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# Why is Exporting Hard in Some Sectors?


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Abstract

This paper models the market entry cost of exporters as dependent on the size of the export market as well as on sector specific factors. We introduce these features in a Melitz trade model with heterogeneous firms. The predictions of our model are tested using Swedish and Japanese firm level data. We find that sector level advertising or sales promotion intensity is an important component of the market entry cost. A larger market size, if anything, lowers entry costs.

*Keywords*: Heterogeneous firms, Market size, Market entry costs
*JEL classification*: D21, F12, F15



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# 1 Introduction

It is empirically well established that exporting firms tend to be more productive, larger, and endure longer than domestic firms; see Tybout (2003) for a survey.[1] One of the proposed reasons for this is the costs of entering a foreign market. The purpose of this paper is to investigate the nature of market entry costs. We employ a heterogeneous firms and trade model a la Melitz (2003), where the market entry cost is modelled as having a fixed and a variable part as well as a sector specific component.

While the standard models of heterogeneous firms employ a fixed and exogenous market entry cost, Arkolakis (2010) proposes a model with an endogenous market entry cost. He uses a model of advertising where the probability that an advertising message is received by one consumer increases with the size of the population. Thus, a firm gets a relatively larger payoff for a small investment in marketing when exporting to larger countries. The marginal exporter that is just sufficiently productive to export will therefore prefer to export to a large rather than to a small market. A small firm will therefore find it easier to enter a large market, and this is consistent with the empirical observation by e.g. Eaton, Kortum, and Kramarz (2005) that show that many small firms typically export a small amount to large markets.

As in Arkolakis (2010), we allow the market size to affect entry costs, but while a large market may be easier to enter because it is easier to find consumers that match a particular product, it may also be the case that it is more difficult to enter a large market e.g. due to higher advertising requirements. Our specification allows for both these possibilities. We also model the market entry cost as a product group or sector dependent. It may e.g. require more marketing to establish a branded consumer good, such as soft drinks or clothes, in a foreign market than to establish a more standardised product.

We test the predictions of our model using data on Swedish firm level export to Japan combined with Japanese firm level data. We use the Japanese data to calculate market specific advertising outlays, sales promotion and firm sales. We also have sector level data for tariffs. Our empirical part support the notion that higher average adverting outlays at the sector level makes it more difficult to enter a foreign market. A larger market size, if anything, makes it easier to enter a market. However, this effect is not significant in the regressions.

The paper is organized as follows: Section 2 contains the model. Section 3 contains empirical tests. Finally, section 4 concludes the paper.

# 2 The Model

This paper introduces a formulation of the market entry cost that is sector and market specific in a multisector version of Melitz (2003) monopolistic competition trade model with heterogeneous firms.

[1] Other studies include Aw, Chung, and Roberts (2000), Bernard and Jensen (1995, 1999a, 1999b) Clerides, Lach, and Tybout (1998) as well as Eaton, Kortum, and Kramarz (2004).

## 2.1 Basics

There are two countries (Home and Foreign) and multiple sectors. The A-sector (traditional sector) is a Walrasian, homogeneous-goods sector with costless trade. There is also a continuum of M-sectors (manufactures) marked by increasing returns, Dixit-Stiglitz monopolistic competition and iceberg trade costs. M-sector firms face constant marginal production costs and three types of fixed costs. Each country has a single primary factor of production labour, $L$, used in each sector. For simplicity, there is no comparative advantage across the M-sectors. All manufacturing sectors have an identical structure but final demand for each sector differs.

Firms in the manufacturing sectors are heterogeneous a la Melitz(2003). In essence, there is heterogeneity with respect to firms' marginal costs. Each Dixit-Stiglitz firm/variety is associated with a particular labour input coefficient – denoted as $a_i$ for firm $i$. After sinking $F_E$ units of labour in the product innovation process, the firm is randomly assigned an '$a_i$' from a probability distribution G($a$). On the other hand there are three types of fixed costs. The first fixed cost, $F_E$, is the standard Dixit-Stiglitz cost of developing a new variety. The second and third fixed costs are 'beachhead' costs reflecting the one-time expense of introducing a new variety into a market. These costs are here assumed to depend on the size of the market.

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

All individuals have the utility function

$$U_j = \mu_0 \ln C_A + \int_{j\in\Theta} \mu_j \ln C_{Mj} dj \tag{1}$$

where $\Theta$ is the set of manufacturing sectors, $\int_{j\in\theta} \mu_j dj = 1 - \mu_0$, and $C_A$ is consumption of the homogenous good. Each manufacturing sector $j$ enters the utility function through the index $C_{Mj}$, defined by

$$C_{Mj} = \left[ \int_0^{N_j} c_{ij}^{(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)}, \tag{2}$$

$N_j$ being the mass of varieties consumed in sector $j$, $c_{ij}$ the amount of variety $i$ consumed in sector $j$, and $\sigma > 1$ the elasticity of substitution. Each consumer spends a share $\mu_j$ of his income on sector $j$, and demand for a variety $i$ in sector $j$ is therefore

$$x_{ij} = \frac{p_{ij}^{-\sigma}}{P_j^{1-\sigma}} \mu_j Y, \tag{3}$$

where $p_{ij}$ is the consumer price of variety $i$ in sector $j$, $Y$ is income, and $P_j \equiv \left( \int_0^{N_j} p_{ij}^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}$ the price index of manufacturing goods in sector $j$.

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

$$p_A = w = 1; \tag{4}$$

$w$ being the nominal wage of workers in all countries.

Shipping the manufactured good involves a frictional trade cost of the "iceberg" form: for one unit of a good from one country to the other, $\tau > 1$ units must be shipped. It is assumed that trade costs are equal in both directions and that $\tau = 1$. Profit maximization by a manufacturing firm $i$ leads to consumer price $p_i = \frac{\sigma}{\sigma-1}\tau a_i$.

Manufacturing firms draw their marginal cost, $a$, from the probability distribution $G(a)$ after having sunk $F_E$ units of labour to develop a new variety. Having learned their productivity, firms decide on entry in the domestic and foreign market, respectively. Firms will enter a market as long as the operating profit in this market is sufficiently large to cover the beachhead (market entry) cost associated with the market. Because of the constant mark-up pricing, it is easily shown that operating profits equal sales divided by $\sigma$. Using this and (3), the critical 'cut-off' levels of the marginal costs in sector j are given by:

$$a_{Dj}^{1-\sigma} B_j = F_d(D_j), \tag{5}$$

$$a_{Xj}^{1-\sigma} \phi B_j^* = F_x(D_j^*), \tag{6}$$

where $D_j$ ($D_j^*$) is Home (Foreign) demand in sector $j$, i.e. $D_j \equiv \mu_j L$ and $\phi \equiv \tau^{1-\sigma} \in [0,1]$ represents trade freeness. $B_j \equiv \frac{D_j}{\sigma \Delta_j}$ represents market potential where $\Delta_j \equiv (\frac{\sigma-1}{\sigma})^{1-\sigma} P^{1-\sigma}$. The market entry cost (beachhead cost) is assumed to depend on the demand size, and we will parametrize this dependence below. However, note that it is natural that the beachhead costs $F$s are sector specific. For example, branded consumer goods may require more marketing than raw materials.

Finally, free entry ensures that the ex-ante expected profit of developing a new variety in sector $j$ equals the investment cost:

$$\int_0^{a_{Dj}} \left(a^{1-\sigma} B_j - F_d(D_j)\right) dG(a) + \int_0^{a_{Xj}} \left(\phi a^{1-\sigma} B_j^* - F_x(D_j^*)\right) dG(a) = F_E. \tag{7}$$

## 2.2 Solving for the Long-run Equilibrium

First, our model is two-country with multiple sectors but the model is solvable in terms of a representative sector since the sector level expenditure shares, $\mu_j$, are fixed . We focus on one of Manufacturing sectors. Without loss of generality we drop subscript $j$, since sectors are mirror images. Second, we follow Helpman, Melitz, and Yeaple (2004) in assuming the probability density function to be a Pareto distribution, which a cumulative density function given by[2]:

$$G(a) = \left(\frac{a}{a_0}\right)^{\theta}. \tag{8}$$

where $\theta$ is shape parameter and the scale parameter, $a_0$, is normallised as unity. Substituting the cut-off conditions (5) and (6) into the free-entry condition (7) gives $B$,

$$B = \frac{1}{\sigma}\left(\frac{F_E F_d^{\beta-1}(D)\cdot(\beta-1)\,(1-\Omega(D^*))}{1-\Omega(D)\Omega(D^*)}\right)^{\frac{1}{\beta}}, \tag{9}$$

where $\beta \equiv \frac{\theta}{\sigma-1} > 1$, and $\Omega(D) \equiv \phi^{\beta}\left(\frac{F_x(D)}{F_d(D)}\right)^{1-\beta} \in [0,1]$ is a measure of openness (See Baldwin and Forslid (2010)). Using (9) and the cut-off conditions gives the cut-off marginal costs:

$$a_D^{\theta} = \frac{(\beta-1)\,F_E}{F_d(D)}\left(\frac{(1-\Omega(D^*))}{1-\Omega(D)\Omega(D^*)}\right), \tag{10}$$

$$a_X^{\theta} = \frac{(\beta-1)\,\Omega(D^*)F_E}{F_x(D^*)}\left(\frac{(1-\Omega(D))}{1-\Omega(D)\Omega(D^*)}\right). \tag{11}$$

From these, it is seen that, contrary to the standard model by Melitz (2003), the market size will affect the cut-off marginal costs. We will assume that $F_X\,(D^*)\,\frac{\frac{1}{\Omega(D^*)}-1}{1-\Omega(D)} > F_D\,(D)$ for all sectors $j$.[3] This assumption implies that $a_X < a_D$.

$\Delta$ may be written as

$$\Delta = \frac{\beta}{\beta-1}\left(n a_D^{1-\sigma} + n^*\phi a_D^{*(1-\sigma)}\left(\frac{a_X^*}{a_D^*}\right)^{\theta+1-\sigma}\right), \tag{12}$$

and the mass of firms in each country can be calculated using (9), (10), and (11) together with the fact that $B = \frac{D}{\sigma\Delta}$:

$$n = \frac{(\beta-1)}{F_d(D)\beta}\frac{D\,(1-\Omega(D)) - D^*\Omega(D)\,(1-\Omega(D^*))}{(1-\Omega(D)\Omega(D^*))\,(1-\Omega(D))}. \tag{13}$$

Welfare may be measured by indirect utility, which is proportional to the real wage $\frac{w_j}{\int \mu \ln P^{\mu}}$. It suffices to examine $P_j$. Using (10), (11), (12), and (13), we have

$$P = (\frac{\sigma}{\sigma-1})\left(D^{-\beta}F_d^{\beta-1}(D)F_E\,(\beta-1)\cdot\frac{1-\Omega(D^*)}{1-\Omega(D)\Omega(D^*)}\right)^{\frac{1}{\beta(\sigma-1)}}. \tag{14}$$

This expression shows that, as in the Melitz (2003) model, welfare always increases ($P$ decreases) with trade liberalization; that is, with a higher $\phi$ or a lower $\frac{F_X(D^*)}{F_D(D)}$.

[2]This assumption is consistent with the empirical findings by e.g. Axtell (2001).

[3]The corresponding condition in Melitz (2003) is that $\frac{F_X}{\phi} > F_D$.

### 2.3 Parametrisation of the market entry cost

In the following, we parametrise the sector level market entry costs as:

$$F_{dj}(D) \equiv \alpha_j \left( f_d + D_j^{\gamma} \right), \quad F_{xj}(D^*) \equiv \alpha_j \left( f_x + D_j^{*\gamma} \right), \quad \alpha_j > 0, \quad \gamma \lesseqgtr 0. \tag{15}$$

The variable component of the beachhead cost is dependent on market size, while the constant terms picks up costs that are independent of market size. It is quite natural that the beachhead cost would have one fixed and one variable component. The constant $f$ represents the fixed cost of standardizing a product for a particular market or the cost of producing an advertisement tailored to a particular market with its culture and language. We assume that these costs are larger when a firm enters a foreign market: $f_X > f_D$. The variable cost term $D_j^{\gamma}$ represents the fact that the cost of entry depends on the demand (market size), $D_j$, in each sector $j$. $\gamma > 0$ implies that the cost of entry increases in the size of the market. For instance, because the number of free product samples or advertising posters increases in the size of the market. $\gamma < 0$ implies that the cost of entry decreases in the size of the market. This may be e.g. because it is more likely that at least some consumers buy your product in a large market (Arkolakis (2010)). The sign of $\gamma$ may depend on the type of product, but as in previous studies, data only allows us to identify the sector level average $\gamma$ in the empirical part below.

Finally, the sector specific parameter $\alpha_j$ represents the possibility that market entry costs differ among different product groups or sectors. Branded consumer goods may e.g. require more more marketing than standardised inputs or raw materials.

### 2.4 Export cutoffs and the foreign market

The cut-off marginal cost of an exporter in sector $j$ is from (11) given by

$$a_{Xj}^{\theta} = \frac{(\beta - 1) F_E}{F_x(D_j^*)} \left( \frac{(1 - \Omega(D_j))}{\frac{1}{\Omega(D_j^*)} - \Omega(D_j)} \right). \tag{16}$$

Substituting in the market entry cost for the foreign market from (15) gives

$$a_{Xj}^{\theta} = \frac{(\beta - 1) F_E}{\alpha_j \left( f_x + D_j^{*\gamma} \right)} \cdot \left( \frac{(1 - \Omega(D_j))}{\left( \frac{f_x + D_j^{*\gamma}}{f_d + D_j^{*\gamma}} \right)^{\beta - 1} \phi^{-\beta} - \Omega(D_j)} \right). \tag{17}$$

A first result, which can be seen directly from the expression, implies that the export cut-off is tougher in markets with a high $\alpha_j$.

Proposition 1 *The cut-off productivity of exporters increases in $\alpha_j$.*

*Proof:* The result follows directly from (17).■

The effect of the foreign market size, , $D^*$, is given by the following proposition

Proposition 2 *The cut-off productivity of exporters increases in $D^*$ if $\gamma > 0$ and decreases in $D^*$ if $\gamma < 0$ given that $f_X > f_D$.*

*Proof:* See Appendix.

We now turn to data to test these predictions.

# 3 Empirics

Our theory should in principle be tested using cross country firm level data. However, such data is hard to find. There would in any case be a problem of unobserved heterogeneity among countries that makes it difficult to establish the source of varying entry costs. We therefore here use Swedish firm level export to one country, where each sector is considered a separate market. We use Swedish export to Japan combining Swedish firm level data with Japanese data. Sweden is one of the most successfully export countries in the world, and most Swedish firms are exporters. On the other hand, Japan is one of the most closed economies, with a market that is difficult to penetrate for foreign firms. Furthermore, there is a substantial physical and cultural distance between Sweden and Japan, and we therefore expect fixed market entry costs to be relatively important for Swedish exports to Japan.

## 3.1 Data

We use manufacturing census data for Sweden. The census data contain information on a large number of variables such as export (tSEK), employment (number of employees), capital stock (tSEK), use of raw materials (tSEK), value added and production value (tSEK) at the firm level from 2000-2007. We can therefore calculate firms level productivity as the residual from sector-specific production functions estimated by the Levinson Petrin method.

We have information about the Japanese market from two data sources. One is sectoral aggregation from firm level data, entitled the Results of the Basic Survey of Japanese Business Structure and Activities (*Kigyou Katsudo Kihon Chosa* in Japanese) of year 2005 from Ministry of Economy, Trade and Industry of Japan (METI). This dataset provides information on the activities and organisation for all Japanese firms with more than 50 employees and a capital of more than 30 million yen. The sample includes not only Japanese firms (i.e. domestic firms) but also foreign owned firms, which is defined as firms with a foreign ownership of more than 33 percent. We aggregate this firm level data to the 3-digit sector level. The other data source is the Japanese Industrial Productivity Database (JIP data) prepared by the Research Instutute of Economy, Trade and Industry (RIETI). This dataset contains sectoral information about the Japanese market (108 sectors in agriculture, mining, manufacturing and service). We calculate the sales promotion ratio and the advertising cost ratio at the sectoral level, using sales promotion costs, advertisement expenditure and total sales from the Results of the Basic Survey of Japanese Business Structure and Activities dataset. It is possible that the advertising and marketing requirements differ among foreign and domestic firms in Japan, and we therefore both use the average sales promotion of foreign firms in Japan by sector and a measure of advertising per sales for all firms. From the JIP data we use data on demand and tariff rates at the sectorial level. Finally, we match these sectoral variables to the Swedish data.

### 3.2 Results

Consider first the relationship between the marketing intensity in a market and exporter productivity. We use the advertising ratio (advertising per sales) as well as the sales promotion ration (sales promotion per sales) as measures of marketing intensity. The main difference being that the sales promotion data is collected only among foreign firms in Japan, whereas the advertising ratio is for all firms in the market. We have estimated firm productivity using the Levinson Petrin method. To have an impression of the importance of the marketing intensity of a market for the productivity of exporters we divide the markets (sectors) into two groups: those above and those below the mean advertising ratio (advertising per sales) and those above and below the mean sales promotion ratio. We then make a kernel density plot for exporters belonging to the two groups of exporter. Figure 1 shows how the entire productivity distribution of exporters to markets with intense advertising or sales promotion is shifted to the right compared to exporters to the less marketing intensive markets. This pattern is present for both measures of marketing costs.

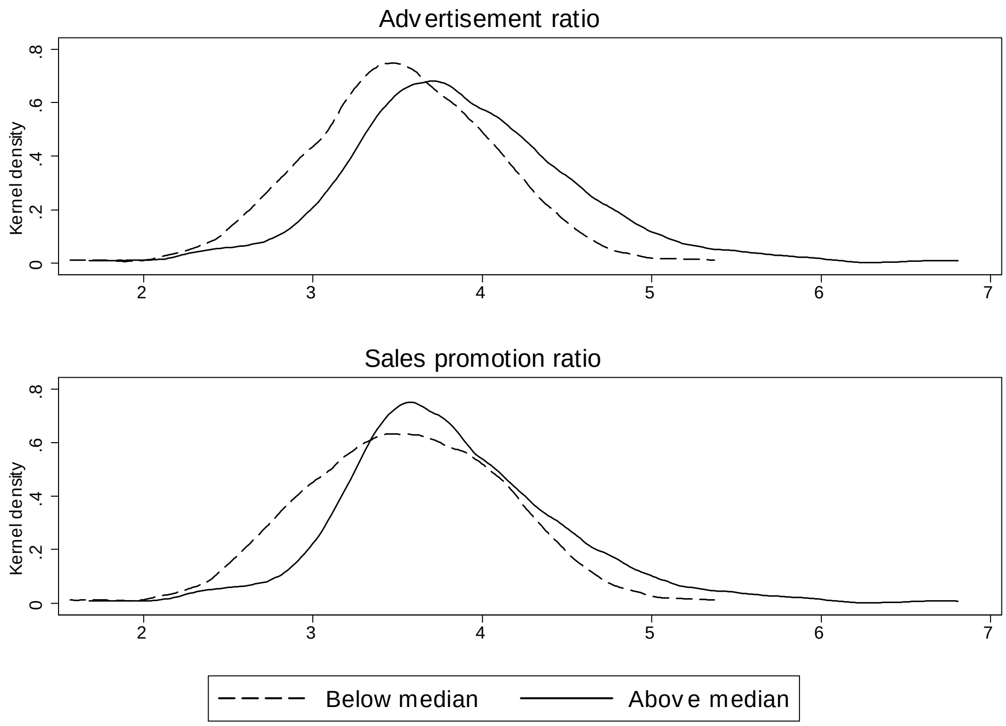


Figure 1: Productivity distributions of Swedish exporters to Japan.

Turning to sector level averages, Figure 2 and Figure 3 plot our two measures of marketing intensity against sector average exporter productivity. Both figures show a marked positive relationship between exporter productivity and the market intensity in a market. A very similar pattern emerges when plotting productivity calculated at the 3-digit sector level as shown in Appendix. The pattern of Figure 2 and Figure 3 is consistent with Proposition 1: the exporting cut-off productivity being higher in markets with a higher marketing intensity ($\alpha_j$).

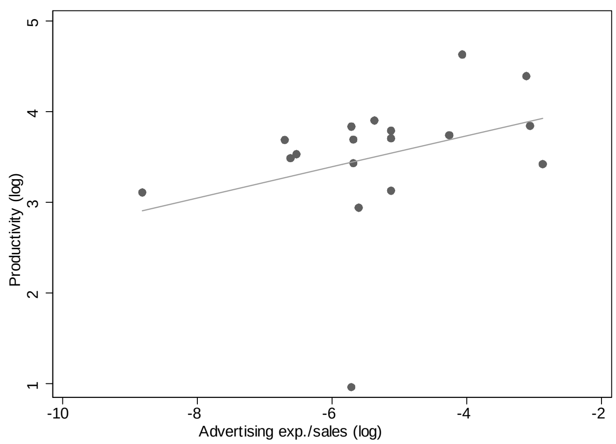


Figure 2: Advertising intensity and exporter productivity.

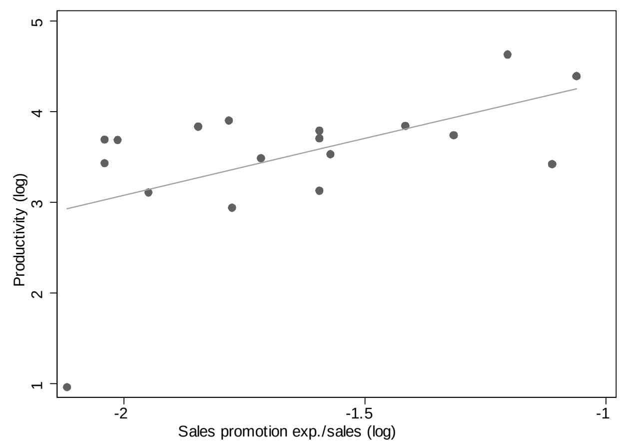


Figure 3: Sales promotion intensity and exporter productivity.

We turn to next to the effect of the size of the export market. Figure 4 plots the size (demand) of Japanese sectors against the average productivity of the exporters.

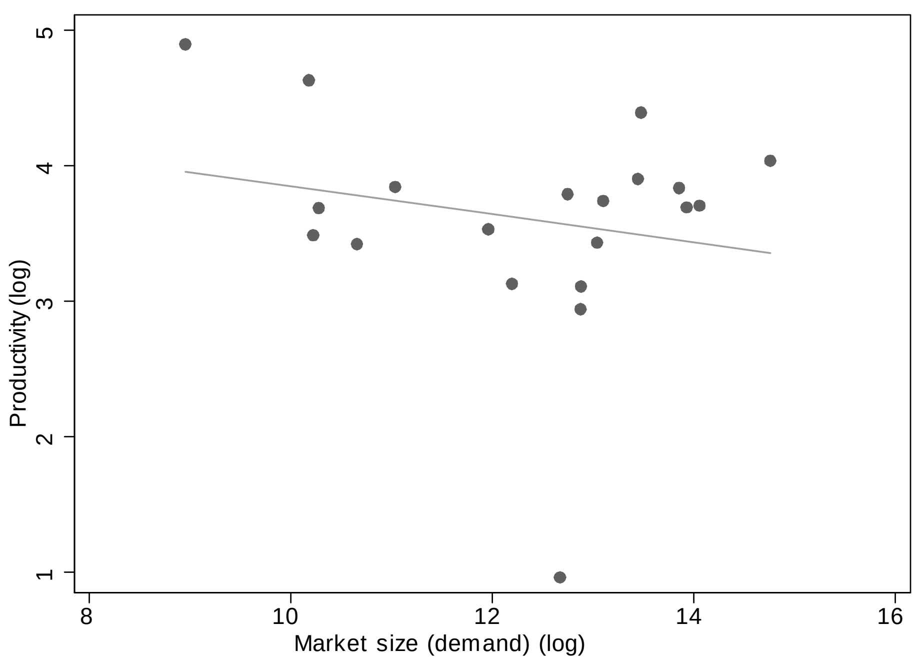


Figure 4: Market size and exporter productivity.

Figure 4 shows a negative relationship between average productivity and market size (a negative $\gamma$). That is, this pattern is consistent with entry costs being lower in large markets, as proposed by Arkolakis (2010). However, the relationship between exporter productivity and market size will not turn out significant in the regressions below.

Finally, Table 1 shows a set of regressions with exporter productivity as the dependent variable. We use sector level demand and average sector level tariffs as controls alongside with our two measures of marketing intensity. We show regressions with and without clustering at the sector level, as well as one regression where the data has been collapsed by sector. In particular sales promotion per sales by foreign firms in Japan has a very strong and significant effect on average exporter productivity. Also advertising per sales averaged over all firms in a sector has a significant effect in two of the three regressions. The point estimate at the sectoral regression in (3) is larger than in the firm level regression but we lack the precision to estimate it with statistical significance.

Table 1: Regressions results

| Dependent variable: | Productivity (log) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Advertisement ratio (log) | 0.110*** | 0.110* | 0.177 | | | |
| | (0.0183) | (0.0593) | (0.140) | | | |
| Sales promotion ratio (log) | | | | 0.476*** | 0.476* | 1.333** |
| | | | | (0.0812) | (0.255) | (0.555) |
| Demand (log) | -0.0275 | -0.0275 | -0.0204 | -0.0113 | -0.0113 | 0.0493 |
| | (0.0170) | (0.0734) | (0.157) | (0.0180) | (0.0692) | (0.144) |
| Tariff (log) | 0.128 | 0.128 | -0.0975 | 0.178** | 0.178 | -0.195 |
| | (0.0833) | (0.299) | (0.586) | (0.0817) | (0.279) | (0.508) |
| Observations | 785 | 785 | 18 | 785 | 785 | 18 |
| R-squared | 0.06 | 0.06 | 0.115 | 0.06 | 0.06 | 0.30 |
| Clustered standard errors | NO | YES | NO | NO | YES | NO |

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

## 4 Conclusion

This paper has introduced a market and sector dependent market entry or beachhead cost in the heterogeneous firms and trade model of Melitz (2003). We model this cost as having one variable component that depends on the market size, and one fixed component. The fixed component could e.g. be interpreted as the cost of standardizing a product for a particular market, while the variable cost term e.g. represents the fact that the advertising cost of introducing a new product may depend on the size of the market (the number of consumers). We do not put any restriction on the effect of the market size. A larger market may be easier to enter because it is easier to find consumers for a particular product, or it may be harder to enter due to higher costs of e.g. sampling. We also introduce a sector specific component in the formulation of the market entry cost. This component picks up sector level differences e.g. in advertising intensity.

In essence we make a relatively small change to the framework of Helpman, Melitz, and Yeaple (2004), which preserves the analytical solvability of the model.

We combine Swedish firm level data with Japanese data to test the predictions of the model. The empirical part suggests that exporting is harder when there is a high advertising intensity in the export market. If anything, we find a negative relationship between exporter productivity and size of the export market, but this effect is not significant in the regressions.

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# 5 Appendix

## 5.1 Proof of proposition 2

Taking logs of (11) gives

$$\ln a_{Xj} = \frac{1}{\theta}\{\ln((\beta-1)\,F_E)(1-\Omega(D_j)) - \ln(F_x(D_j^*)) - \ln(\frac{1}{\Omega(D_j^*)} - \Omega(D_j))\}.$$

Differentiation of $\ln a_X$ in terms of $D^*$gives

$$\frac{d\ln a_X}{dD^*} = -\frac{1}{\theta F_x(D_j^*)}\frac{dF_x(D^*)}{dD^*} + \frac{1}{\theta(\frac{1}{\Omega(D_j^*)} - \Omega(D_j))}\left(\frac{1}{\Omega(D_j^*)}\right)^2\frac{d\Omega(D^*)}{dD^*}.$$

To sign this expression note first that

$$\begin{aligned}\frac{dF_x(D^*)}{dD^*} &> 0 \text{ for } \gamma > 0 \\ \frac{dF_x(D^*)}{dD^*} &< 0 \text{ for } \gamma < 0,\end{aligned}$$

from the definition of $F_x$.

Next, to determine the sign of $\frac{d\Omega(D^*)}{dD^*}$ we take the logarithm of $\Omega(D^*)$:

$$\ln\Omega(D^*) = (1-\beta)\ln(f_x + D_j^{*\gamma}) - (1-\beta)\ln(f_d + D_j^{*\gamma}) + \beta\ln\phi.$$

Differentiation w.r.t. $D^*$ gives

$$\frac{d\ln\Omega(D^*)}{dD^*} = (1-\beta)\gamma D^{*\gamma-1}\left(\frac{1}{f_x + D_j^{*\gamma}} - \frac{1}{f_d + D_j^{*\gamma}}\right)$$

Given the assumption that $f_x > f_d$ we have:

$$\begin{aligned}\frac{d\ln\Omega(D^*)}{dD^*} &< 0 \text{ for } \gamma > 0 \\ \frac{d\ln\Omega(D^*)}{dD^*} &> 0 \text{ for } \gamma < 0\end{aligned}$$

Combining these results gives

$$\begin{aligned}\frac{d\ln a_X}{dD^*} &< 0 \text{ for } \gamma > 0 \\ \frac{d\ln a_X}{dD^*} &> 0 \text{ for } \gamma < 0.\end{aligned}$$

■

## 5.2 Exporter productivity and the intensity of marketing

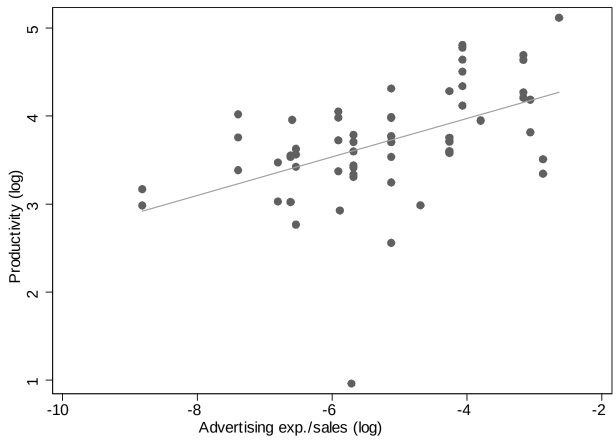


Figure 2b: Advertising intensity and exporter productivity at the 3-digit level.

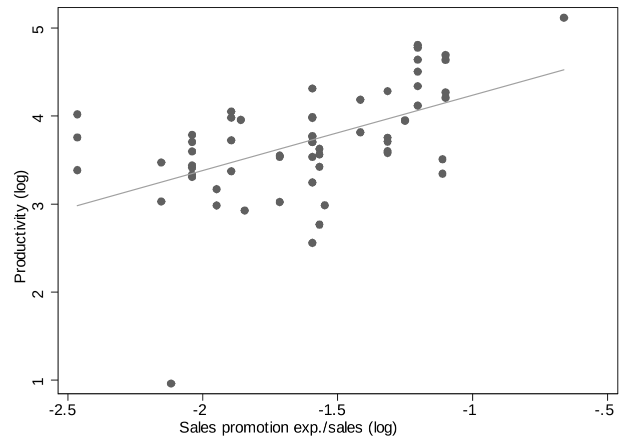


Figure 3b: Sales promotion intensity and exporter productivity at the 3-digit level.