are negative. One explanation is that, for manufacturing sector, an excess of highly-educated employees add to the costs of production and does not result in the improvement of firm's productivity. An illustrious example would be of hiring an MBA graduate to operate a cargo truck. One could expect this variable to turn positive in the service and knowledge-intensive business sector instead.

A variable of total number of employees is always negative. This exhibits a diminishing S-shaped marginal productivity of labour in the production.

Lastly, a lagged import dummy turns out positive in homogeneous products and negative in differentiated products. This could suggest that past experiences and network are only applicable to future export of homogeneous products, underlying the importance of product type difference in firm's trade.

6 Conclusion

Not all firms and their products are equal. The heterogeneity characterises the differences of firm's decision to engage in export activities. The differing productivity threshold arising from fixed entry costs in each market allows only more productive firms to enter. Once entered, penetration costs impede them to be capable of export at a small volume. The distance affects both decisions but at a different magnitude between homogeneous versus differentiated products. Theories suggest that network and search costs would be higher for products required greater relationship specificity.

However, the empirical analyses on a product level using gravity equation for Swedish manufacturing export starters show mixed results. Higher distance sensitivity for differentiated products holds for the full dataset but becomes insignificant in non-affiliated sub-sample.

Micro-data reveals firm's decision at a much finer level and together with the appropriate empirical strategy not the less for the feasibility, future research on other countries is warranted.

Table 2: Heckman selection regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Products			Homogeneous Products			Differentiated Products		
VARIABLES	lnVolume	Export	mills	lnVolume	Export	mills	lnVolume	Export	mills
lngdp	0.324***	0.034***		0.067**	0.005		0.375***	0.041***	
	(0.027)	(0.003)		(0.034)	(0.007)		(0.033)	(0.004)	
lndist	-1.516***	-0.185***		-1.087***	-0.232***		-1.421***	-0.179***	
	(0.097)	(0.006)		(0.140)	(0.015)		(0.110)	(0.007)	
lngdpcap	-0.016	0.017***		-0.100	0.025**		-0.025	0.014**	
	(0.041)	(0.005)		(0.062)	(0.012)		(0.043)	(0.006)	
contig	0.511***	0.261***		-0.008	0.313***		0.283*	0.247***	
	(0.144)	(0.010)		(0.183)	(0.022)		(0.161)	(0.012)	
landlocked	-1.289***	-0.161***		-0.748***	-0.130***		-1.262***	-0.167***	
	(0.136)	(0.016)		(0.202)	(0.038)		(0.150)	(0.018)	
English	0.814***	0.081***		0.568***	0.013		0.793***	0.087***	
	(0.111)	(0.014)		(0.187)	(0.036)		(0.118)	(0.016)	
lnvalueadd		0.042***			0.066***			0.042***	
		(0.008)			(0.018)			(0.009)	
HumanCapPerEmpl		-0.144***			-0.015			-0.170***	
		(0.033)			(0.092)			(0.036)	
lnempl		-0.039***			-0.067***			-0.028***	
		(0.003)			(0.006)			(0.003)	
L.DImp		-0.029***			0.045**			-0.044***	
		(0.008)			(0.018)			(0.009)	
lambda			6.085***			2.523***			5.741***
			(0.520)			(0.557)			(0.630)
Constant	2.740***	-1.100***		10.934***	-0.728***		2.440**	-1.192***	
	(0.896)	(0.080)		(0.972)	(0.183)		(1.087)	(0.090)	
Year dummies	YES			YES			YES		
Industry dummies	YES			YES			YES		
Observations	355,125	355,125	355,125	85,196	85,196	85,196	269,929	269,929	269,929

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Heckman selection regression results of non-affiliated firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Products			Homogeneous Products			Differentiated Products		
VARIABLES	lnVolume	Export	mills	lnVolume	Export	mills	lnVolume	Export	mills
lngdp	0.033	0.015***		0.067	0.000		0.022	0.019***	
	(0.047)	(0.006)		(0.061)	(0.016)		(0.048)	(0.006)	
lndist	0.210	-0.125***		-0.702***	-0.261***		0.104	-0.108***	
	(0.180)	(0.012)		(0.252)	(0.037)		(0.145)	(0.013)	
lngdpcap	-0.131*	-0.003		-0.171	-0.084***		-0.185**	0.008	
	(0.075)	(0.010)		(0.126)	(0.025)		(0.077)	(0.011)	
contig	-2.580***	0.356***		-0.439	0.366***		-2.455***	0.356***	
	(0.441)	(0.019)		(0.355)	(0.045)		(0.375)	(0.021)	
landlocked	0.147	-0.059**		-0.072	0.117		0.227	-0.080***	
	(0.220)	(0.029)		(0.298)	(0.078)		(0.227)	(0.031)	
English	-0.500*	0.158***		1.036***	0.177**		-0.432*	0.143***	
	(0.284)	(0.029)		(0.341)	(0.086)		(0.256)	(0.031)	
lnvalueadd		0.063***			0.016			0.070***	
		(0.016)			(0.043)			(0.017)	
HumanCapPerEmpl		-0.153***			-0.445***			-0.131***	
		(0.045)			(0.147)			(0.047)	
lnempl		0.010			-0.057***			0.027***	
		(0.007)			(0.017)			(0.008)	
L.DImp		0.030**			0.064*			0.034**	
		(0.013)			(0.033)			(0.014)	
lambda			-6.103***			1.186			-5.739***
			(1.418)			(0.954)			(1.188)
Constant	20.278***	-1.322***		11.269***	0.903**		21.051***	-1.661***	
	(2.230)	(0.153)		(1.360)	(0.407)		(2.201)	(0.167)	
Year dummies	YES			YES			YES		
Industry dummies	YES			YES			YES		
Observations	92,183	92,183	92,183	15,371	15,371	15,371	76,812	76,812	76,812

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7 Appendix

7.1 Country list

ISO2	Country Name	Distance*	ISO2	Country Name	Distance*
AE	United Arab Emirates	4,859.49	DK	Denmark	450.08
AF	Afghanistan	4,644.21	DO	Dominican Republic	8,006.54
AL	Albania	1,995.41	DZ	Algeria	2,709.28
AM	Armenia	2,899.19	EC	Ecuador	10,457.59
AN	Netherland Antilles	8,441.07	EE	Estonia	595.36
AO	Angola	7,644.17	EG	Egypt	3,412.79
AR	Argentina	12,404.68	ER	Eritrea	5,250.37
AT	Austria	1,228.47	ES	Spain	2,486.55
AU	Australia	15,385.40	ET	Ethiopia	5,847.94
AW	Aruba	8,587.53	FI	Finland	604.91
BA	Bosnia & Herzegovina	1,644.60	FJ	Fiji	15,252.19
BB	Barbados	7,930.83	FO	Faroe Islands	1,303.04
BD	Bangladesh	6,912.31	FR	France	1,616.32
BE	Belgium	1,151.50	GA	Gabon	6,577.58
BF	Burkina Faso	5,408.34	GB	United Kingdom	1,292.80
BG	Bulgaria	1,912.32	GE	Georgia	2,708.50
BH	Bahrain	4,526.21	GH	Ghana	6,005.78
BI	Burundi	7,027.18	GI	Gibraltar	2,956.84
BJ	Benin	5,803.46	GL	Greenland	3,368.65
BM	Bermuda	6,456.30	GM	Gambia	5,712.82
BN	Brunei Darussalam	10,069.25	GN	Guinea	5,966.61
BO	Bolivia	11,201.18	GR	Greece	2,353.03
BR	Brazil	10,185.49	GT	Guatemala	9,539.39
BS	Bahamas	7,808.63	HK	Hong Kong	8,368.68
BW	Botswana	9,199.48	HN	Honduras	9,338.07
BY	Belarus	986.48	HR	Croatia	1,519.27
CA	Canada	6,347.80	HT	Haiti	8,142.33
CG	Congo	7,007.02	HU	Hungary	1,315.38
CH	Switzerland	1,422.90	ID	Indonesia	10,632.05
CI	Cte d'Ivoire	6,129.18	IE	Ireland	1,549.43
CL	Chile	12,956.19	IL	Israel	3,315.60
CM	Cameroon	5,907.75	IN	India	6,308.11
CN	China	7,276.97	IQ	Iraq	3,552.56
CO	Colombia	9,491.13	IR	Iran	3,765.08
CR	Costa Rica	9,629.91	IS	Iceland	2,047.33
CU	Cuba	8,246.69	IT	Italy	1,833.43
CV	Cape Verde	5,794.42	JM	Jamaica	8,463.56
CY	Cyprus	2,955.68	JO	Jordan	3,358.22
CZ	Czech Republic	1,009.36	JP	Japan	8,226.76
DE	Germany	929.32	KE	Kenya	6,957.80

ISO2	Country Name	Distance*	ISO2	Country Name	Distance*
KH	Cambodia	8,820.19	PL	Poland	848.39
KP	North Korea	7,371.20	PT	Portugal	2,821.62
KR	South Korea	7,682.77	PY	Paraguay	11,477.31
KW	Kuwait	4,107.62	QA	Qatar	4,653.14
KY	Cayman Islands	8,589.82	RW	Rwanda	6,884.48
KZ	Kazakstan	3,774.62	SA	Saudi Arabia	4,479.74
LB	Lebanon	3,148.39	SD	Sudan	5,100.44
LC	Saint Lucia	7,928.13	SG	Singapore	9,782.64
LK	Sri Lanka	7,849.86	SI	Slovenia	1,420.52
LT	Lithuania	676.56	SK	Slovakia	1,176.30
LU	Luxembourg	1,207.73	SL	Sierra Leone	6,101.36
LV	Latvia	591.22	SM	San Marino	1,678.00
LY	Libya	2,993.48	SN	Senegal	5,613.46
MA	Morocco	3,274.22	SO	Somalia	6,638.56
MD	Moldova, Rep.of	1,580.09	SR	Suriname	8,366.51
MG	Madagascar	9,152.54	SV	El Salvador	9,548.48
MH	Marshall Islands	12,283.25	SY	Syrian Arab Republic	3,084.28
MK	Macedonia	1,950.69	TC	Turks & Caicos Is.	7,815.33
MO	Macau (Aomen)	8,201.04	TG	Togo	5,878.81
MT	Malta	2,558.88	TH	Thailand	8,415.42
MU	Mauritius	9,593.82	TJ	Tajikistan	4,346.91
MV	Maldives	7,861.62	TK	Tokelau	14,475.37
MW	Malawi	8,326.36	TN	Tunisia	2,582.25
MX	Mexico	9,357.39	TO	Tonga	15,710.15
MY	Malaysia	9,568.98	TR	Turkey	2,453.42
MZ	Mozambique	9,058.94	TT	Trinidad & Tobago	8,286.25
NA	Namibia	8,993.66	TW	Taiwan	8,551.70
NC	New Caledonia	15,294.21	TZ	Tanzania	7,468.98
NE	Niger	5,062.04	UA	Ukraine	1,616.60
NG	Nigeria	5,721.76	UG	Uganda	6,634.94
NI	Nicaragua	9,522.18	US	U.S.A.	7,440.51
NL	Netherlands	1,009.40	UY	Uruguay	12,286.37
NO	Norway	502.69	UZ	Uzbekistan	4,141.06
NP	Nepal	6,223.75	VC	St Vincent	8,018.46
NZ	New Zealand	17,389.62	VE	Venezuela	8,692.38
OM	Oman	5,162.00	VG	British Virgin Is.	7,718.33
PA	Panama	9,511.23	VN	Viet Nam	8,727.68
PE	Peru	11,219.56	YE	Yemen	5,474.30
PF	French Polynesia	15,277.91	YU	Serbia & Montenegro	1,686.69
PH	Philippines	9,639.51	ZA	South Africa	9,838.57
PK	Pakistan	5,294.92	ZM	Zambia	8,207.19
RO	Romania	1,640.88	ZW	Zimbabwe	8,722.59
RU	Russian Federation	2,081.84		**Total countries**	**165**

Source: Gravity dataset obtained from CEPII.

* Measured as kilometers from Sweden using major cities of each country as weight.

7.2 Variable description

Variable	Description	Source	Expected Sign
Volume	Export volume	Statistics Sweden	-
GDP	Gross Domestic Product of destination country (in log).	CEPII	+
Distance	Weighted distance as measured in km. from Sweden, calculated using great circle distance between major cities as weight (in log).	CEPII	-
GDP per capita	GDP per capita of destination country (in log).	CEPII	+/-
Contiguity	Dummy taking value of 1 if the destination country shares border with Sweden and 0 otherwise.	CEPII	+
Landlocked	Dummy taking value of 1 if the destination country does not have coastal line.	CEPII	-
English	Dummy taking value of 1 if one of the official languages in the destination country is English.	CEPII	+
Value-Added	Firm's value-added at year end. Used as ratio per employee in the regression (in log).	Statistics Sweden	+
Human Capital	Fraction of employees graduated at university level.	Statistics Sweden	+/-
Employees	Number of employees at year end (in log).	Statistics Sweden	-
Import Dummy Lag	Dummy taking value of 1 if the firm import from destination country a year before and 0 otherwise.	Author-generated from Statistics Sweden data	+

7.3 Participation of Swedish Exports

SNI	Industry	Producers	Exporters* (%)	Exported** (%)
15	Food products; beverages and tobacco	1296	18.9	17.57
16	Tobacco products	3	33.33	3.58
17	Textiles and textile products	380	41.84	18.58
18	Wearing apparel; dressing and dyeing of fur	102	51.96	26.6
19	Leather; luggage, handbags, and footwear	65	58.46	19.98
20	Wood and wood products except furniture	1540	31.75	25.32
21	Pulp, paper and paper products	218	78.44	31.96
22	Publishing, printing and reproduction of recorded media	1958	18.74	5.03
23	Coke, refined petroleum products and nuclear fuel	16	56.25	49.21
24	Chemicals, chemical products and man-made fibres	308	75	32.24
25	Rubber and plastic products	718	58.91	23.15
26	Other non-metallic mineral products	401	39.9	18.14
27	Basic metals	226	64.6	35.07
28	Fabricated metal products except machinery	4272	27.88	16.04
29	Machinery and equipment n.e.c.	2069	48.53	29.55
30	Office machinery and computers	90	36.67	34.4
31	Electrical machinery and apparatus n.e.c.	527	49.91	21.03
32	Radio, television and communication equipment and apparatus	192	45.83	31.05
33	Medical, precision and optical instruments, watches and clocks	747	37.88	36.77
34	Motor vehicles, trailers and semi-trailers	366	59.56	26.15
35	Other transport equipment	353	36.26	28.54
36	Furniture; manufacturing n.e.c.	859	45.52	18.27
	Average	**759**	**46.19**	**24.92**

* Exporters' share of total number of producers.
** Average share of exports per total firm's sales.
Source: Statistics Sweden, author's calculation.

References

[1] JaeBin Ahn, Amit K. Khandelwal, and Shang-Jin Wei, *The role of intermediaries in facilitating trade*, Journal of International Economics **84** (2011), no. 1, 73–85.

[2] Takeshi Amemiya, *Advanced econometrics*, Harvard University Press, 1985.

[3] James E. Anderson, *A theoretical foundation for the gravity equation*, The American Economic Review **69** (1979), no. 1, 106–116.

[4] James E. Anderson and Eric van Wincoop, *Gravity with gravitas: A solution to the border puzzle*, The American Economic Review **93** (2003), no. 1, 170–192.

[5] ———, *Trade costs*, Journal of Economic Literature **42** (2004), no. 3, 691–751.

[6] B. Bernard Andrew, J. Bradford Jensen, and K. Schott Peter, *Importers, exporters, and multinationals: A portrait of firms in the u.s. that trade goods*, Tech. report, National Bureau of Economic Research, Inc, Jun 2005, NBER Working Papers.

[7] Costas Arkolakis, *Market penetration costs and the new consumers margin in international trade*, Working Paper 14214, National Bureau of Economic Research, August 2008.

[8] Richard Baldwin, *Hysteresis in import prices: The beachhead effect*, The American Economic Review **78** (1988), no. 4, pp. 773–785 (English).

[9] Richard Baldwin and Paul Krugman, *Persistent trade effects of large exchange rate shocks*, The Quarterly Journal of Economics **104** (1989), no. 4, pp. 635–654 (English).

[10] Richard Baldwin and Daria Taglioni, *Gravity for dummies and dummies for gravity equations*, National Bureau of Economic Research Working Paper Series **No. 12516** (2006).

[11] Jeffrey H. Bergstrand, *The gravity equation in international trade: Some microeconomic foundations and empirical evidence*, The Review of Economics and Statistics **67** (1985), no. 3, 474–481.

[12] Andrew B. Bernard, J. Bradford Jensen, and Robert Z. Lawrence, *Exporters, jobs, and wages in u.s. manufacturing: 1976-1987*, Brookings Papers on Economic Activity. Microeconomics **1995** (1995), 67–119.

[13] Martijn J. Burger, Frank Van Oort, and Gert-Jan Linders, *On the specification of the gravity model of trade: Zeros, excess zeros and zero-inflated estimation*, SSRN eLibrary (2009).

[14] R. H. Coase, *The nature of the firm*, Economica **4** (1937), no. 16, 386–405.

[15] Peter Egger and Michael Pfaffermayr, *Structural estimation of gravity models with path-dependent market entry*, Tech. report, C.E.P.R. Discussion Papers, Jun 2011, CEPR Discussion Papers.

[16] Helpman Elhanan, *Chapter 7 increasing returns, imperfect markets, and trade theory*, vol. Volume 1, pp. 325–365, Elsevier, 1984.

[17] James J. Heckman, *Sample selection bias as a specification error*, Econometrica **47** (1979), no. 1, pp. 153–161 (English).

[18] D. Hummels, *Have international transportation costs declined?*, Working paper, Perdue University, July 1999.

[19] Pamina Koenig, Florian Mayneris, and Sandra Poncet, *Local export spillovers in france*, European Economic Review **54** (2010), no. 4, 622–641.

[20] Gert-Jan Linders and Henri L. De Groot, *Estimation of the gravity equation in the presence of zero flows*, SSRN eLibrary (2006).

[21] Mark J. Melitz, *The impact of trade on intra-industry reallocations and aggregate industry productivity*, Working Paper 8881, National Bureau of Economic Research, April 2002.

[22] John Mullahy, *Heterogeneity, excess zeros, and the structure of count data models*, Journal of Applied Econometrics **12** (1997), no. 3, 337–350.

[23] James E. Rauch, *Trade and search: Social capital, sogo shosha, and spillovers*, NBER Working Papers 5618, National Bureau of Economic Research, Inc, June 1996.

[24] ———, *Networks versus markets in international trade*, Journal of International Economics **48** (1999), no. 1, 7 – 35.

[25] Mark J. Roberts and James R. Tybout, *An empirical model of sunk costs and the decision to export*, Policy Research Working Paper Series 1436, The World Bank, March 1995.

[26] Andrew K. Rose, *One money, one market: the effect of common currencies on trade*, Economic Policy **15** (2000), no. 30, 7–46.

[27] Joao Santos Silva and Silvana Tenreyro, *The log of gravity*, Tech. report, C.E.P.R. Discussion Papers, Oct 2005, CEPR Discussion Papers.

[28] Joachim Wagner, *From estimation results to stylized facts twelve recommendations for empirical research in international activities of heterogeneous firms*, De Economist **159** (2011), no. 4, 389–412.

[29] Oliver E. Williamson, *The economic institutions of capitalism : firms, markets, relational contracting*, Free Press ; Collier Macmillan, New York London, 1985, 27.50 (Oliver Eaton), Oliver E. Williamson. ill ; 25cm. Bibliography: p409-436. - Includes index.

[30] ———, *The theory of the firm as governance structure: From choice to contract*, The Journal of Economic Perspectives **16** (2002), no. 3, pp. 171–195 (English).