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Abstract
Firms may face substantial fixed and sunk costs when entering an export market. Whereas previous studies have focused on global or country-specific sunk export costs, this study analyses the importance of market-specific sunk export costs as well as the impact of market-specific versus country-specific sunk export costs. We distinguish between sunk and fixed costs by analysing the decision to enter new markets separately from the decision to stay in existing markets. Market-specific fixed and sunk export costs are affected by various kinds of learning and spillover effects. We use firm-level panel data for Norwegian seafood exports distributed on products and countries. The results lend support to the existence of market-specific sunk costs, learning and spillovers

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1. Introduction

Recent years have seen the emergence of a literature which incorporates fixed or sunk export costs in models of international trade. This literature shows that, in the presence of such costs, not all firms export (see Melitz, 2003 or also Medin, 2003 for a model with homogeneous firms). Additionally, several empirical studies, using firm-level data to study persistence in export behaviour, find evidence of sunk export costs (see e.g., Roberts and Tybout, 1997 and Bernard and Jensen, 2004). These studies focus on a firm's decision of whether or not to export as such, but most firms only export a few products to a few countries. This may indicate that part of the sunk export cost is market-specific (defining 'market' as the market for a particular product in a particular country).[1] Analysing only the export decision as such will then misrepresent sunk export costs, as it cannot distinguish entry into one export market from entry into several markets.

Some recent contributions focus on how firm-level export develops in different markets along extensive and intensive margins (see Mayer and Ottaviano, 2008; Bernard *et al*., 2011a). But only a few studies have investigated the importance of country-specific sunk export costs,[2] and, to our knowledge, no studies have investigated the importance of *market*-specific sunk export cost. This is important because not taking market-specific sunk export costs into account will overestimate the importance of country-specific or global sunk export costs.

Models of global sunk export costs can explain how temporary export-promotion policies or macro-shocks (such as exchange-rate fluctuations) may have persistent effects on aggregated trade flows (see Baldwin, 1988; Baldwin and Krugman 1989; Dixit, 1989). If market specific sunk costs are important, temporary shocks may have persistent effect also on the number of trading partners or traded products. Further, persistence will be higher in markets with large sunk costs.

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1 See e.g., Helpman *et al*. 2008; Chaney, 2008 for models of country-specific sunk export costs and Bernard *et al.,* 2011b for a model of country- and product- specific sunk export costs. In the presence of such costs, only the large and most productive firms find it profitable to export many products to many countries.

2 Meinen (2012) estimates the importance of country-specific sunk costs. Moxnes (2010) demonstrates that both country-specific *and* global sunk export costs should be taken into account, otherwise, estimates of the effect of the latter will be biased. Evidence in Gullstrand (2011) suggests that country-specific sunk export costs vary with firm characteristics. Morales *et al*. (2011) estimate the magnitude of country-specific sunk export costs. Ottaviano and Martincus (2011) and Blanes *et al*. (2008) investigate the importance of region-specific sunk export costs in two and three regions, respectively.

Thus, knowledge about market-specific sunk export costs may have consequences for various types of export-promotion policies.[3]

The first aim of this article is to study the importance of market-specific sunk export costs. We use a panel dataset of all seafood exporters in Norway in the period 1996 to 2007. Norway is one of the world's largest exporters of seafood, with an annual export value of 35.7 billion NOK in 2007 (approx. 7.28 billion USD). The industry is highly internationalized, with exports of a wide range of products to almost 200 countries; approximately 90 per cent of all Norwegian seafood production is exported.[4] The sector is therefore an interesting case for the study of international sales activity. Unlike earlier studies of sunk export costs, which focus on firms that produce what they export, our data include trading companies that buy all the seafood they export from other producers. Such firms constitute a significant part of all exporters, so including them is important for studying market-specific export.

We apply a random effects probit model to see whether previous presence in a particular export market increases the probability of exporting to that market in the current period. Our results support the existence of both market-specific and country-specific sunk costs; we also show how the former may be overestimated if the latter is not taken into consideration.

Our second aim is to study how learning and spillovers affect the magnitude of market-specific sunk and fixed export costs in a dynamic framework that includes lagged export status among the explanatory variables. Not many studies do this.[5] Further, most studies have focused on either learning or spillovers: but we include both in the same regression, as it is conceivable that both effects could influence sunk export costs at the same time.

Most empirical literature on learning has examined 'learning by exporting', i.e. whether export experience affects a firm's production costs (see Clerides *et al.*, 1998), but there is little evidence to support such effects (for a survey, see Wagner, 2007). However, export experience may reduce a firm's *export* costs rather than its production costs. Schmeiser (2012) develops a theoretical model where learning about exporting from other countries reduces firms' entry costs to a

3 Generally there is evidence of positive effects from export promotion policies. See Hiller (2012) for a good overview of the literature.
4 Figure based on information from the Norwegian Seafood Council
5 We know only of Gullstrand (2011) and Meinen (2012), who both focus on country-specific learning, not spillovers.

given country, denoting it 'learning to export', as opposed to 'learning by exporting'.[6]

In this article we allow for a range of 'learning to export' effects: intra- and inter-country as well as intra- and inter-product. We hypothesise that a firm's export costs to a particular market can be reduced due to export experience, whether from that same country or other countries (both within and between products). We find evidence of several 'learning to export' effects.[7]

Concerning spillovers, we hypothesise that knowledge acquired by other exporters may spill over to potential exporters and reduce their market-specific export costs. Such spillover effects can have important policy implications. Earlier empirical evidence is mixed regarding spillovers that reduce global sunk export costs.[8] If, on the other hand, market-specific spillovers are more important than global spillovers, then policies aimed at exploiting spillovers could benefit from focus on encouraging export to certain markets rather than exports in general. Further, firms targeting the same market would benefit from organizing themselves in 'exporting societies'.

Some recent studies have found support for the hypothesis that spillovers reduce country or market-specific export costs.[9] Most of these hypothesise that spillovers occur in the home country, from other exporters.[10] In line with a recent theoretical model presented in Krautheim (2012), we investigate spillovers from other exporting firms in the destination markets and not the home country, assuming there to be 'exporting societies' in the former. As for learning, we dis-

6 Arkolakis and Muendler (2011) find empirical support for a model where firms face market-specific sunk export costs that may decline with the number of products sold in a country. The authors do not discuss learning effects as such, but an obvious explanation for the mechanism described in the paper is "learning to export".

7 Some studies have used aggregated trade flows to investigate the impact of experience acquired in other export markets. See e.g. Nicita and Olarreanga (2000) or Evenett and Venables (2002). Some studies also examine how learning affects the probability of export to a particular country or market using firm-level data. See e.g. Fabling et al. (2011); Alvarez et al. (2010); Lawless (2011); Morales et al. (2011); Castagnino (2011); Gullstrand (2011) and Meinen (2012). These employ different learning variables from ours, and do not include such a rich variety of different effects. None of these distinguish between entering and continuing exporters within the same regression as we do, and all but Gullstrand (2011) and Meinen (2012) focus on entering firms only. Most of them also differ from ours in the econometric methods applied.

8 See e.g. Clerides *et al*. (1998) and Bernard and Jensen (2004) for dynamic frameworks; and Aitken *et al*. (1997); Greenaway *et al*. (2004); and Barrios *et al*. (2003) for static frameworks.

9 Requena and Castillo (2007), Koenig (2009) and Lawless (2011) find that spillovers affect country-specific export costs; while Alvarez et al. (2010), Koenig et al. (2010) and Fabling (2011) find that spillovers affect market-specific sunk export costs. While we use a dynamic model, that focus on firms continuing exporting to a given market as well as entrants, these either focus on entering firms only or use a cross sectional dataset (Requena and Castillo, 2007).

10 An exception is Lawless (2011), who finds that if there is a high number of national firms exporting to a country, this increases the probability that a firm will enter that country.

tinguish between inter- and intra-product spillovers, and find evidence of several effects.

As opposed to most other studies on learning and spillovers we include in the same regression discrete variables on firms' lagged *presence* in markets, capturing the extensive margin, and continuous variables on firms' lagged export *value* to markets, capturing the intensive margin. We show that it is important to include both margins in the same regression, because the extensive margin induces more learning and spillover effects than the intensive margin.

We allow exporting firms to face both fixed and sunk costs. These costs occur independently of exported volume, given that firms export, but sunk costs are entry costs that occur only once. Sunk costs introduce persistence in export behaviour, since staying in a market that is already served by a firm does not require additional sunk costs. Fixed costs on the other hand, occur for each period; they impact on the decision to stay in a market as well as on the decision to enter markets. Within the same regression, we distinguish effects on firms that enter new markets, which we interpret as affecting both sunk and fixed costs, from effects on firms that continue exporting in existing markets, which we interpret as affecting only fixed costs. This enables us to investigate how learning and spillovers affect sunk and fixed costs differently. To our knowledge, this study is the first to do so.
Our focus is twofold: to investigate the existence of market-specific sunk export costs, i.e. firm *i*'s costs of exporting product *v* to country *j;* and to investigate whether market-specific fixed and sunk export costs are reduced by learning and spillover effects. In section 3 we present some preliminary evidence for persistence and clustering. The regression results presented in section 4 further support the hypotheses of market-specific sunk costs, learning and spillovers, even after controlling for other possible explanations by including standard gravity variables and firm and product characteristics.

The remainder of this article is organized as follows: the next section presents the theoretical background for the estimation equation. Section 3 gives a more detailed presentation of the dataset we use, and other data used in the analysis. Results are presented in section 4, with concluding remarks offered in section 5.

2. Theoretical background

This section presents the theoretical background for our empirical specifications. It follows Roberts and Tybout (1997) in modelling firms' export decisions in the presence of sunk export costs. They construct a multi-period model of firms' export participation decisions. We consider export to a given market rather than exports in general or exports to a given country, and allow for both sunk and fixed costs.

We introduce several learning and spillover effects. In the model, a firm may learn from its export experience, both in the given export market and in other export markets. Further, spillovers occur from other firms in the destination country. In contrast to previous studies, we allow learning and spillovers to impact both on sunk costs and on fixed costs. We identify these effects by distinguishing between the decisions to enter new markets versus staying in existing markets.

2.1 Profits from exporting

There are many firms that export one or more products to one or more countries. Consider *market-specific export:* i.e. firm i's export of product v to country j. For each firm i in period t, the term $\pi^*_{ivjt}(\boldsymbol{p}_{vjt}, \boldsymbol{v}_{ivjt})$ denotes extra profits from exporting product v to country j. These are operating profits not adjusted for sunk cost of entering markets or for fixed costs for operating in a market. The vector $\boldsymbol{p}_{vjt}$ consists of variables that are exogenous for firms. It reflects product, country- and time-specific factors. $\boldsymbol{v}_{ivjt}$ is a vector of factors that are firm-specific. It includes firm size, experience and market position.

We assume constant marginal costs. This allows us to treat each firm's export volumes in each market independently. We also assume that the price received by firm i for product v in country j is independent of export activities in other markets ($v' \neq v$ and/or $j' \neq j$). We assume that any effects of other firms' export on the price received by firm i are external. In the appendix we describe how a profit function can be constructed on the basis of standard *CES* preferences, monopolistic competition, and constant marginal costs. In that case, the firm's operating profit is proportional to sales values in each market. Without sunk and fixed export costs, firm i will export product v to country j if $\pi^*_{ivjt} > 0$.

Each firm faces fixed costs of exporting any product v to any country j, M_{ivjt}, and sunk costs of entering a market, G_{ivjt}. These are assumed to depend on a set of learning and spillover effects described in detail below. If there are no sunk costs, firm i will export product v to country j in period t if $\pi^*_{ivjt} > M_{ivjt}$. Sunk costs, G_{ivjt}, occur only when the firm enters the market, not if it is already present there.

2.2 Market-specific sunk export costs

Future prices and costs, and hence profits in any future period, $t+s$, π^*_{ivjt+s}, are uncertain to the firm. If there are market-specific sunk export costs, the decision to export to the market today hinges on expected future profits. If the firm exits the market one year and then re-enters later, the full sunk cost recurs.[11] We define the variable y_{ivjt} as taking on the value of 1 if firm i exports product v to a country j in period t and 0 otherwise.

With market-specific sunk export costs, the single-period profit from exporting product v to county j becomes:

$$\pi_{ivjt}\left(y_{ivjt}\right) = \left[\pi^*_{ivjt} - \left(1 - y_{ivjt-1}\right)G_{ivjt} - M_{ivjt}\right]y_{ivjt} \qquad (1)$$

Equation 1 shows that in the presence of market-specific sunk export costs, previous export status will affect today's profit from exporting. Consequently, once in the market, the firm may find it profitable to continue exporting even if this yields negative profits in single periods, because the expected profits of exporting to the market in the future may be positive.[12] Since future profits are uncertain, at time t the firm chooses the infinite sequence of values $y^+_{ivjt} = \{y_{ivjt+s} | s \geq 0\}$ that maximizes the expected present value of current and future profits. Firm i's optimal export strategy is the y^+_{ivjt} that satisfies the Bellman equation:

$$V_{ivjt} = \max_{y^+_{ivjt}} \left(\pi_{ivjt} + \delta E_t\left(V_{ivjt+1}\left(\Omega_{it}\right) | \, y_{ivjt}\right)\right) \qquad (2)$$

E_t is an expectations operator conditioned on firm i's information set at time t, Ω_{it}, and δ is the discount rate in each period. Consequently V_{ivjt} is the value of the optimal strategy for firm i's export strategy for product v in country j in period t. A firm chooses to export in period t if the expected value of exporting exceeds the expected value of not

11 This assumption is made for simplicity. Other authors, such as Roberts and Tybout (1997), Bernard and Jensen (2004), Gullstrand (2011) and Meinen (2011), discuss the possibility that only part of the sunk costs recurs if the firm re-enters the market. Some authors also include exit costs in the theoretical formulation. Roberts and Tybout (1997) find that that most of the sunk cost must be repaid after one period of exit.

12 See Baldwin (1988), Dixit (1989) and Baldwin and Krugman (1989).

exporting. Using eq. 1, we see that export in this period will be positive ($y_{ivjt}>0$) if:

$$3 \quad \underbrace{\pi^{*}_{ivjt} + \delta\left[E_t\left(V_{ivjt+1}(\Omega_{it}) \mid y_{ivjt}=1\right) - E_t\left(V_{ivjt+1}(\Omega_{it}) \mid y_{ivjt}=0\right)\right]}_{\pi^{n}_{ivjt}} \geq \left(1-y_{ivjt-1}\right)G_{ivjt} + M_{ivjt}$$

Equation 3 shows that, in the presence of market-specific sunk export costs, the decision to export in period t depends on export status in period $t-1$. In the regression analysis, the effect of lagged export status on today's export decision is interpreted to indicate the importance of market-specific sunk export costs.

The left-hand side of eq.1.3 describes expected profits net of sunk and fixed export costs; this we denote π^{n}_{ivjt}.

Firm i therefore exports product v to country j in period t if:

$$y_{ivjt} = \begin{cases} 1 & \text{if } \pi^{n}_{ivjt} \geq \left(1\text{-}y_{ivjt\text{-}1}\right)G_{ivjt} + M_{ivjt} \\ 0 & \text{otherwise} \end{cases}$$

2.3 Learning and spillovers

The model includes several learning and spillover effects that may influence firm i's decision to export product v country j. Firm i may learn from past presence with other products in the same country ($y_{iv'jt-1}=1$); from the number of other countries it exports product v to ($\Sigma y_{ivj't-1}$); and from the number of other countries it exports all products to ($\Sigma y_{ij't-1}$). In addition there may be positive spillovers from the number of other exporters in country j, both for exporters of product v ($\Sigma y_{i'vjt-1}$) and for exporters of all products ($\Sigma y_{i'jt-1}$) $i'\neq i$, $v'\neq v$ and $j'\neq j$. There may also be additional learning and spillover effects from high *export value* in other markets or from other firms. See Section 4 and Appendix 2 for detailed descriptions of all learning and spillovers effects investigated in the regression analysis.

Several other studies have hypothesised that learning and/or spillovers affect sunk export costs.[13] We distinguish between effects on sunk costs and on fixed costs. Effects on sunk costs are present only for entrants, when past export experience is 0. (If $y_{ivjt-1}=1$, then $G_{ivjt}=0$, so no variables can reduce G_{ivjt} further.) Effects on fixed costs are present for both entrants and firms that exported to the market in the previous period, so that reduced M_{ivjt} has consequences also for already-

13 See e.g. Clerides et al. (1998), Koenig (2009), Koenig et al. (2010), Lawless (2011) and Fabling et al. (2011), on spillovers; and Lawless (2011) and Morales et al. (2011), on learning.

exporting firms. In other words, sunk costs are important for the decision to enter markets, whereas fixed costs also influence the decision to stay in a market. Consequently, we attempt to distinguish between the combined effect on fixed and sunk costs and on fixed costs alone by interacting learning and spillover variables with a categorical variable for the firm's presence in the market the year before (lagged export status). We therefore include both entrants and firms that exported to the market last year in the same regression, but allow learning and spillovers to affect two kinds of firms differently.

We allow G and M to depend on firm i's experience from other markets and on spillovers from other firms. The firm's decision is therefore to export if:

$$\pi^{n}_{ivjt} \geq \left(1\text{-}y_{ivjt\text{-}1}\right)G_{ivjt} + M_{ivjt} = \left(1\text{-}y_{ivjt\text{-}1}\right)\left(G^{0} - G^{L}y^{*}_{it-1} - G^{S}y^{*}_{i't-1}\right) + \left(M^{0} - M^{L}y^{*}_{it-1} - M^{S}y^{*}_{i't-1}\right), \quad i \neq i'$$

This can be reformulated as

$$\begin{aligned} &\pi^{n}_{ivjt} - G^{0} - M^{0} \geq -G^{0}y_{ivjt-1} - G^{L}\left(1 - y_{ivjt}\right)y^{*}_{it-1} \\ &- G^{S}\left(1\text{-}y_{ivjt\text{-}1}\right)y^{*}_{i't-1} - M^{L}y^{*}_{it-1} - M^{S}y^{*}_{i't-1}, \quad i \neq i' \end{aligned} \tag{4}$$

Above, G^0 and M^0 denote market-specific sunk and fixed costs that are independent of learning and spillovers from *other* markets. Nevertheless, if the firm learns through own export activities in the *same* market, M^0 may be reduced, and this effect cannot be separated from the effect of market-specific sunk costs. Effectively, these reductions in fixed costs due to learning are sunk costs. Both are captured by $y_{ivjt\text{-}1}$ in the regression analysis.

G^L and M^L denote the reductions in sunk and fixed costs due to firm i's experience from other markets (learning effects). These are specified to occur if firm i exported to any other market in the previous period. Firm i's activities in other markets are indicated by the vector $y^{*}_{it\text{-}1}$. This vector consists of an indicator for presence in the same country: $y_{iv'jt-1}$, $v' \neq v$; and a vector indicating presence in other countries with the same product or with any product: $y^{*}_{ij't-1}$, $j' \neq j$. Consequently, G^L and M^L are coefficient vectors. Other firms' activities are denoted with the vector $y^{*}_{i't\text{-}1}$, $i' \neq i$. G^S and M^S are therefore coefficient vectors for reductions in sunk and fixed costs because of spillovers.

2.4 The regression equation

In line with several other studies (e.g., Roberts and Tybout, 1997) we specify a reduced form of the latent variable π^n_{ivjt}-G^0-M^0. Therefore we do not specify the profit function but approximate it with an expression in exogenous firm, product, country and time variables and combinations of the four dimensions. Thus, we write

$$\pi^n_{ivjt} - G^0 - M^0 = \mathbf{z}_{ivjt}\boldsymbol{\eta} + e_{ivjt}$$

The vector **z** consists of variables that are specific to the firm, the product or country, or any combination of the three. These are captured by dummy variables and by other variables as described in section 4. e_{vijt} denotes noise. Based on eq. 1.4 we therefore specify the binary choice equation as:

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$$y_{ivjt} = \begin{cases} 1 \text{ if } 0 \le \alpha_0 y_{ivjt-1} + \alpha_1 (1 - y_{ivjt-1}) y_{iv'jt-1} + \alpha_2 y_{ivjt-1} y_{iv'jt-1} + \alpha_3 (1 - y_{ivjt-1}) y^*_{ij't-1} \\ + \alpha_4 y_{ivjt-1} y^*_{ij't-1} + \alpha_5 (1 - y_{ivjt-1}) y^*_{i'jt-1} + \alpha_6 y_{ivjt-1} y^*_{i'jt-1} + \mathbf{z}_{ivjt}\boldsymbol{\eta} + e_{ivjt} \\ 0 \text{ otherwise} \end{cases}$$

We hence have a model where the dependent variable lagged one period is among the explanatory variables. Its coefficient is α_0. A positive α_0 implies that having exported to the market in the previous year increases the probability of exporting there this year, and it is interpreted as the sunk cost parameter of serving that single market (but again – it may also capture learning from own experience in the market in question).

In eq. 5 we include several other variables interacted with a categorical variable for whether the firm is an entrant, (1-y_{ivjt}), or a continuing exporter, y_{ivjt}. Effects for entrants may be interpreted as combined effects on fixed costs and sunk costs. These are captured by α_1, α_3 and α_5. Effects for continuing exporters may be interpreted as effects on fixed costs and are correspondingly captured by α_2, α_4 and α_6. Section 4.2 discusses alternative interpretations

We pay particular attention to α_1, which denotes the effects of experience from exporting other products to a country on the fixed or sunk costs of introducing a new product in the same country (note the interaction with 1-y_{ivjt-1}). We expect a positive effect. One interpretation of this variable is that it captures country-specific learning. [14] Another is

[14] Arkolakis and Muendler (2011) find that Brazilian multi-product firms systematically export their top products across multiple destinations but their lowest-selling products ship in smaller amounts than the lowest-selling products of small exporters. To explain this they develop a model where firms face market-specific sunk export costs that may

that it reflects country-specific sunk export costs, which may accrue in addition to pure market-specific sunk export costs. For example, costs related to establishing a sales office may be specific to the country, not to the market. In this case, having exported another product to the country the year before reduces sunk costs of starting to export a new product to the same country, because the country-specific part of the entry cost is already paid for. Not taking this effect into account will give upward biased estimates of the effect of market-specific sunk export costs.[15]

As was the case for market-specific sunk export costs and learning, it is not possible to separate the effect of country-specific sunk export costs from country-specific learning. Also in this case the reduction in fixed costs due to learning can be interpreted as sunk costs. α_1 denotes the effect of both, and in the regression analysis $y_{iv'jt-1}$ will capture both effects.

α_2 is the equivalent to α_1 for continuing exporters and we interpret it as country-specific learning. It will increase the probability that the firm will continue to export to a given market (note the interaction with y_{ivjt-1}).

α_3 and α_4 denote the reduction in market-specific sunk and fixed costs from experiences from other countries, and we interpret them as learning effects. As indicated above, $y^*_{ij't-1}$ is a vector of varying indicators of experience from other countries. Together with $y_{iv'jt-1}$ it constitute the vector y^*_{it-1} in equation 1.4; it captures the number of countries to which the firm exports product v and the number of countries to which the firm exports all products as well. $y^*_{i'jt-1}$ is a vector of indicators of the number of other firms exporting the same or different products to the country, and we interpret the coefficients α_5 and α_6 as capturing spillover effects.

Including the learning and spillover variables along the extensive margin is in accordance with two recent theoretical models. In Schmeiser (2012), learning to export to a particular country is a function of the number of countries the firms has previously exported to, while in Krautheim (2012) spillovers in the destination markets are a function of the number of other exporters present there. Nevertheless, contrary to these studies we also model learning and spillovers as

decline with the number of products the firm sells in a country. They do not discuss learning effects as such, but an obvious explanation for the mechanism described in the paper is learning to export from other products in the same country, as described above.

15 Moxnes (2010) studies country-specific versus global sunk export costs. He argues that not including country-specific export participants in the analysis will overestimate the effect of global sunk export costs. Further, Meinen (2011) argues that export experience from another country may reduce country-specific sunk export costs if these have a global component.

functions of export intensity, and include variables of export *value* that correspond to the learning and spillover variables described above. For simplicity, these variables are not included in the equations, but are described in detail in section 4 and in Appendix 2. Allowing for spillovers from both the extensive and intensive margins enables us to test for various effects. For example, the number of exporters, their average export value as well as the total value of exports may induce spillovers.

The probability that firm i exports product v to country j in period t is therefore given by the probability regression equation:

6

$$P\left(y_{ivjt}=1\right)=f\left(\begin{array}{l}\alpha_0 y_{ivjt-1},\alpha_1\left(1-y_{ivjt-1}\right)y_{iv'jt-1},\alpha_2 y_{ivjt-1}y_{iv'jt-1},\alpha_3\left(1-y_{ivjt-1}\right)y^*_{ij't-1},\\ \alpha_4 y_{ivjt-1}y^*_{ij't-1},\alpha_5\left(1-y_{ivjt-1}\right)y^*_{i'jt-1},\alpha_6 y_{ivjt-1}y^*_{i'jt-1},\mathbf{z}_{ivjt}\boldsymbol{\eta}\end{array}\right)$$

2.5 Econometric issues

Unobserved heterogeneity is likely to create persistence in the dependent variable. If it is not corrected for, α_0 will be overestimated. To handle this problem, we estimate 6 using a random effects probit model. This is in accordance with most other studies on sunk export costs (see Roberts and Tybout, 1997; Clerides *et al*., 1998; Bugiamelli and Infante, 2002; Bernard and Jensen, 2004; and Gullstrand, 2011). Unobserved heterogeneity is modelled at the firm-product-country level, and the method implies assuming that the error term consists of two terms:

$$e_{ivjt}=\varepsilon_{ivj}+u_{ivjt}$$

where ε_{ivj} captures elements that are time-invariant and specific to firm-product-country. Remaining noise is captured by u_{ivjt}. There may also be unobserved heterogeneity at other levels. To correct for this, we also include firm, year, product, and year-product dummies.[16]

An important problem is the *initial conditions* problem (see Heckman, 1981). This concerns how to treat the first observation of the lagged dependent variable. Export experience is likely to be correlated with unobservable characteristics. However, simply including y_{ivj0} as an explanatory variable for y_{ivj1}, implies treating y_{ivj0} as exogenous and

16 We also experimented with running a regression including country dummies, but the results were qualitatively almost identical to results presented here.

hence uncorrelated with the unobservable characteristics – which. This is not likely to be true.

Several solutions have been proposed in the literature. Wooldridge (2005) suggests capturing the correlation between unobserved heterogeneity and y_{ivj0} by including, as auxiliary explanatory variables for every year in the regression, all observations for all years of the time-variant exogenous variables together with y_{ivj0}, and then running a standard random effects probit regression. We use this methodology but choose to include the within means of the time-variant exogenous variables instead of all observations, in order to make the computational task manageable.[17] The Wooldridge method then consists in considering the unobserved heterogeneity, ε_{ivj}, as the expression:

$$\varepsilon_{ivj} = \lambda_0 + \lambda_1 y_{ivj0} + \boldsymbol{\lambda_2}\bar{\mathbf{x}}_{\mathbf{ivj}} + \mu_{ivj}$$

Above $\bar{\mathbf{x}}_{\mathbf{ivj}}$ now denotes the vector of the within mean of all time-variant right-hand variables in eq. 7. $\boldsymbol{\lambda_i}$ is the vector of coefficients to be estimated and μ_{ivj} is an unobserved individual effect which is assumed *iid* $N[0,\sigma^2_{\mu}]$. Our learning and spillover variables are constructed with interactions with dummy variables for non-presence ($1-y_{ivjt-1}$) or presence (y_{ivjt-1}) in markets. The regression equation becomes:

7

$$P\left(y_{ivjt}=1\right)= f\left(\begin{array}{l}\alpha_0 y_{ivjt-1}, \alpha_1\left(1-y_{ivjt-1}\right)y_{iv'jt-1}, \alpha_2 y_{ivjt-1}y_{iv'jt-1}, \alpha_3\left(1-y_{ivjt-1}\right)y^*_{ij't-1}, \\ \alpha_4 y_{ivjt-1}y^*_{ij't-1}, \alpha_5\left(1-y_{ivjt-1}\right)y^*_{i'jt-1}, \alpha_6 y_{ivjt-1}y^*_{i'jt-1}, \mathbf{z}_{ivjt}\boldsymbol{\eta}, \lambda_0, \lambda_1 y_{ivj1}, \bar{\mathbf{x}}_{ivj}\boldsymbol{\lambda_2}\end{array}\right)$$

which is estimated using a random effects probit estimation.
We use this random effects Wooldridge regression as our baseline regression, but we compare the results with the standard random effects probit regression. The Wooldridge methodology implies that several of our variables are included together with their within means. This is important when interpreting the results.

17 An advantage of the Wooldridge method is that it also corrects for potential serial correlation in uivjt caused by εivj being correlated with the explanatory variables (see Chamberlain, 1984, and Mundlak, 1978). Furthermore, it reduces the variance of the unobserved heterogeneity, σ2ε. As pointed out by Heckman (1981), a large σ2ε may overestimate the effect of the lagged dependent variable.

3. Data and descriptive statistics

We use a panel dataset of all seafood exporters in Norway for the years 1996 to 2007, provided by statistics Norway. Export is disaggregated on firms, products and countries. For the whole period, the most important export destinations in terms of export value are Denmark, Japan, France, the UK and Russia; the most important exported products are Fresh Whole Salmon/Trout, Stockfish/Clipfish/Salted Whitefish and Frozen Whole Pelagic Fish.

Unlike earlier studies of sunk export costs, which focus on firms that export own production, our data also include trading companies that buy all the seafood they export from other producers. We cannot identify these trading companies, but they probably constitute around 30 per cent of all seafood exporters (see Melchior and Medin, 2002). These firms are thus important for the study of market-specific export, and it is a great advantage that our data include them. However, they make it difficult to merge our data with data on firm characteristics, such as production or factor productivity. Other empirical studies of sunk export costs often find such characteristics important for entry into the export activity. Nevertheless, such characteristics are probably less important for our study because, as explained below, we concentrate on market-specific export entry, not global export entry. We also proxy for differences in the ability to export by using information about firm exports. For example, total export value is a proxy for firm size and may capture time-variant productivity differences. We further account for time-invariant unobserved heterogeneity by including random effects at the firm-product-country level, as well as firm, product, and product-year dummies.

Most other studies have focused on manufacturing firms, and an important question is whether the results from our study can be generalised to other sectors. Admittedly, seafood has some specific characteristics. For one thing, some seafood product groups are necessarily quantity-restricted, as fishing rights for caught fish are distributed by quotas. We do not believe that this is a serious objection regarding the general implications of our findings. In Appendix 1 we show that that our analysis is also relevant for the distribution of a given export volume across countries. In addition, important product groups in our data are farmed fish, and these are not quantity-restricted to the same extent as caught fish. Further, many manufacturing sectors are also characterised by varying degrees of quantity restrictions.

Much seafood constitutes more homogeneous product groups than manufactured products. Some findings indicate that sunk and fixed export costs are more important for heterogeneous products than for homogeneous ones (Rauch, 1999). We expect sunk costs, e.g. related to adjustment to different product and veterinary standards, to be present also for seafood exporters. Nevertheless, Melchior (2003) shows that the sunk costs of exporting are far higher among Norwegian IT exporters than among seafood exporters. If anything, then, our results underestimate the general impact of market-specific sunk and fixed costs.

3.1 Full dataset versus the sample used for regression analysis

Firms in our data export in total 376 product groups at eight-digit HS-level to 196 countries. On average 496 (out of 1242) firms are active each year during the sample period, yielding an average of 376 x 196 x 496 = 37,112,704 firm-product-country observations each year: prohibitively large for data computation purposes. Nevertheless, it is not adequate to include all firms in the regression analyses, and we aggregate products into 25 groups.

3.1.1 Firms

We do not include temporary exporters in the regression analysis as our purpose is to study firms' exports to specific markets, not firms' global exports. There are several different kinds of potential sunk costs of entering into the export activity: global as well as product-specific sunk costs may accrue, in addition to market and country-specific sunk costs. We wish to focus on the two latter. Therefore, we include only firms that export all years throughout the sample period (in total 146) and only those firm-product combinations that that are positive all years. This reduces the number of firms to 116.[18] It allows us to analyse market or country-specific sunk export costs separately, without running the risk of incorrectly interpreting them as global or product-specific sunk export costs.

There are three additional advantages of reducing the sample in this way. Firstly, we do not risk incorrectly interpreting sunk production costs as sunk export costs. If a firm enters into export activity or starts exporting a new product, we cannot know whether this is due to production start-up or to export entry, since we do not have information about firms' production.

[18] An alternative to including only firm-product combinations that are positive all years could be to include those that are positive at least one year during the sample period. Results from the regression analysis are robust to which of the two methods we apply.

Secondly, we get a more homogeneous sample and reduce bias from omitted firm-level and firm-product-level variables that are not captured by the proxies for firm characteristics or random effects/dummies.

Thirdly, it allows us to deal with acquisitions. If one firm acquires another firm it is reasonable that the price includes, and therefore reflects, already-paid sunk costs. Thus, these costs are reflected in an observation of increasing market coverage due to acquisitions. Firms that are acquired by other firms represent exits in the dataset and are not included in our sample.

Even though we focus solely on entry into new countries by existing firms-product channels, our sample shows considerable variation. Average entry and exit rates are both around 25 per cent.

3.1.2 Products

Many of the 8-digit HS-level products are similar. We therefore aggregate them into 25 groups that are fairly homogeneous in terms of production and exporting conditions.[19] This also have the advantage of reducing the number of observations to a more manageable figure. Three of the groups differ substantially from the others, and sunk and fixed costs may differ considerably. Consequently, we have omitted them from the sample used for regression analysis.[20] Further, we merge export data with data for country- and product-level import from the COMTRADE database, where products are on 6-digit HS-level. This is necessary for including countries' total import of the product groups in the regressions. Aggregations of 6- and 8-digit HS-level products do not fully correspond. For four of our groups, the deviation is severe, so we exclude them from the sample used for regression analysis,[21] and include only the remaining 18 product groups..

3.1.3 Colountries

Export data are merged with data for countries from several databases. Data for GDP and GDP per capita (in current NOK), and GDP growth (in fixed US dollars, three-year moving average) are provided by the

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19 These groups are Conserved Fish, Whitefish (fresh whole, fresh fillet, frozen whole and frozen fillet), Farmed Fresh Whitefish (whole and fillet), Farmed Salmon/Trout (fresh whole, fresh fillet, frozen whole and frozen fillet), Caught Whole Salmon/Trout (fresh and frozen), Clipfish/Stockfish/Salted Whitefish, Meal/Oil/Industry, Pelagic (fresh whole, fresh fillet, frozen whole and frozen fillet), Salted Herring, Shellfish and similar (fresh, frozen and conserved), Smoked Salmon, and Miscellaneous.

20 Products are particularly heterogeneous in two of these groups (Meal/Oil/Industry and Miscellaneous); the latter group consists of products with a much higher level of manufacturing than the others (Conserved Fish).

21 Export of these product groups is marginal. These groups are: Caught Salmon/Trout (fresh and frozen) and Farmed Whitefish (whole and filet).

World Bank, from the World Development Indicators (WDI).[22] Three indicators of good governance (regulatory quality, rule of law and control of corruption) are provided by the World Bank, from the Worldwide Governance Indicators (WGI).[23] Geographical distances are great-circle distances (in kilometres) based on coordinates for the capitals as found in Gyldendal (1970). Data for country-specific exchange rates come from the CIA World Factbook, and data for country- and product-level import from the COMTRADE database.[24] Compared to our export data, 52 countries are missing from the above-mentioned databases.

3.1.4 The sample

The first year of the period (1996) is used to construct lagged variables, and the sample therefore spans the period 1997 to 2007.
Following the methods described above, the sample now contains 116 firms, 18 products, 268 firm-product combinations, and 144 countries. This gives 38,592 observations each year. One observation represents export of one product from one firm to one country: this we refer to as an *export market channel*. On average, only 5.5 per cent of these are positive each year.

Compared to the whole dataset, the sample is biased towards larger firms that export more products to more countries. Although the number of firms is highly reduced in the sample, it still covers 49 per cent of total Norwegian seafood export value during the period and 66 per cent of all markets with positive import. Obviously, this is not a representative sample of all exporting firms, but, since our focus is on market or country-specific entry, our aim is to study the behaviour of permanent exporters and not that of all firms. In the present study, the entire population of permanent exporters, small as well as large, are included, as are most countries in the world. In addition, unlike other studies, our data include pure trading companies. Many studies of sunk costs apply samples that are biased towards more successful firms or markets. Often, only firms that are operational during the whole sample period are included, and several studies do not include

22 WDIs for the Faroe Islands lack GDP growth figures for the whole period and GDP for 1997, so our figures for the Faroes come from the Statistics Faroe Islands. Growth figures are in current USD. WDIs for Brunei lack GDP for the year 2007, so we have estimated that figure. WDIs for Qatar lack growth figures for the years 1996–2000, so we have supplemented with growth figures from the IMF.

23 Data for the Faroe Islands and Greenland are lacking in the WGIs, so we have set figures for these countries equal to those s for Denmark.

24 A problem with the COMTRADE data is that some countries fail to report import of certain products in certain years, even if import was positive. It is not possible to distinguish these missing observations from observations that are in fact zero. In the case where import of product v to country j was positive at least one year during the sample period, we replace the zero observations with the mean of the positive observations from the years these were reported. If import of product v to country j was zero all years, these remain zero. Nevertheless, results from the regression analysis are robust to alternative methods, such as treating all missing observations as zero.

small firms (e.g., Roberts and Tybout, 1997; Bernard and Jensen, 2004). Further, some studies of country-specific export include only the most important importing countries (Moxnes, 2010).

3.2 Preliminary evidence

Our analysis is closely related to the analyses of extensive and intensive margins of trade frequently found in recent literature (e.g., Bernard *et al.*, 2007; Chaney, 2008; Mayer and Ottaviano, 2008; Bernard *et al*., 2011a). The extensive margin of trade refers to the number of exporters (and potentially their number of export products and destinations), while the intensive margin of trade refers to the value of one firm's export (potentially distributed across products and countries). This section presents characteristics of our sample along the different extensive and intensive margins. We pay special attention to variables indicating the existence of sunk export costs, learning and spillovers.

3.2.1 Persistence

Persistence in firm-level export is a well-known phenomenon. In our sample, 5.5 per cent of all export market channels are positive each year, so if firm-product combinations chose countries randomly we would see entry and exit rates of 94.5 per cent. The fact that both these rates amount to approximately 25 per cent indicates persistence. In the presence of country- or market-specific sunk costs, learning or spillovers, country or market entry and exit are costly. We should therefore expect persistence in export at the firm-country level as well as at the even more disaggregated firm-product-country level.

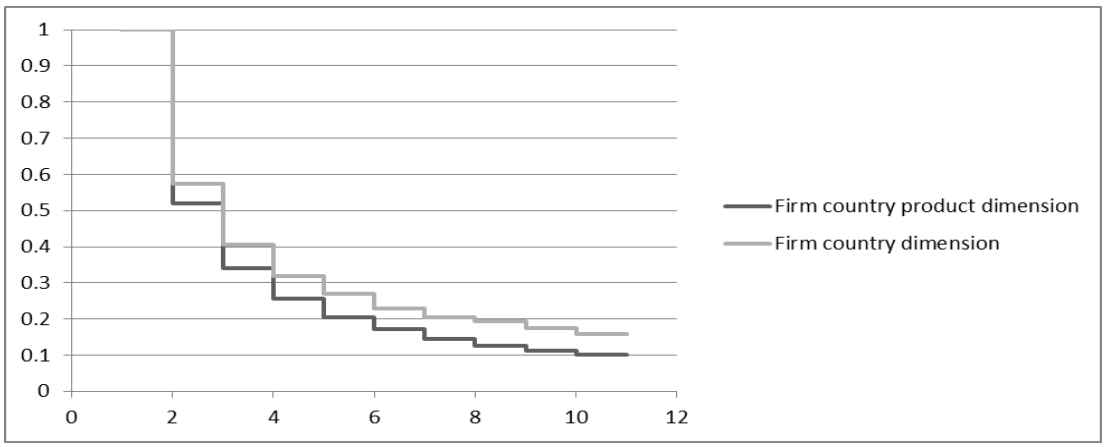
One way of analysing persistence is to calculate the Kaplan-Meier survival function. Figure 1 graphs the Kaplan-Meier survival functions for market-specific export (firm-product-country dimension) and for country-specific export (firm-country dimension). The survival function shows the share of export channels that were positive in year 1 that continued to be positive in subsequent years. Note that year 1 in Figure 1 refers to the year when the firm enters. Since a firm may enter and exit a market (country) several times in the course of the sample years, we have treated each period of positive market- (country-)specific export from a given firm as one observation. The case of a firm that enters, exits, and then re-enters is hence treated as two different observations in calculating the survival functions. Also note that our sample suffers from left-censoring: we do not observe the year of entry for export channels that are positive in the year 1996. When calculating the survival functions, we therefore include only observations that enter in 1997 or later. As a consequence, the persistence evidenced in Figure 1 underestimates persistence in our sample: all firms that exported in 1996 are excluded from the analysis in order to avoid

problems with left-censoring. This includes firms that exported to a market in all the years covered. The share of positive export market channels is now reduced from 5.5 to 3.9 per cent, whereas the share of positive export country channels is reduced from 8.2 to 4.5 per cent.

Graph 1 shows that, despite the low probability of exporting to a particular market, as much as 52 per cent of positive firm-market combinations that start exporting one year continue to be positive the subsequent year. The corresponding figure for firm-country combinations is 57 per cent.[25] After 11 years, 10 per cent of the export *market* channels survived, while16 per cent of the export *country* channels survived.

The survival functions show that firm-country persistence is higher than firm-product-country persistence. This is not surprising, as the latter is part of the former. Nevertheless, it indicates that both market- and country-specific sunk export costs may accrue. In the regression analysis we attempt to distinguish between the two, and show how the former may be overestimated if the latter is omitted.

Graph 1 Kaplan-Meier survival estimates, firms in markets and in countries



3.2.2 Characteristics of firms related to learning variables

In the presence of market-specific sunk export costs, we should expect firms to export to a limited number of markets. Only 5.5 per cent of all export market channels in our sample are positive, and most firms sell only a few products to a few countries.

[25] Eaton et al. (2008) find that, among Colombian exporters, only about one third of both firms and firm-country combinations are still exporting the year after entry.

If a firm learns from own export experience in other markets, the probability that it will export to a given market increases with the number of other markets to which it has exported. In the regression analysis we investigate such effects. Table 1 presents characteristics of firms, along the extensive and intensive margins that are related to the learning variables included in the regression analysis. Figures are for the year 2000, which was an 'average' year in terms of the number of export markets per firm and the average value of an export market channel.[26]

Table 1 Characteristics of firms in the sample, year 2000

	Intensive margins		Extensive margins			
	Firm export value (NOK mill.)*	Export value of a firm to a market (NOK mill.)*	No. of markets a firm exports to*	No. of countries a firm exports to*	No. of products a firm exports*	Average no. of countries a firm exports a product to**
5 percentile	1.5	0.005	1	1	1	1
Median	40	0.36	20	9	6	6
Mean	143	4.7	31	13	6.7	7.1
95 percentile	623	21	93	38	15	18.2
Correlation with firm export value	1	0.08***	0.81***	0.72***	0.50***	0.57***

* Figures are based on the 116 firms, but include all 25 products and 196 countries.
** Figures are based on the 268 sample firm-product combinations, but include all 196 countries. The variable is calculated by taking the average number of countries per product for each firm. The column shows how this variable varies across firms in the sample.
*** Significant at the 1% level.

Table 1 shows that the distribution of firms is highly skewed: there are many small firms and a few large ones. In 2000, the 5 per cent largest firms in terms of export value accounted for 41 per cent of exports and 30 per cent of all positive export market channels in the sample. In the regression analysis we will distinguish between intra- and inter-country and intra- and inter-product learning. The number of markets per firm (column 3) may be high either because the firm exports to many countries (column 4), or because it exports many products (col-

[26] We construct learning variables based on all countries to which a firm exports and all products a firm exports, since learning might occur from a firm's temporary as well as permanent export. Therefore, except for the last column, figures in Table 1 include all 25 products and 196 countries, but only the 116 firms in our sample. Figures in the last column include all 196 countries, but only the 268 firm-product combinations in the sample.

umn 5). Again, the distribution is skewed: most firms sell few products in few countries.

The last row in Table 1 presents correlation coefficients between the different variables and firm export value, which we use as a proxy for firm size. All coefficients are positive and highly significant. Hence, it is the small firms that tend to export few products to few countries. There is also a positive, albeit much smaller, correlation between sales in each market and firm size. This lends support to our hypothesis of sunk and fixed costs: Many firms concentrate their exports in a limited number of markets.[27]

3.2.3 Clustering and characteristics of markets related to spillover variables

In the presence of spillovers, we should expect firms to cluster in the same countries or markets. Despite the large number of countries that import Norwegian seafood, a high share of the export value is concentrated in a few large countries: in 2000 the 5% top countries imported 53 % of total export of Norwegian seafood. As expected, these countries also have a high number of Norwegian exporters present (164 on average). The same is true for markets: as much as 67 per cent of total Norwegian seafood export is concentrated in the top 5 per cent markets, and on average there are 34 Norwegian exporters present in these markets. Further, there are on average 132 other Norwegian exporters present in an average firm's portfolio of destination countries. Consequently, the data clearly demonstrate that firms cluster in the same countries and markets.

Table 2 presents characteristics of countries and markets in our sample along the intensive and extensive margins in the year 2000. Country characteristics (the first three columns) include those of the 144 sample countries with positive import of Norwegian seafood (118 countries in 2000). The fourth and fifth columns in Table 2 present market characteristics.[28]

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27 Other empirical studies find patterns similar to those described above (see Mayer and Ottaviano, 2008, for a survey of European firms; Bernard et al., 2009 for US firms). Most exporters tend to be small and export to a few markets. A few very large exporters which also export to numerous markets account for a large share of total export value.

28 Spillover variables in the regression analysis include all firms and firm-product combinations, as do country characteristics in Table 2. The reason is that spillovers might come from temporary exports as well as permanent ones. Figures include those sample markets with positive import in the year 2000 (in total 837), and all firms.

Table 2 Characteristics of countries and markets in the sample, year 2000

	Country characteristics			Market characteristics	
	Intensive margin	Extensive margins		Intensive margin	Extensive margin
	Norwegian export value to a country (NOK mill.)*	No. of products a country imports*	No. of firms that export to a country*	Norwegian export value to a market (NOK mill.)**	No. of firms that export to a market**
Min	0.002	1	1	0.001	1
Median	11	6	8	0.9	3
Mean	263	8.8	31	35	7.7
Max	4224	23	247	2209	75

* Figures include those of the 144 sample countries that had positive import of Norwegian seafood in the year 2000 (total 118), but include all firms that exported Norwegian seafood in the year 2000 (total 484) and all 25 products.

** Figures include those sample markets with positive import of Norwegian seafood in the year 2000 (total 837), but include all firms that exported Norwegian seafood in the year 2000 (total 484).

Table 2 shows that the distribution of exporters per country or market is skewed: most countries and markets have few Norwegian exporters present (in fact, there was only one Norwegian exporting firm present in as much as 15 per cent of the countries and 33 per cent of the markets). In the regression analysis we distinguish between intra-product spillovers (firms that export the same product to the same country), and inter-product spillovers (firms that export any product to the same country). The average number of Norwegian firms in each market is only 7.7, which is less than one quarter of the average number of firms in a country (31). In the regression analysis we include variables that control for market attractiveness. Still, clustering in a limited number of markets seems to characterise the data.

4. Results

We estimate several variants of the regression eq. 1.7. For comparison purposes we also report results from random effects probit models (REP). The regression equations include lagged export status and several learning and spillover terms. The learning and spillover effects are interacted with indicators for lagged export status (y_{ivjt-1}) to capture effects on the probability of staying in a market and indicators for lagged absence in a market ($1-y_{ivjt-1}$) to capture effects on the probability of entering a market In addition, the vector **z** contains a range of firm-specific, product-specific and country-specific variables (and combinations of the three), both time-independent and time-varying.

Main results are presented in Table 3, which reports coefficients and estimated marginal effects evaluated at the mean of the explanatory variables and the respective standard deviations. This table reports only results on variables that reflect market-specific sunk and fixed costs, learning and spillovers. Results for other explanatory variables (and for their time-independent averages in the Wooldridge model) are reported and discussed in appendix 3.

In our data, the probability of serving an export market is on average very low. The predicted probability of positive export channels is 5.42 per cent. Therefore, marginal effects are calculated at the lower tail of the distribution, where it is necessarily relatively flat. The marginal effects should therefore be interpreted with care. Nevertheless, we have computed them (evaluated at the mean of the other independent variables) in order to get an idea of the economic impact of the explanatory variables.[29]

It should be noted that in comparing the coefficients of the Wooldridge random effects probit model (the WREP model) with those of the random effects probit model (the REP model), the coefficients should be scaled with the models' estimate of $\sqrt{1-\rho}$. ρ is the proportion of total variance contributed by σ^2_ε (the constant cross-period variance due to unobserved heterogeneity on the firm-product-country-level) and it is given *by* $\rho=\sigma^2_\varepsilon/(\sigma^2_\varepsilon+1)$ (see Wooldridge, 2005; Arulampalam and Stewart, 2009). Also the estimated ρs are reported in Table 3, where it is evident that the WREP approach is important for dealing with unobserved heterogeneity. By applying the WREP

[29] Marginal effects for dummy variables indicate the change in the predicted probability of export, as the dummy changes from 0 to 1 while all other explanatory variables are held at their population mean and unobserved heterogeneity (μ_{ivj}) is set to 0.

model, ρ is substantially reduced from 0.278 in the REP model to almost nil. Also its significance vanishes. This demonstrates that the Wooldridge model reduces possible bias of α_0 due to large σ_ε (see section 2.5 for discussion).

Table 3 Regression results – learning and spillovers

	WREP		REP		WREP		REP	
	Coeff.		Coeff.		M.effects		M.effects	
Market export status	0.715	***	1.802	***	0.0204	***	0.0928	***
	(0.058)		(0.053)		(0.00313)		(0.00987)	
Market export value	0.008	**	0.024	***	0.00010	***	0.000	***
	(0.003)		(0.004)		(0.00003)		(0.00002)	
Country export status, other products. Entrants.	0.440	***	0.735	***	0.00874	***	0.00859	***
	(0.025)		(0.021)		(0.00080)		(0.00071)	
Country export status, other products. Continuing exporters.	0.309	***	0.35	***	0.00535	***	0.0024	***
	(0.036)		(0.031)		(0.00088)		(0.00036)	
Export intensity, same country, other products. Entrants.	-0.001		-0.001		-0.00001		0.000	
	(0.001)		(0.000)		(0.00001)		(0.00000)	
Export intensity, same country, other products. Continuing exporters.	-0.002		-0.002	***	-0.00002	***	-0.00001	***
	(0.001)		(0.001)		(0.00001)		(0.00000)	
Number of other countries, same product. Entrants.	0.04	***	0.044	***	0.00041	***	0.00018	***
	(0.003)		(0.002)		(0.00004)		(0.00001)	
Number of other countries, same product. Continuing exporters.	0.029	***	0.031	***	0.00034	***	0.00013	***
	(0.003)		(0.002)		(0.00003)		(0.00001)	
Average export intensity, other countries, same product. Entrants.	-0.003		0.001		-0.00003		0.000	
	(0.002)		(0.002)		(0.00002)		(0.00001)	
Average export intensity, other countries, same product. Continuing exporters.	-0.001		0.001		-0.00001		0.000	
	(0.003)		(0.002)		(0.00003)		(0.00001)	
Number of other countries, all products. Entrants.	0.001		-0.014	***	0.00001		-0.00006	***
	(0.002)		(0.002)		(0.00002)		(0.00001)	
Number of other countries, all products. Continuing exporters.	0.001		-0.017	***	0.00000		-0.00007	***
	(0.002)		(0.002)		(0.00002)		(0.00001)	
Average export intensity, other countries, all products. Entrants.	0.000		0.000		0.00000		0.000	
	(0.002)		(0.002)		(0.00002)		(0.00001)	
Average export intensity, other countries, all products. Continuing exporters.	-0.000		-0.001		-0.0000		0.000	
	(0.002)		(0.002)		(0.00002)		(0.00001)	
Number of other firms, same country, same product. Entrants.	0.020	***	0.044	***	0.00024	***	0.00018	***
	(0.002)		(0.001)		(0.00003)		(0.00001)	
Number of other firms, same country, same product. Continuing exporters.	0.024	***	0.034	***	0.00028	***	0.00014	***
	(0.002)		(0.002)		(0.00003)		(0.00001)	
Average export intensity, other firms, same country, same product. Entrants.	0.023	***	0.057	***	0.00028	***	0.00024	***
	(0.005)		(0.004)		(0.00005)		(0.00002)	
Average export intensity, other firms, same country, same product. Continuing exporters.	0.04	***	0.065	***	0.00049	***	0.00027	***
	(0.007)		(0.006)		(0.00008)		(0.00003)	
Number of other firms, same country, all products. Entrants.	0.004	***	0.003	***	0.00004	***	0.00001	***
	(0.001)		(0.000)		(0.00001)		(0.00000)	
Number of other firms, same country, all products. Continuing exporters.	0.003	***	0.001		0.00003	***	0.000	
	(0.001)		(0.001)		(0.00001)		(0.00000)	
Average export intensity, same country, other firms, all products. Entrants.	0.001		0.010	***	0.00001		0.00004	***
	(0.005)		(0.003)		(0.00005)		(0.00001)	
Average export intensity, same country, other firms, all products. Continuing exporters.	-0.001		-0.004		-0.00001		-0.00002	
	(0.006)		(0.004)		(0.00007)		(0.00002)	
Country value, same country, other firms, same product. Entrants.	-0.001	**	-0.002	***	-0.00001	**	-0.00001	***
	(0.000)		(0.000)		(0.00000)		(0.00000)	
Country value, same country, other firms, same product. Continuing exporters.	-0.000	***	-0.002	***	-0.00001	***	-0.00001	***
	(0.000)		(0.000)		(0.00000)		(0.00000)	
Country value, same country, other firms, all products. Entrants.	-0.000	**	0.000	***	-0.00000	**	0.000	***
	(0.000)		(0.000)		(0.00000)		(0.00000)	
Country value, same country, other firms, all products. Continuing exporters.	-0.000	**	0.000		-0.00000	**	0.000	
	(0.000)		(0.000)		(0.00000)		(0.00000)	
Rho	0.000		0.278	***				
	(0.000)		(0.009)					

Note: Standard deviations in parentheses. Entrants and continuing exporters denote interacted with $(1-y_{ivjt-1})$ and y_{ivjt-1}, respectively. *, ** and *** correspond to significance at the 10%, 5% and 1% levels. Number of observations is 424,512. Value variables are in NOK million. Random effects are for firm-product-country. The number of firm-country-product observations is 38,592. Log-likelihood and sigma for WREP are -24 487and 0.0009. Log-likelihood and sigma for REP are -31,670 and 0.620. Regressions also included several control variables not shown here. For results for standard gravity variables, proxies for firm characteristics and the Wooldridge control variables, see appendix 3. Results for year dummies, product dummies, firm dummies, regional dummies and product-year dummies are available from the authors upon request.

4.1 Sunk costs, learning and spillovers

4.1.1 Market-specific sunk costs

The effect of sunk export costs is captured by the variable *market export status,* which is equal to y_{ivjt-1}. The coefficient is positive and significant in both regression models, which gives support to the hypothesis of market-specific sunk costs. This holds true for our baseline regression, WREP, as well as for the REP model. As expected, the coefficient is considerably higher for the REP model than it is for the WREP model. The coefficient for the WREP model is 0.72 and the scaled coefficient for the REP model is 1.53. This underlines the importance of adequately correcting for unobserved heterogeneity. Both results imply that the probability of serving a market increases with lagged export status in that market.

The marginal effect is calculated as 2 per cent points in the WREP model – considerably lower than the results reported in studies of global sunk export costs. Roberts and Tybout (1997) find that if a firm exported in the preceding year, the probability of export in the current year increases by 60 per cent points. Bernard and Jensen (2004) find that the corresponding figure lies between 20 and 60. Our results are qualitatively in line with these, but the calculated effects are much smaller. However, the results should be compared with the overall probability of serving a market, which is 5.42 per cent. An increase in probability of 2 per cent points therefore represents an increase of almost 40 per cent.

The results in the above studies concern the probability of engaging in export activity as such. Gullstrand (2011) reports insignificant and very small effects in a model similar to ours for country-specific export (not product-specific). For a limited sample of high-income countries, he finds positive and larger, significant effects. Also Moxnes (2010) finds positive and larger effects, but he includes only the five most important export destinations. Since our dependent variable is exports of a given product to a given country, and we include 144 countries, it is hardly surprising that our estimates are lower.

Our results seem quite robust. We experimented with running regressions excluding the largest firm from the regressions, which account for 13.2 per cent of total exports and 13.3 per cent of the total number of positive export market channels. This did not alter the results much. Neither did excluding the 5% smallest or largest firms (results are available upon request).

4.1.2 Market-specific learning

As discussed in section 2.3, it is not possible to distinguish the effects of market-specific sunk export costs from the effects of market-specific learning. Thus the positive coefficient for *market export status* may also indicate the firms' sunk cost and fixed export costs that have been reduced through learning.

There may be an additional learning effect from export intensity in the market. It seems plausible that a firm will learn more about demand the more it exports. This effect is analysed separately by including the variable *market export value* in addition to *market export status*. The effect of export value on a given market is also positive and significant, but small compared to export status. Export value is given in NOK million (corresponding to about USD 0.11 million in the year 2000). From the calculated marginal effects, the estimates imply that in order to double the effect of mere presence in a market, a firm must increase its market-specific exports by about NOK 200 million. As a comparison, median export value from a firm to a market is only NOK 0.36 million (see Table 1).

4.1.3 Country- versus market-specific sunk costs.

The variable *country export status, other products* equals 1 if firm *i* exported other products to country *j* last period and 0 otherwise. When interacted with $(1\text{-}y_{ivjt\text{-}1})$ this variable may capture the effect of country-specific sunk costs that come in addition to market-specific sunk costs. For example, costs related to acquiring information about a country's business culture and legislation are specific to that country rather than to the market.[30] If the firm exported other products, but not product *v*, to country *j* in the last period, then part of *G* is already paid, making it less costly to start exporting product *v*.

The results on country-specific export status are important. If these effects are not taken into account, they will be captured as market-specific effects. Table 4 shows results for lagged export status from comparable regressions where we excluded the *country export status, other products* (interacted with dummy for entry as well as continuance). The results indicate that the coefficients for lagged export status are greater when country-specific effects are not taken into account. Exclusion of country-specific effects is therefore an important mis-specification that results in overestimation of market-specific sunk costs.

[30] Information gathering is believed to be an important part of sunk export costs (see Roberts and Tybout, 1997).

Table 4 Adjusted coefficients when country export status is excluded* (compared with inclusion)

Description	WREP.		ρ**	REP.		ρ
Market export status without country experience	**0.715**	***	**0**	**1.498**	***	**0.333**
Market export status with country experience	**0.818**	***	**0**	**1.531**	***	**0.278**

Note: Similar regressions as those reported in Table 3 were run without the variables indicating country export status (for entrance or continuance in a market). Other results from these regressions are available from the authors upon request.
*Coefficients are adjusted with $\sqrt{(1-\rho)}$
** For the WREP model ρ is not significantly different from 0. Adjusted estimates therefore equal the unadjusted.
***Significant at the 1% level

The importance of country-specific sunk costs also becomes evident when we run regressions on the country dimension only. Such regressions yield larger coefficients for the lagged dependent variable as compared to our baseline firm-product-country regressions (results are available upon request).

4.1.4 Country-specific learning

Country export status, other products may also reflect country-specific learning (see section 2.4). Firms may learn about exporting a given product to a given country from their export experience with other products in the same country. Finding customers is one example of how experience with exporting a product can reduce the sunk or fixed costs of exporting another product. A firm that exported product v to country j in the last period may have established contacts with several customers in that country. Those same customers may be interested in another product, v', and so the costs related to finding customers for v' will be lower.

Its coefficient is positive and significant. This is the case both when the firm was not in the market in the previous year (interact $1\text{-}y_{ivjt-1}$) and when it was (interacted with y_{ivjt-1}). The probability of entry increases by almost 0.1 per cent points, or 16 per cent, and the probability of continuing exporting a given good increases by about 0.5 per cent points, or 10 per cent, if the firm exported other goods to the same country the year before. Medin and Melchior (2002) also present qualitative evidence on such intra-country learning: From interviews with Norwegian seafood exporters, they found that different products were often sold to the same customers, and that costs of introducing a

new product in a country were significantly lower if the firm exported other products to that country.

Also for market experience, there may be an additional learning effect from export intensity. In this case, firm *i*'s export value of other products to country *j* should reduce its sunk and/or fixed costs of exporting product *v* to country *j*. The effect is captured by the variable *export intensity, same country, other products.* Our results indicate no additional learning effects from export intensity, as the coefficients are negative and partly significant. These effects may indicate that firms tend to remain specialised in their export markets, given high export values. One reason for such specialisation effects may come from the supply side: firms may have limited production capacity, so that the *export value* of other products does not increase the probabilities of starting or continuing to export a given product.

4.1.5 Learning from export experience in other countries

Firms may also learn about exporting to a specific market from their own experience in other countries. Demand patterns, customs procedures and competition legislation may be similar across countries, so export experience in other countries may make it easier to export to a given country. The effect is likely to increase with the number of other countries to which the firm exports.

Some effects, like learning about demand patterns, may be product-specific, while others, like learning about business culture, may be more general. We therefore distinguish between intra-product effects, captured by the variable *number of other countries, same product*, and inter-product effects captured by the variable *number of other countries, all products*. Again, there may be additional learning effects from export intensity in other countries.

The results show positive effects of having product-specific experience from other countries: the variable *number of other countries, same product,* is positive and significant for both entrants and continuing exporters.[31] However, the effect is much smaller than the intra-country learning effect described in section 4.1.3. Still, the probability of entering a new country with the same product increases by 0.04 per cent points, or 0.75 per cent, for a firm that exports to one additional country as compared to otherwise similar firms.[32] As a comparison,

[31] These results confirm the qualitative results from interviews with Norwegian seafood exporters in Medin and Melchior (2002). They found evidence on learning from experience in other countries, but the effect was less important than experience within the same country.

[32] This figure is not as small as it may appear, since we include in the analysis a full 144 countries, of many of which have only one or a few Norwegian exporters present,.

the median number of countries a firm exports a product to is 6 (see Table 1).

We do not find similar effects, however, from a firm's average export value in other countries. The coefficients for *average export intensity, other countries, same product* is not significant for the probability of continuing to export to a given country.
Similarly, the *WREP* models do not give support for learning effects across product groups from other countries, whether along the extensive or the intensive margins (coefficients for *number of other countries, all products* and *average export intensity, other countries, all products* are insignificant*)*.

4.1.6 Comparison with other studies

Summing up, the results on learning from own export experience seem to indicate that such effects are strongest within one and the same country. A firm's presence with a product in a given country seems to induce learning about exporting another product to that country. Results further indicate that learning effects are weakly present within product groups across countries, and absent between countries and products. Learning from own export experience in other countries takes place through the extensive margin (number of other countries to which the firm exports), and not the intensive margin (average export value to other countries) although there is some evidence of learning from own export intensity in the same market.

Also other studies have documented learning effects from exporting. Some, among them Schmeiser (2012), Eaton *et al.* (2008), Lawless, (2009) and Albornoz *et al*. (2012), find that export expands through gradual entrance, possibly caused by learning. Lawless (2011), Morales *et al*. (2011), Castagnino (2011), Alvarez *et al.* (2010), Fabling *et al*. (2011), Gullstrand (2011) and Meinen (2012) all find that export experience in other countries or markets increases the probability of exporting to a particular country or market. These studies define learning variables somewhat differently than we do, and do not include learning effects along the extensive and intensive margins as we do. None of these distinguish between entering and continuing exporters within the same regression as we do, and all but Gullstrand (2011) and Meinen (2012) concentrate on learning effects for entering firms only. Most of these studies also differ from ours in the econometric methods applied.

4.1.7 Spillovers from other exporters

Firms that export to a specific country gain information about that country on factors like exporting procedures, business culture, demand

patterns, legislation and distribution networks. Such knowledge may spill over to other firms, reducing their sunk or fixed export costs. Spillover effects are likely to be stronger the larger the number of other exporters in the country. Some spillovers, such as information about demand, may be product-specific, whereas others, such as information about business culture, may be more general. In the first case, the export costs of a given firm will decrease with the number of other Norwegian firms exporting the same product, captured by the variable number of other firms, same country, same product. In the second case, the costs will decline with the number of other Norwegian firms exporting any product, captured by number of other firms, same country, all products.

As in the case of learning, spillovers may be stronger the larger the average export intensity of other firms to the country (both within and across products). In addition there may be positive spillovers from total export of Norwegian seafood to the country in question. The more Norwegian seafood in the market, the better known is this product group – which may reduce marketing costs and increase demand. Increased exports to a market may also improve distribution and retail services in that market. Again, the effect may be specific to a given product or general, across products.

We find evidence of positive spillovers along the extensive margin. The number of other firms selling the same product in the same country has a positive and significant effect on the probability of starting exporting to a given market and on the probability of staying in a market. This is interesting since the presence of other firms might also indicate more intense competition in a market. Obviously, clustering effects in export markets are larger than such centrifugal effects. This is in line with findings in Medin and Melchior (2002), where interviews with Norwegian seafood exporters showed that firms consider it advantageous if there are other Norwegian exporters present in a market. There is also evidence on inter-product spillovers: the effect of number of other firms, same country, all products is positive and significant as regards starting to export to a market. So is the effect for continuing to export in our main model (WREP).

Also the export intensity of other firms in the same market has positive and significant effects, as coefficients for average export intensity, other firms, same country, same product are positive and significant (for entrants as well as for continuing exporters). Comparing marginal effects for the extensive and intensive margins, we find that the effect of one additional firm selling the same product in a country corresponds to the effect of an increase in the average export value of other firms of about NOK 1 million for the probability of starting to

export, and to about NOK 2 million for the probability of continuing to export. As a comparison, the median number of firms in a market is 3, while the median value of Norwegian exports to a market is 0.9 million NOK (see Table 2).

However, we do not find clear evidence of inter-product spillovers from other firms' export intensity in the country. The coefficients on average export intensity, other firms, same country, all products in the WREP model indicate no effect on the probability that a firm will start export activity (interacted with 1- yivjt-1) or continue to export (interacted with yivjt-1).

The total value of Norwegian exports of the same products from other firms has negative and significant effects, for the probability of starting and for the probability of continuing to export. We interpret this as a dominating competition effect. Similarly, total export value of all products has negative and significant effects on the probability of starting to export and to continue exporting

Summing up, we find strong indications of intra-product spillovers along the extensive margin (number of other firms exporting a particular product to the country) as well as the intensive margin (their average export value). There is also some evidence of inter-product spillovers along the extensive margin (number of other firms exporting any product to the country), but not along the intensive margin. We find is no evidence of spillovers from total Norwegian export value to country.

One risk is that our spillover variables may capture market attractiveness rather than actual spillovers. To control for this, we have included several indications of market attractiveness (see section 4.3.1). We also experimented with including country dummies in our regressions. The results for the spillover variables remained very similar to those reported in Table 3, indicating that they capture actual spillovers (results are available upon request).

Our results are in line with the theory of network spillovers presented in Krautheim (2012), which predicts spillovers to be a function of the number of other exporters. Other studies consider the impact of concentration of export activity within a region or industry in the exporting firm's home country. Regarding spillovers that affect global export costs, results are mixed. However, evidence regarding spillovers that affect country or market-specific export costs is more clear: Requena and Castillo (2007), Koenig (2009), and Lawless (2011) find that spillovers affect country-specific export costs; while Alvarez et al. (2010), Koenig et al. (2010) and Fabling et al. (2011) find that spillo-

vers affect market-specific sunk export costs. As opposed to our study, these studies focus solely on firms entering into different markets, not on firms that continue to export. Koenig et al. (2010) also distinguish between fixed and variable export costs in two separate regressions, and find that only the former are affected by spillovers.

4.1.8 Entrants versus continuing exporters

Table 3 shows that the effects of a certain variable on entering and continuing exporters generally have the same sign, so learning and spillovers variables seem to affect entering and continuing firms in a similar manner.

The coefficient for entrants is generally larger for entrants than for continuing exporters in the REP regressions. This is in line with what we would expect if entry reflects sunk and fixed costs, while continuing reflects only fixed costs. Further, these coefficients are generally smaller in the WREP regressions than in the REP regressions. This is as expected because the Wooldridge methodology separates the time-independent effects of these variables. Not controlling for this therefore overestimates changes in these variables.

4.2 Alternative explanations

We included a range of other explanatory variables in our regressions. These are reported in the appendix to this paper.

4.2.1 Internal learning and spillovers

We have assumed, like most studies of export decisions referred to here, that both learning and spillover effects are external to firms. It may be, however, that learning and (to a lesser extent) spillover effects are endogenous. A firm may want to try exporting to a market not only because it believes that this market is profitable, but also because it learns from exporting and therefore takes into account that entry into other markets will become easier. In this case, firm entry across markets is not independent. This is discussed in Krautheim (2012) and Albornoz *et al.* (2012). The latter analyse sequential exporting and argue that firms internalise learning effects, especially for the first market they enter. We have not modelled the decision to enter into export activity, since we include only firm-product observations that have positive observations each year. If learning effects are particularly important for the *first* export decision, we have reduced the problem of assuming that learning effects are external to the firm. Furthermore, if learning is internalised into the firms' decision problem, it is not clear whether the resulting interdependence would alter our re-

sults, since the sequence of entry into new markets could well be the same.

Furthermore, it may be that firms take into account that their export decisions make it more likely that also other firms will follow. In that case, spillovers between firms are internalised. Firms may, for instance, try to choose countries or markets where spillovers are less likely to materialise (in order to avoid competition) – or markets where spillovers are more likely to materialise (in order to benefit from mutual spillover effects). Again it is not clear whether such internalised spillover effects would alter the sequence of market entrances.

Also, the presence of other firms in a market or a country does not necessarily imply positive spillovers. Other firms may also represent competition with the firm in question. High export value from other firms or the presence of many firms could mean more competition in the relevant markets. When coefficients are positive, we interpret the results as indicating spillovers that are so strong that they outweigh the effects of competition.

4.2.2 Fixed versus sunk costs

In section 2 we hypothesised that learning and spillovers impact on fixed and sunk export costs, and this is our motivation for distinguishing between effects on entering firms and continuing exporters. Other interpretations are also possible.

Our approach differs from some other contributions in how we interpret the effect of interaction variables between learning/spillover variables and lagged export status (i.e. the effect for continuing exporters). If the coefficients for our learning and spillover variables for continuing exporters are positive, we interpret this as supporting the hypothesis that learning and spillovers reduce fixed, and not sunk costs.

An alternative interpretation could be that sunk costs are greater for certain types of firms. If our learning and spillover variables reflect characteristics of firms rather than actual learning and spillovers, and sunk export costs vary according to these characteristics, then positive coefficients for continuing exporters can reflect the fact that sunk costs are higher for firms with those characteristics. In such cases, persistence, and hence the probability of continuing to export, should be higher for the firms with the characteristics in question. Other authors (e.g., Bugamelli and Infante, 2003, Máñez *et al.,* 2008 and Gullstrand, 2011), who do not distinguish between sunk and fixed export costs, interpret coefficients for interaction variables between lagged export status and firm (and possibly country) characteristics this way.

For example, we include the number of other markets the firm exports to, and we find a positive effect for continuing exporters. Using the alternative interpretation, this should indicate that firms that export to many markets face greater market-specific sunk export costs. We find such an interpretation counterintuitive and therefore choose to interpret the positive coefficient as reductions in fixed costs due to learning.

A related alternative interpretation is that learning/spillovers impact on continuing exporters' sunk as well as fixed costs, because lower sunk costs make exit and re-entry less costly. [33] This is an effect that works in the opposite direction of the effect from increased probability of staying in the market due to reduced fixed cost from learning/spillovers. If anything then, the impact of learning/spillovers on fixed costs is underestimated in our model.

4.3 Other independent variables

Our regressions include a range of other explanatory variables. Here we offer only a short description of these, but the regression results are reported in appendix 3.

4.3.1 Other variables

As a proxy for productivity, firm size is often included in studies of sunk export costs, and is generally found to be positively related the probability of exports (see Roberts and Tybout, 1997; Bernard and Jensen, 2004; Lawless, 2011; Koenig *et al*. 2010; Gullstrand, 2011). Lacking data for productivity, production or capital stock, we use the log of the firm's total export value. The variable is lagged one year and is called *size*. We further correct for the firm's specific competitive advantage by including variables that reflect the firm's position in the market, the country and for the product among Norwegian firms: *leader market*, *leader country* and *leader product*. These variables equal the ratio of the firm's export value to total Norwegian export value in the market, country, or product in question (i.e. the firm's market share). The variables are lagged one year. Note that the *size* and *leader* variables vary over time in the firm-product-country, the firm-country, firm-product, and the firm dimensions. They may therefore capture differences in exporting ability that vary over time. For instance, a firm that employs a German-speaking person one year may have a higher probability of exporting to Germany the next year. This

[33] This is not correct if our assumption about full recurrence of the sunk cost after one period of exit holds. In that case, a reduction in a firm's sunk cost due to learning/spillovers will fully depreciate after one period of exit, so the probability of staying in the market is not affected. Roberts and Tybout (1997) find that that most of the sunk cost must be repaid after one period of exit.

will be captured by the *leader country* variable. In addition, we include firm dummies to correct for time-invariant differences in exporting ability differences. Consequently, although we lack data for several firm-characteristics, we believe that we have adequately corrected for differences in the ability to export along the different dimensions.

We include the variable *import adjusted,* defined as log of import (from all countries) of product *v* to country *j*, as explanatory variable. It captures demand and demand differences for each product within and between the countries included in the regressions.[34]

We also include changes in the *country-specific* exchange rates, *appreciation.*

In the gravity literature of international trade, GDP is commonly used as a measure of market size, and distance as a measure of transport costs.[35] We therefore include log of GDP, *gdp*, and log of GDP per capita, *gdp per capita,* in order to control for different demand patterns in wealthy versus poor countries. In addition we include three-year moving averages of growth rates in GDP. As is standard, we also include (log of) *distance* to capture transportation costs.

The governance qualities of a country may influence its attractiveness as a market. We include three measures of governance indicators: indicators of regulatory quality, rule of law and control of corruption. The first of these indicates the ability of governments to formulate and implement regulations that permit and promote private-sector development. The second reflects perceptions of the quality of contract enforcement, property rights, the police and the likelihood of crime and violence. Control of corruption indicates low levels of corruption and good control with corrupt practices.

Of the above-mentioned variables, only leader variables, import adjusted, GDP growth, control of corruption and distance prove to be significant and with the expected signs (see appendix 3 for discussion).

4.3.2 Dummy variables

Ideally, but not possible in our model, we should correct for unobserved heterogeneity by including fixed effects on the firm-product-country combination. This would have corrected for all time-invariant

34 In some versions of our regressions we also included total Norwegian exports and Norway's export share (in the world market) of each product. These were included to reflect Norway's comparative advantages and time-varying supply characteristics. Results varied (available upon request). The results presented here are when product-year dummies were included; these variables capture time-varying product-specific effects.

35 See Feenstra *et al.* (2001) for a survey.

unobserved heterogeneity in all combinations of the three dimensions. An alternative approach would be to include dummies on the following combinations of variables: firm-product, firm-country, and country-product, in addition to random effects on the firm-product-country combination. This, on the other hand, would yield a large number of independent variables, prohibitively large for data computational purposes. We therefore choose to include dummies along the dimensions where we have few other independent variables to account for heterogeneity.

We include product-year dummy variables to capture cycles on the production and demand side. This may reflect comparative advantages (fish farming is due to time-specific shocks, as is wild fish catching). We further include firm-dummy variables to correct for unobserved heterogeneity at the firm-level, such as productivity differences. We include year dummies to correct for temporary shocks that have an equal effect across all products, firms and countries. To correct for product differences we also include a product dummy. Further, several factors, like culture and demand patterns, may be similar within regions. We therefore divide the countries into four regions and include region-specific dummies.[36] We include dummy variables for EU countries, for countries of the European Economic Area (EEA), for countries that Norway has free trade agreements with, and for the USA.[37] We also include dummy variables for countries that became EU members in 2004 and in 2007 (FTAEEA04 and FTAEEA007). Norway had generous free trade agreements with these countries (for seafood) that became void when they joined the EU.

Although our analysis includes many standard gravity variables capturing differences between countries, a concern in interpreting the results is that persistence in firm-market export may be due to unobserved characteristics of countries. We therefore experimented with running a regression also including country dummies, but the results (available upon request) were qualitatively almost identical to those presented here.

36 The four regions are Europe, Asia, Africa and the Americas.
37 We include a separate dummy for the USA since anti-dumping duties have been imposed on Norwegian exports of salmon in the US market.

5. Conclusions

In this article we have investigated the importance of sunk export costs by examining persistence in firms' export behaviour of firms. Unlike earlier studies, which have focused on global or country-specific sunk export costs, we have concentrated on the costs for already-established exporters of entering a particular market. We find that having exported to a particular market the previous period doubles the probability of exporting to the same market in the current period. This we interpret as evidence of the existence of market-specific sunk export costs.

Further, we have investigated how market-specific sunk and fixed export costs are affected by learning and spillovers. We have looked for a wide range of learning spillover effects, intra- and inter-product as well as intra- and inter-country. These effects may occur along the extensive margin as well as along the intensive margin. We also investigate how learning and spillovers affect sunk and fixed costs differently, by analysing the decision to enter new markets separately from the decision to stay in existing markets. While the probability of starting export activities is related to sunk and fixed costs combined, the probability of staying in export markets is related to fixed costs only. Several new effects are identified.

Our evidence indicates that firms learn about exporting to a particular market from their own exporting experience in the market in question as well as from own export experience in other markets. Learning effects appear to be strongest for presence within one and the same country: having exported another product to that country the previous period increases the probability of entering the country with a new product this period by 3.9 per cent and the probability of continuing to export a particular product to the country by 21 per cent. Whereas a firm's *presence* in the country seems to induce learning, we found no learning effects from high export *value* of other products of the country. Our results further indicate that learning effects are weakly present within product groups across countries, but absent between countries and products. Learning from own export experience takes place through the extensive margin (number of other countries the firm exports to), and not through the intensive margin (average export value to other countries).

We also provide evidence on spillovers from the presence of other Norwegian exporters. As opposed to most other studies, which con-

centrate on spillovers in the home country, we focus on spillovers in the destination country. Our results indicate that a greater number of other Norwegian exporters in a given country increases the probability of export to that country. We find strong indications of intra-product spillovers along the extensive margin (number of firms exporting a particular product to the country) as well as long the intensive margin (their average export value). There is also some evidence of inter-product spillovers along the extensive margin (number of firms exporting any product to the country), but not along the intensive margin (their average export value). There is no evidence of spillovers from total Norwegian export value to country.

Appendix 1

In the text we proposed that the profit function $\pi^*_{ivjt}(\mathbf{p}_{vjt},\mathbf{v}_{ivt})$ could be represented as proportional to sales in a given market, independently of sales of other products in a country or of the same product in other countries. Here we present a simple model set-up that gives such a profit function. We assume that the firm faces iso-elastic demand functions in each market from standard CES preferences with elasticity of substitution σ>1. Thus firm *i*'s demand for a variety *v* sold in country *j* can be written as:

$$\text{A1} \qquad \begin{aligned} q_{ivj} &= W_{vj}\, p_{ivj}^{-\sigma} \\ W_{vj} &= \mu_{vj} Y_j P_j^{\sigma-1} \end{aligned}$$

Above, q_{ivj} denotes demanded quantity, W_{vj} denotes product-country specific demand level and p_{ivj} denotes the price charged by firm *i* for product *v* in country *j*. W_{vj} depends on (potential) country-specific preferences for product v, μ_{vj}, country *j*'s income level, Y_j, and an overall price index in country *j*, P_j, taken as exogenous for firm i.
Assume that firm *i* produces under constant marginal costs. For exports of product *v* to country *j*, these are given by:

$$\text{A2} \qquad c_{ivj} = \tau_{vj} w / a_{iv}$$

Above, c_{ivj} denotes firm, product and country-specific marginal costs. These depend on variable transportation costs, τ_{vj}, marginal production costs, *w*, and a firm-product specific productivity parameter a_{iv}. Profits for firm i from exporting are given by:

$$\text{A3} \qquad \prod_i = \sum_j \sum_v \pi^*_{ivj}\left(\mathbf{p}_{vj}, \mathbf{v}_{iv}\right) - \mathbf{C}_{ivj}$$

Above, $\pi^*_{ivj}(\mathbf{p}_{vj},\mathbf{v}_{iv})$ represents extra running profits from exporting good *v* to country *j*. It depends on product-country characteristics, **p**, that are exogenous for the firm and firm-product characteristics**,** **v**. The vector **C** denotes fixed and sunk costs (in this Appendix we suppress the time dimension so that fixed and sunk costs are treated similarly) which could be firm-specific, firm-product specific, firm-country specific and firm-product-country specific. This vector therefore captures all sunk/fixed costs discussed in the text, as well as others. In the empirical specification in the text we focused on firm-

country and firm-product-country specific sunk and fixed costs. The profit function can now be written:

A4 $$\prod_i = \sum_j \sum_v \left(p_{ivj} q_{ivj} - \frac{\tau_{vj} w}{a_{iv}} q_{ivj} \right) - \mathbf{C}_{ivj}$$

The first-order condition for profit maximizing sales of product *v* in country *j* is:

$$\frac{d \prod_i}{dq_{ivj}} = p_{ivj} \frac{\sigma - 1}{\sigma} - \frac{\tau_{vj} w}{a_{iv}} = 0$$

The firm charges a price that is a mark-up, *σ/(σ-1)*, over marginal costs:

$$p_{ivj} = \frac{\sigma}{\sigma - 1} \frac{\tau_{vj} w}{a_{iv}}$$

Extra running profits from exporting product *v* to country *j* are therefore:

$$\pi^*_{ivj} = \left(p_{ivj} q_{ivj} - \frac{\tau_{vj} w}{a_{iv}} q_{ivj} \right) = \left(\frac{1}{\sigma - 1} \frac{\tau_{vj} w}{a_{iv}} \right) q_{ivj} = \frac{1}{\sigma} (sales)$$

Extra running profits are therefore proportional to sales. The exact formulation is:

A5 $$\pi^*_{ivj} = \left(\frac{1}{\sigma - 1} \frac{\tau_{vj} w}{a_{iv}} \right) q_{ivj} = \left(\frac{1}{\sigma - 1} \frac{\tau_{vj} w}{a_{iv}} \right) p_{ivj}^{-\sigma} \mu_{vj} Y_j P_j^{\sigma - 1} = \left(\frac{1}{\sigma - 1} \right)^{1-\sigma} \sigma^{-\sigma} \left(\frac{\tau_{vj} w}{a_{iv}} \right) \mu_{vj} Y_j P_j^{\sigma - 1}$$

As seen, these profits π^*_{ivj} depend on variables exogenous to the firm (captured by the vector $\mathbf{p}_{vj}$ and variables that are product and firm-specific (captured by the vector $\mathbf{v}_{iv}$). Therefore we write the profit equation in the text as $\pi^*_{ivj}(\mathbf{p}_{vj}, \mathbf{v}_{iv})$.

We have modelled fish exports as traditional monopolistic competition markets where firms have (limited) market power and constant marginal costs. As a consequence, supply is assumed to be perfectly flexible. This may be a realistic assumption for fish farming industries – but not for wild fish, which is caught according to quotas that are determined by the government and that are issued in fixed supply. For a firm with fixed supply, our model requires only minimal adjustments. To illustrate this, consider a firm that sells to two countries on-

ly. Consequently subscript *j* now refers to country *j* (*j*=1,2). We simplify by setting *w*=1 and *a*=1, so that marginal costs are:

$$c_j = \tau_j$$

Profits are:

$$\Pi = \sum_j \left(p_j q_j - \tau_j q_j \right) - \mathbf{C}_j$$

The corresponding profit-maximization problem is a constrained one, since the sum of exports to the two countries cannot exceed the total quota, Q. The Lagrangian for the maximization problem is:

$$\text{A6} \qquad L = \sum_j \left(p_j q_j - \tau_j q_j \right) - \mathbf{C}_j - \lambda \left(\sum_j q_j - Q \right)$$

The first-order conditions are

$$\text{A7} \qquad \begin{aligned} &\frac{\partial L}{\partial q_j} = p_j \left(\frac{\sigma - 1}{\sigma} \right) - \left(\tau_j + \lambda \right) = 0 \\ &\sum_j q_j = Q \end{aligned}$$

As compared to our unconstrained maximization problem, the problem corresponds to adding a constant (shadow price of quotas) to the marginal cost. The shadow price in turn depends on export costs and income levels in the two countries which are exogenous to the firm.

Appendix 2

Independent variables

Independent variable	Description
Market export status	Lagged export status. A dummy equal to 1 if firm *i* exported product *v* to country *j*. It reflects the importance of market-specific sunk exporting cost or learning.
Country export status	A dummy equal to 1 if firm *i* exported other products to country *j* last year. Reflects the importance of country-specific sunk costs and learning from own experience of exporting other products to country *j*.
Number of other countries, same product	Number of other countries (not including country *j*) firm *i* exported product *v* to last year. Reflects learning from experience in other countries.
Number of other countries, all products	Number of other countries (not including country *j*) firm *i* exported all products to last year. Reflects learning from experience from exporting to other countries.
Number of firms, same product	Number of other Norwegian firms (not including firm *i*) that exported product *v* to country *j* the previous year. Reflects market-specific spillovers.
Number of firms, all products	Number of other Norwegian firms (not including firm *i*) that exported all products to country *j* the previous year. Reflects country-specific spillovers from exporters.
Market export value	The firm's export value of product *v'* to country *j'* the previous year. Reflects additional learning effects from being deep in the market, and corresponds to *market export status*
Export intensity, same country, other products	The export value of other products (not including product *v'*) from firm *i* to country *j'* the previous year. A learning variable corresponding to *country export status.*
Average export intensity, other countries, same product	Average value of export of product *v* from firm *i* to other countries (excluding country *j*) the previous year. A learning variable corresponding to *number of other countries, same product*.[38]
Average export intensity, other countries, all products	Average value of export of all products from firm *i* to other countries (not including country *j*) the previous year. A learning variable corresponding to *number of other countries, all products*.[39]
Average export intensity, other firms, same product	Average export value of product *v* from other firms (not including firm *i*) to country *j* the previous year. A spillover variable corresponding to *number of other firms, same product.*[40]

38 This variable is equal to the export value of product *v* from firm *i* to other countries, divided by *number of other countries, same product*

39 This variable is equal to the export value of all products from firm *i* to other countries, divided by *number of other countries, other products.*

40 This variable is equal to *country value, other firms, same product* divided by *number of other firms, same product.*

Average export intensity, other firms, all products	Average export value of other products from other firms (not including firm *i*) to country *j* the previous year. A spillover variable corresponding to *number of other firms, all products*.[41]
Country value, other firms, same product	Export value from other Norwegian firms (not including firm *i*) of product *v* to country *j* the previous year. An additional spillover variable.
Country value, other firms, all products	Export value from other Norwegian firms (not including firm *i*) to country *j* the previous year. An additional spillover variable.
Leader, market	Export value of product *v* from firm *i* to country *j*, divided by Norway's export value of product *v* to country *j*. Lagged one year.
Leader, country	Export value of all products from firm *i* country *j*, divided by Norway's total export value to country *j*. Lagged one year.
Leader, product	Export value of product *v* from firm *i* to all countries, divided by total Norwegian exports of product *v*. Lagged one year.
Size	Log of firm *i's* export value. A proxy for firm size. Lagged one year.
Gdp	Log of GDP. In 1000 current NOK.
Gdp per capita	Log of GDP per capita. In 1000 current NOK.
Growth in gdp	3-year moving averages of growth rates in GDP (fixed UD$).
Appreciation	Growth in the exchange rate between NOK and the local currency.
Distance	Log of distance from Norway to country *j*. In km.
Import	Log of import of product v in country *j*. In 1000 current NOK. Missing observations are replaced by mean.
Governance indicator, regulatory quality	Perceived quality of a government's regulatory quality, normally distributed for country ranking.
Governance indicator, rule of law	Perceived quality of rule of law, normally distributed for country ranking.
Governance indicator, control of corruption	Perceived control of corruption, normally distributed for country ranking.
Dyear	Dummy equal to 1 for all years except, 2007.
Dregion	Dummy equal to 1 for all regions, except Africa.
Dproduct	Dummy equal to 1 for all products, except fresh fillets of whitefish.
Dfirm	Dummy equal to 1 for all firms, except one.
Dyearproduct	Dummy equal to one for all year - product combinations, except fresh fillets of whitefish in 2007.
DUSA	Dummy equal to 1 for USA.

41 This variable is equal to *country value, other firms, all products,* divided by *number of other firms, all products*.

DEU	Dummy equal to 1 for EU member countries.
DFTA	Dummy equal to 1 for countries with which Norway has free trade agreements.
DEEA	Dummy equal to 1 for EFTA countries.
DFTAEEA04	Dummy for new EU member countries in 2004 with which Norway previously had free trade agreements.
DFTAEEA07	Dummy for new EU member countries in 2007 with which Norway previously had free trade agreements.

Appendix 3. Other explanatory variables

In the main text we report and discuss results for lagged export status and for the learning and spillover variables. In this appendix we report and discuss results from the other variables included as well as the results for the time independent means of the variables included in the WREP model. The estimated ρ and the coefficients for lagged export status and lagged export value of the product are included for reference purposes. We include product-year dummy variables, firm-dummy variables, year dummies, product dummy and region-specific dummies.[42] We do not report the results for the above dummy variables, but they are available upon request.The results tables are included as Tables A3.1 and A3.2.

A1 Leader

The estimated coefficients of the three leadership variables, leader market, leader country and leader product are all positive and significant. The variable is defined as the firms' sales values in the market, the country and totally for the product group divided by the total sales in these the market, the country and totally for the product group for all Norwegian exporters. Leaderships in the market, the country and for the product (in the previous period) have positive effects on the probability of exporting a product to a market. This is as expected. The estimated effects are larger for the market, smaller for the country and smallest for leadership in a given product.

A2 Firm size

The variable firm size (log of the firm's total export value) is not significant. This contradicts with earlier studies, where firm size is found to significantly increase the probability of export. This result reflects the inclusion of our dummy variables. Firm dummies reflect firm characteristics, and product-year dummy variables reflect product dynamics. Hence our firm size variable reflects only firm size dynamics that can not be attributed to product specific dynamics. The results therefore reflect that firm export growth (when we have controlled for other variables) mainly occurs through expansion in existing export channels rather than through entrance in new markets. This is in line

42 The four regions are Europe, Asia, Africa and America.

with theory (see e.g. Lawless (2009).[43] The WREP model and the REP model controls for individual specific (i.e. firm-product-country) random effects. The WREP model also controls for correlation between the individual specific effects and (i) initial export status and (ii) time independent effects from the other explanatory variables. This underlines the importance of adequately correcting for unobserved heterogeneity.

A3 World trade

We include the variable import which is defined as log of import (from all countries) of product v to country j, as explanatory variable. It captures demand and demand differences for each product within and between the countries included in the regressions. The coefficient is positive and significant in the two models.[44]

A4 Exchange rates

An appreciation of Norwegian kroner relative to the currency of country j has no significant effect on the probability of export. Results from other studies are mixed: Bernard and Jensen (2004) find a weak effect of the industry specific exchange rate. Campa (2002) finds a significant effect of changes in the firm-specific exchange rate, where each firm's exchange rate is calculated according to its export markets. Clerides et al. (1998) also find an effect in some cases. Meinen (2012) and Gullstrand (2011) find no effect of country specific exchange rates. However, Gullstrand (2011) finds a negative effect of country specific exchange rate variation.

A5 Market size and transport costs

The variable measuring market size, gdp, is not significant in the WREP regressions, but turns up with the expected sign in the REP model. Income level, measured by gdp per capita, is insignificant. The fact that market size becomes insignificant is because we also include the countries' total import of the seafood product in question. Furthermore, country specific time-invariant averages of this variable are included in the WREP regression. Note however, that gdp also turns out insignificant in its time invariant average version (see table A3.2). Growth of gdp (growth, gdp) has positive and significant coefficients, however. Export presence is more prevalent in markets with high growth rates. This may possibly reflect positive expectations about profitability in emerging markets.

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43 Lawless (2009) concludes that (p. 247) "... we would expect to see export growth at the firm level come more from adding to sales in existing markets than form sales in new markets.".

44 In some versions of our regressions we also included total Norwegian exports and Norway's export share (in the world market) of each product. These were included to reflect Norway's comparative advantages and time varying supply characteristics. Results varied (and they are available upon request). The results presented here are when product-year dummies were included and these variables capture time varying product specific effects.

Further, the effect of distance is negative and significant, as expected, in the two models. These results correspond to results found in the gravity literature of international trade (see Feenstra et al., 2001). Since distance is time invariant, its mean is not included among the auxiliary time independent variables in the WREP model.

A6 Governance indicators

The two indicators of good governance (Regulatory Quality and Rule of Law) have insignificant coefficients in the WREP model (but positive and significant in the REP model). The reason for this result may be that these indicators are highly persistent across countries over time. Their time invariant means have positive, but not significant coefficients in the WREP model. Control of Corruption, is negative and significant in the REP model, but positive and significant in the WREP model. Again, the difference between REP model and the WREP model can be explained with the fact that time-invariant averages of this indicator are included in the latter. In this case, the economic interpretation is interesting. Control of corruption has a negative and significant coefficient in the REP model. Ceteris paribus therefore, corruption does not seem to discourage Norwegian seafood exporters. From the Wooldridge regressions, however, the time variation for the Control of Corruption variable has a positive and significant effect. The coefficient of the time-invariant mean is negative and significant. Thus, when controlling for time invariant mean and when taking into account initial conditions, it seems that corruption deters Norwegian exporters. One potential explanation is that unobserved firm-market characteristics that affect firms' abilities to handle corruption are correlated with the initial value of the dependent variable. This interpretation implies that many firm-market combinations have good abilities to handle corruption. When initial conditions are controlled for, the isolated effect of corruption is negative (giving a positive coefficient for Control of Corruption). Again, our results indicate the importance of adequately correcting for unobserved heterogeneity.

A7 Trade policy relevant dummy variables.

The trade policy dummies included in the regressions are generally insignificant. Both the USA and EU have imposed trade reducing restrictions on imports of Norwegian seafood. This is so in particular for farmed salmon and trout. Still the results are insignificant in the WREP model (but we obtain negative and significant results in the REP model). Also, note that the signs are the opposite for the countries for which Norway had free trade agreements prior to their EU membership (and partly significant).

Table A3.2 Other regression results

	WREP			REP			WREP			REP		
	Coeff.		St. dev	Coeff.		St.dev	M.effects		St.dev	M.effects		St.dev
market export status	0.715	***	0.058	1.802	***	0.053	0.0204	***	0.00313	0.09280	***	0.00987
market export value	0.008	**	0.003	0.024	***	0.004	0.00009	***	0.00004	0.00000	***	0.00002
leader, market	0.191	***	0.015	0.250	***	0.014	0.00225	***	0.00019	0.00103	***	0.00009
leader, country	0.049	***	0.006	0.067	***	0.005	0.00058	***	0.00008	0.00028	***	0.00003
leader, product	0.008	**	0.003	0.007	***	0.003	0.00009	**	0.00023	0.00003	***	0.00001
size	0.019		0.016	-0.023		0.015	0.00023		0.00018	-0.00009		0.00006
appreciation	-0.000		0.000	0.000		0.000	-0.00000		0.00000	0.00000		0.00000
gdp	0.186		0.203	0.109	***	0.007	0.00218		0.00239	0.00045	***	0.00004
gdp per capita	0.084		0.203	0.010		0.014	0.00099		0.00239	0.00004		0.00006
growth, GDP	0.014	***	0.003	0.006	**	0.002	0.00016	***	0.00003	0.00002	**	0.00001
Government indicator Regulatory qual.	0.017		0.048	0.149	***	0.027	0.00020		0.00056	0.00062	***	0.00012
Government indicator Rule of law	-0.040		0.058	0.069	**	0.033	-0.00047		0.00069	0.00028	**	0.00014
Government indicator Control of corr.	0.123	***	0.043	-0.123	***	0.026	0.00145	***	0.00051	-0.00051	***	0.00011
Import adjusted[+]	0.045	***	0.015	0.011	**	0.005	0.00053	***	0.00017	0.00000	**	0.00000
EU	0.018		0.109	-0.184	***	0.036	0.00022		0.00133	-0.00060	***	0.00017
USA	-0.051		0.054	-0.190	***	0.073	-0.00056		0.00056	-0.00063	***	0.00011
FTA	-0.074		0.058	-0.003		0.034	-0.00084		0.00062	-0.00001		0.00014
FTAEEA04	0.209	*	0.118	0.019		0.045	0.00319		0.00230	0.00008		0.00020
FTAEEA07	0.196		0.145	0.288	***	0.062	0.00299		0.00279	0.00185	***	0.00058
distance	-0.111	***	0.022	-0.162	***	0.025	-0.00131	***	0.00026	-0.00067	***	0.00011
Rho	0.000		0.000	0.278	***	0.009						

Note: *, ** and *** correspond to significance at the 10%, 5% and 1% levels. Number of observations is 424,512. Value variables are in NOK million. Year dummies, product dummies, firm dummies, regional dummies and product-year dummies were included in the regressions but are not reported. Random effects are for firm-product-country. The number of firm-country-product observations is 38,592. Log-likelihood and sigma for WREP are -27 294 and 0.221. Log-likelihood and sigma for REP are -31,670 and 0.620.

Coefficients for time-independent means of variables included in the WREP regressions

Description	Coeff.		St.dev
market export status	-0.48600	***	0.01970
market export value	-0.00804	***	0.00263
country export status, other products. Interact (1-y)	-5.79700	***	0.11000
country export status, other products. Interact y	-0.74000	***	0.07310
firm export value, same country, other products. Interact (1-y)	0.00135		0.00097
firm export value, same country, other products. Interact y	0.00183	*	0.00101
number of countries, same product. Interact (1-y)	-0.00873	***	0.00338
number of countries, same product. Interact y	-0.03430	***	0.00448
average firm value, other countries, same product. Interact (1-y)	0.00948	***	0.00360
average firm value, other countries, same product. Interact y	0.00162		0.00495
number of countries, all products. Interact (1-y)	-5.96700	***	0.09960
number of countries, all products . Interact y	-5.97400	***	0.10100
average firm value, other countries, all products. Interact (1-y)	-0.00335		0.01370
average firm value, other countries, all products. Interact y	0.00492		0.01360
number of other firms, same product. Interact (1-y)	0.00147		0.00281
number of other firms, same product. Interact y	-0.03910	***	0.00300
average country value, other firms, same product. Interact (1-y)	0.02290	***	0.00791
average country value, other firms, same product. Interact y	0.08020	***	0.01040
number of other firms, all products. Interact (1-y)	-0.00211	**	0.00105
number of other firms, all products. Interact y	-0.00700	***	0.00117
average country value, other firms, all products. Interact (1-y)	0.01580	***	0.00549
average country value, other firms, all products. Interact y	-0.02880	***	0.00861
country value, other firms, same product. Interact (1-y)	-0.00118	***	0.00030
country value, other firms, same product. Interact y	0.00250	***	0.00036
country value, other firms, all products. Interact (1-y)	-0.00010	*	0.00006
country value, other firms, all products. Interact y	0.00038	***	0.00008
leader, market	-0.08620	***	0.02020
leader, country	-0.05360	***	0.00886
leader, product	-0.01430	***	0.00496
appreciation	0.00003		0.00006
gdp	-0.14500		0.20300
gdp per capita	-0.08890		0.20300
growth, GDP	-0.00977	*	0.00524
Government indicator Regulatory quality	0.09340	*	0.05570
Government indicator Rule of law	0.08830		0.06800
Government indicator Control of corruption	-0.22400	***	0.05250
Import adjusted	-0.00000	**	0.00000
EU	-0.09560		0.11300
FTA	0.02530		0.06730
FTAEEA04	-0.34400	****	0.13000
FTAEEA07	-0.14200		0.15400

Note: Distance and USA dummy, which are time-invariant: and firm size, which is captured by firm dummies, are not included.

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