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Fixed export costs and multi-product firms

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Abstract

This paper has two aims. First, we uncover some salient components of fixed export costs, which play a crucial role in recent heterogeneous firms models of international trade. Second, we investigate whether the importance of these fixed export costs varies with the size of a firms export product portfolio. We find that a destination country's institutional quality, such as the quality of regulation or the extent of corruption, form important impediments to a firm's export decision, lowering the export probability by up to 10%-points. Moreover, relative to single-product firms, multi-product firms experience additional export probability decreases of around 2%-points.

JEL-codes: F12, F55
Keywords: International trade, firm heterogeneity, fixed export costs, multi-product firms

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1 Introduction

Recent heterogeneous firms models of international trade stress the importance of fixed export costs in shaping empirical trade patterns (Melitz, 2003; Chaney, 2008). Yet so far there has been little systematic research regarding the empirical components of such fixed export costs. Early studies have provided indirect evidence for their existence by demonstrating the persistence in export patterns (Roberts and Tybout, 1997; Clerides et al., 1998). More recently, authors have proposed more structural approaches to quantify their importance (Das et al., 2007). Even though these studies are of substantial academic interest in suggesting the presence of fixed export costs, they offer little guidance as to what these costs actually entail.

Some studies have investigated an important implication of the existence of fixed export costs, which is the resulting hierarchy in export destinations (Eaton et al., 2008; Lawless, 2009). That is, we should expect the number of firms serving a particular market to decrease as the fixed export costs to enter this market increase. However, the results are generally disappointing, as firms do not appear to stick to a universal hierarchy. This might imply that fixed export costs are not (only) country-specific, but perhaps even firm-specific.

In this light, recent theories of multi-product firms offer a valuable explanation (Bernard et al., 2009; Brambilla, 2009; Bernard et al., 2010; Arkolakis and Muendler, 2010). [1] In particular, they assume that the impact of fixed export costs is conditional on the size of a firm's product portfolio. That is, *total* fixed export costs will increase with the size of a firm's export portfolio (even though costs *per product* might fall).

In this paper, we take up both these issues in turn. We use a sample of approximately 1,200 large Dutch firms, exporting to 130 countries during the years 2006 and 2007.[2] First, we attempt to open the black box of fixed export costs. Building on a model by Chaney (2008), we derive a two-stage export decision model, in which fixed export costs function as a natural exclusion restriction (cf. Helpman et al., 2008). We consider various indicators of national

[1] This literature has been spawned by the revealed prevalence of multi-product firms in international trade flows. For example, Bernard et al. (2007) show that, even though only 14% of US exporters are multi-product exporters, they are responsible for 93% of total export value. Mayer and Ottaviano (2008) report similar figures for France (19% and 87% respectively).

[2] When we refer to Dutch firms or Dutch exporters, we mean to imply firms and exporters in the Netherlands. These firms can be (and sometimes are) foreign owned.

institutional quality as proxies for fixed export costs. Generally speaking, poor institutional quality raises the transaction costs of (international) economic exchange by increasing the uncertainty regarding its outcomes, for example in terms of the *ex post* allocation of property rights (North, 1981). These costs are largely independent of the size of the transaction, they vary substantially across countries, and they are quite persistent over time. In short, they are potentially good candidates for fixed export costs, and we investigate which of them qualify in this respect. Second, we investigate whether their importance varies with the size of a firm's export product portfolio.

Previewing our results, we find that a country's voice and accountability, the quality of its regulations, the extent of corruption, and its cultural gap relative to the Netherlands are four important elements of fixed export costs. That is, they affect a firm's country-specific export decision, but not its subsequent export volume decision(s). For instance, we find that if Bangladesh (the most corrupt country in our sample) were to lower its level of corruption to match that in Finland (the least corrupt country in our sample), Dutch single-product exporters would on average be 4%-points more likely to export to Bangladesh. Yet the median multi-product firms in our sample (exporting on average 3 products to a country) would benefit by an additional 1.7%-points in export probability following such a change in corruption. Similar effects hold for the other fixed costs proxies.

Our study closely relates to a growing literature on the importance of institutional barriers in hampering international trade volumes. For example, Anderson and Marcouiller (2002) estimate that the transparency and effectiveness of government regulations have an impact on trade volumes which is comparable to that of tariffs. Similarly, Crozet et al. (2008) find that political unstability in a destination country decreases exports due to the necessity of taking additional safety precautions. Djankov et al. (2010) find that the time it takes to transfer goods across borders also seriously impedes international trade, documenting that each additional day of delay is equivalent to distancing two countries by 70 km. Blum and Goldfarb (2006) and Guiso et al. (2009) find that large differences in culture and trust between countries tend to significantly lower economic exchange in general, and international trade in particular. Further evidence on the importance of institutions for international trade is

provided in *inter alia* de Groot et al. (2004), WTO (2004), Yu (2010) and Musila and Sigue (2010). So far, however, their impact on the extensive and intensive margins of firm-level trade has not been systematically considered.

The rest of this paper is structured as follows: the next section presents the empirical model and our data. In Section 3, we discuss some descriptive features of these data. Section 4 presents the econometric results. Finally, Section 5 concludes.

2 Empirical strategy

2.1 Empirical model

Recent heterogeneous firms models of international trade (Melitz, 2003; Chaney, 2008) explain *inter alia* why exporters are more productive than non-exporters, and why some exporters export to more countries than others. Many of the results center around the combination of firm-level productivity heterogeneity and country-level fixed export costs, which create a hurdle when entering foreign markets. In particular, an important feature of these models is that they decompose firm exports into two decisions: first, a firm decides whether or not it exports to a particular market (the extensive margin decision). Second, and conditional on the first decision, a firm then decides how much to export (the intensive margin decision). Fixed export costs only affect the first-stage decision.

Our empirical model closely follows the model by Chaney (2008). His model generates two equilibrium equations, one governing the extensive margin firm-level export decision and the other governing the (conditional) intensive margin export decision. A firm i's export decision (Exp) to market k is positively affected by its labor productivity (φ), as well as country k's market size (Y) and its remoteness (θ) from the rest of the world (making it *relatively* easier for firm i to serve country k). It is negatively affected by the prevailing variable (τ) and fixed (F) export costs in country k. Conditional on a positive (first-stage) export decision, firm i's (second-stage) export volume decision (x) is governed by the same set of variables (and in the same direction), *except for fixed export costs* which only affect the extensive margin.[3]

[3]For completeness, it should be noted that world income and home-country wages also factor into these

To turn these two equations into an empirical specification, we first construct a latent variable Exp^*_{ijk} as follows:

$$Exp^*_{ik} = \alpha_0 + \alpha_1 \ln \varphi_i + \alpha_2 \ln \tau_k + \alpha_3 \ln \theta_k + \alpha_4 \ln Y_k + \alpha_5 \ln F_k + \varepsilon_{ik} \tag{1}$$

For all the firms in our sample, we observe whether or not they export to country k, so that we can construct a binary (0,1) variable Exp_{ik} which takes the value 1 if firm i exports to county k, and 0 otherwise. Combining this with our latent variable we thus have:

$$\begin{aligned} Exp_{ik} = 1 &\iff Exp^*_{ik} \geq 0 \\ Exp_{ik} = 0 &\iff Exp^*_{ik} < 0 \end{aligned} \tag{2}$$

Assuming that ε_{ik} is normally distributed and independent of the RHS variables in (1) we can write the probability of a positive export decision as:

$$\begin{aligned} &\Pr\left(Exp_{ik} = 1\right) = \Pr\left(Exp^*_{ik} \geq 0 | \varphi_i, \overline{\varphi}_k\right) \\ &= \Phi(\alpha_0 + \alpha_1 \ln \varphi_i + \alpha_2 \ln \tau_k + \alpha_3 \ln \theta_k + \alpha_4 \ln Y_k + \alpha_5 \ln F_k) \end{aligned} \tag{3}$$

where Φ is the cumulative normal distribution function.

When writing down the (log linear) intensive margin export decision , we should account for the fact that this decision is conditional on a positive first-stage export decision as in (3). Hence:

$$E(\ln x_{ik} | Exp_{ik} = 1) = \beta_0 + \beta_1 \ln \varphi_i + \beta_2 \ln \tau_k + \beta_3 \ln \theta_k + \beta_4 \ln Y_k + E(\upsilon_{ik} | Exp_{ik} = 1) \tag{4}$$

where the final term on the RHS captures the correlation between the extensive and intensive export margin decisions. If we normalize the variance of ε to one, and we assume that the joint distribution of ε and υ is bivariate normal, this term can be rewritten as the inverse Mill's ratio, also known as Heckman's lambda (Heckman, 1979). It is derived from the first stage model in (3) and entered as an independent variable in (4). Models (3) and (4) are the

two equations. However, since we only consider one home country (the Netherlands) these drop out of the equations.

estimating equations, and to account for their interdependence we use a (two-stage) Heckman selection model to estimate them.[4]

Note that the theory proposes fixed export costs F as a natural exclusion restriction in the two-stage procedure. That is, it (negatively) affects the extensive margin export decision in (3), but not the subsequent export volume decision in (4). We will use this property in the empirical part to establish which of our variables are proper fixed cost proxies.

Furthermore, we will also extend the model in (3) by adding interactions between F and the number of products a firm exports to establish whether or not the impact of fixed costs varies with the size of the productportfolio. Even though Chaney's (2008) model does not allow for multi-product firms, Arkolakis and Muendler (2010) derive such a model that yields two margin equations that are strongly reminiscent of (3) and (4).[5] Their analysis shows that a firm's optimal product scope on the one hand, and firm productivity, total fixed costs and export volumes on the other hand are all positively correlated. Hence, we should expect a positive *individual* impact of the number of export products on both the export probability and export volume, and a negative interaction effect with F on the export probability.

2.2 Data and variables

We need three types of data: (1) data on firm characteristics, notably on some measure of firm productivity and the number of products exported; (2) data on the export patterns of these firms; and (3) data on export market characteristics. The first two data types are provided by Statistics Netherlands, the third is derived from several public sources.

We use firm-level data for the 1,200 largest non-financial Dutch firms during the years 2006 and 2007.[6] These are firms that report an annual, consolidated, domestic balance sheet total asset value of at least 23 million Euros. The trade data that we use refer to international transactions of goods, and are identified by the VAT numbers on which they were recorded. For each of these transactions, we have information on *inter alia* the value of the transactions,

[4] In order to estimate the first-stage equation, we run pooled Probit models while clustering standard errors at the firm-level. Second stage models are run by means of FGLS while bootstrapping standard errors to account for the bias induced by first-stage selection.

[5] In particular, see equations (11) and (27)-(28) in that paper.

[6] Note that this changes the setup of models (3) and (4) slightly, as a time index t is added.

the amount and type of goods that are transacted, and the country to which the goods were exported.

The reason to focus on large firms is that we require sufficient within-firm variation in the number of export markets served, and that we require a sufficient number of firms that export multiple products abroad. Most small firms only serve one export market with one product, whereas large firms often serve multiple export markets with multiple products (cf. Bernard et al., 2007; Mayer and Ottaviano, 2008).

To construct the dependent variable Exp_{ik} in (**??**), we first gather all the export destinations that any one firm in our sample exports to. This yields a total of 130 export destinations (cf. Table A1). Using the match between the firms and the trade statistics, we first determine for each year if firm i exports to country k (Exp_{ik}=1) or not (Exp_{ik}=0). The dependent variable in the second-stage equation (4) is the log of firm-level exports to country k, where exports are measured in Euros, deflated with 2002 2-digit industry-level deflators.[7]

As a measure of labor productivity φ_i we compute for each firm the ratio of value added over total employment (in FTEs) and take the logarithm. Value added is deflated using 2002 2-digit industry-level deflators. For each firm, we also count how many different products it exports to a particular country at the 8-digit HS classification level.[8]

The country-level variables that we incorporate in our model are derived from a variety of sources. As a measure of market size Y_k we use (the log of) total GDP (in constant mln. US$), which are taken from the World Bank's World Development Indicators and converted to Euros using the year-averaged Euro-Dollar exchange rate. Variable trade costs τ_k are approximated by (1) the (logged) distance (in km.) between the most populated city of the export destination and Amsterdam, derived from the CEPII dataset, and (2) the mean *ad valorem* import tariff of the export destination, taken from the Fraser Institute.[9] We also use these variables to compute the remoteness term θ_k for each export destination k in our sample, where we use a

[7]Several issues arise when performing the matching of the data. For example, even though there are many multinationals (MNEs) in our dataset, the data do not allow us to distinguish between intra-firm and arm's length trade flows. For more information regarding this and other issues, see Smeets et al. (2010).

[8]We use the 2007 HS classification system to identify unique products.

[9]Hence, we assume that $\tau_k = d_k e^{t_k}$ where d is distance and t is the average tariff. We do not include other common aspects of variable trade costs, such as common borders or common language, as the variation therein is primarly driven by home-host country heterogeneity. Since we only consider one home-country, the variation in these variables is very limited in our sample.

simplified version of the one proposed by Chaney (2008).[10]

Finally, we use a number of different measures for fixed export costs F_k. Following earlier studies in this field (cf. Section 1), we proxy three broad types of institutional quality. First, we consider four proxies for *general* institutional quality (cf. Anderson and Marcouiller, 2002; Crozet et al., 2008). The first two are taken from Kaufman et al. (2009) and measure the right to elect government and the freedom of expression, association and media (*voice*), and the government's ability to formulate and implement sound policies promoting private sector development (*regulation*). The third measure is taken from Transparancy International, and measures the extent of corruption in a country (*corruption*). The fourth measure captures the extent of Intellectual Property Rights (IPR) protection and is taken from the updated Ginarte and Park (1997) dataset (*ipr*).

Second, we consider two measures of institutional quality that relate more directly to international trade (cf. Djankov et al., 2010). These indicators are derived from the Trading Across Borders index of the World Bank Doing Business database. These indicators are collected from a survey, but refer to the (average) costs and procedures for importing a standard container of goods into the respondents country. The two measures that we use are the number of documents required to import a standard container of goods into a country (*documents*), and the time it takes (in days) to do so (*time*).

Third, we also consider a measure of the cultural distance between the Netherlands and potential export destinations (cf. Guiso et al., 2009). We adopt the KOF index on cultural proximity (cf. Dreher, 2006; Bjornskov et al., 2008), which measures the extent of cultural differences between the importing country and western industrialized countries (*culture*).[11]

[10]In particular, Chaney (2008) derives that $\theta_k = \sum_{r=1}^{M} (Y_r/Y)^{(-1/\gamma)} w_r \tau_{rk} F_{kr}^{1/(\sigma-1)-1/\gamma}$.We only use bilateral distance as a proxy of variable trade costs τ in the computation of θ, as we do not have information on bilateral average tariffs for the countries in our sample. Similarly, we exclude fixed export costs F from the computation, as we do not know *a priori* what these costs are. Furthermore, we compute multilateral resistance terms for each country k relative to all other countries in our sample, effectively assuming that all countries in our sample have trade relationships with each other. γ is the regression coefficient from the log rank of a firm in the productivity distribution, on the log of its productivity (Gabaix and Ibragimov, 2007; Gabaix, 2008).We have performed this regression also including the full sample of small firms that are surveyed by Statistics Netherlands each year. Moreover, we computed both an overall γ as well as a 1-digit industry-specific γ, each time applying the correction suggested by Gabaix and Ibragimov (2007). The results reported below use the overall γ but results are very similar when using industry-specific γ's.

[11]This indicator combines the number of McDonalds restaurants and Ikea shops per capita in a country with the value of trade in books (as a percentage in GDP). For more information see Bjornskov et al. (2008).

Table 1 provides some descriptive statistics for these variables in our sample.

<< INSERT TABLE 1 ABOUT HERE >>

3 Export market hierarchies

An important implication of recent models of heterogeneous firms and fixed export costs, such as Chaney (2008), is that we should observe a hierarchy in the popularity of export markets. This is due to the variation in cross-country fixed export costs. Given that firms are heterogeneous in their productivity, the number of firms serving a particular market decreases with the height of its fixed export costs. We should thus be able to construct a ranking of export markets, with the most popular export destination at the top of the hierarchy, and the least popular at the bottom.

The empirical evidence on export market hierarchies is rather weak (Eaton et al., 2008; Lawless, 2009). In order to investigate its relevance for Dutch exports, Table 2 presents three definitions of export market hierarchy, and the number of firms that stick to it.

<< INSERT TABLE 2 ABOUT HERE >>

Column one presents the number of firms that serve a particular market, which determines the ordering of export markets in terms of their popularity. The resulting country ranking indicates the relevance of the model in Section 2, as the top 10 consists of large, well developed markets, and the top 3 of markets that are geographically very close to the Netherlands.

Column two imposes more structure. Specifically, each row counts the number of exporters to a particular country that adhere to a hierarchy within the top 10. Hence, the first row counts the number of firms serving only Germany, only Germany and Belgium, only Germany, Begium and France, etc., and similarly for the following rows. The number of firms adhering to this hierarchy drops substantially relative to column one, particularly within the top 5.

Column three is most strict and fully incorporates the theoretical implications. It counts the number of firms sticking to an export market hierarchy within the entire set of export destinations. As can be seen, the number of firms doing so is very small, and once we reach

the sixth most popular market (Italy) it drops to zero. This is in line with previous findings for France (Eaton et al., 2008) and Ireland (Lawless, 2009).

One conclusion could be that fixed export costs are not the crucial factor in determining firms' export decisions. However, above we already noted that recent theories of multi-product firms stress that firms might incur product-specific fixed export costs. This would imply that the impact of fixed export costs on the export decisions varies with the size of a firm's export product portfolio, and hence might be firm-specific.

In this respect, Figure 1 provides some tentative evidence. The figure shows the correlation between the average number of products that firms' export to a particular country, and the corruption perception index of a country (where a higher index means less corruption).[12] It is clear that less perceived corruption (i.e. a higher index) is accompanied by a larger export product portfolio. This is consistent with the notion that fixed export costs are product specific, and increase with the size of the product portfolio. In the next section, we investigate this implication more formally.

<< INSERT FIGURE 1 ABOUT HERE >>

4 Empirical results

4.1 Measuring fixed export costs

The first aim of this paper is to open the black box of fixed export costs. As we explained in Section 2.1, a proper proxy for fixed export costs affects the extensive but not the intensive export margin decision. In order to investigate if a proxy has an effect on only one or both export margins, we enter it both in models (3) and (4). Since we also need an exclusion restriction to properly estimate this system of equations, we have to add at least two proxies to the model in (3), one of which can function as the exclusion restriction. By letting each of them function as such in turn, we maintain maximum flexibility in the specification and are able to consider a proxy's performance in all possible contexts. If a variable is a proper fixed

[12] As we will show in detail in the next section, the extent of corruption is one of the institutional proxies in our data that qualifies as a fixed export cost.

costs proxy, it should affect the export decision in (3) but not the volume decision in (4). We do not add more than two proxies at once because of multicollinearity issues. Table 3 presents the results.

<< INSERT TABLE 3 ABOUT HERE >>

In order to determine if a variable is an appropriate fixed cost proxy, we compare its effects within a row and across columns. Specifically, we require that there is a significant (+ or -) impact on the extensive margin (Ext) but no impact (0) on the intensive margin (Int). Two variables clearly fail this test: the strenght of IPR (ipr) and the number of days it takes to ship goods across borders ($time$). These two variables have the expected effects, but on both margins simultaneously. This could imply that they are either better proxies for variable trade costs, or that they contain elements of both fixed and variable trade costs. The number of documents required to ship goods across a foreign border ($documents$) does not qualify as a fixed export cost either. Although it only affects the intensive margin significantly (and with the expected effect) in two out of six specifications, its impact on the extensive margin is systematically insignificant.

The remaining four variables ($voice$, $regulation$, $corruption$, and $culture$) meet the fixed export cost requirements reasonably well. In the majority of specifications they affect the extensive margin significantly, but are of no importance for the intensive margin. Also note that they carry the expected sign in all specifications.[13] In order to quantify their impact, Table 4 below presents the estimates of models (3) and (4), using each of these proxies as a fixed export cost in turn.

First consider the other export determinants. Most of them enter both models significantly and with the expected signs, except for the remoteness term which is never significant, and trade tariffs which are usually only significant in the intensive margin regression. Coefficient estimates are comparable across the different specifications. The estimates in Model 1 indicate that a 10% increase in firm productivity increases the export probability – which on average is +/- 19%-points to any country – by 0.3%-points, and the export volume by 7.4%. The

[13] An increase in these measures implies increased institutional quality, decreased corruption, and decreased cultural distance, so that we expect positive coefficients.

corresponding figures for the other variables are 1%-point and 20% for GDP, and -1.6%-points and -30% for distance.[14] A 1% increase in tariffs reduces the export volume by 4.7%. Heckman's lamda (i.e. the inverse Mill's ratio) enters the intensive margins positively and significantly in all specifications, indicating that indeed there is a selection bias as the error terms in both models are positively correlated.[15]

<< **INSERT TABLE 4 ABOUT HERE** >>

Next consider the impact of the fixed export cost proxies. Because most of these variables are measured as indices, their marginal impact is not easily interpreted. Instead, we consider the following thought experiment: what would happen to a firm's export probability to a country experiencing the highest fixed export cost, if this country would be able to lower those costs to the level of the best performing country in our sample? For instance, Model 1 uses *voice* as the fixed export cost proxy. Syria has the lowest index on this variable (-1.77) whereas Norway has the highest (1.55). Accordingly, if Syria was able to improve its voice and accountability to the level of Norway, this would increase the average firm's export probability to Syria by 8%-points (i.e. (1.55+1.77)×0.024).

Similarly, if Iran (-1.61) was able to improve the quality of its regulation to the level of Denmark (1.93), firms would be 13.1%-points more likely to export to Iran, as indicated in Model 2. Model 3 shows that decreasing the level of corruption in Bangladesh (with a ranking of 17) to that in Finland (with a ranking of 97) would increase the export probability by 4%-points. Finally, if the cultural distance gap between Bangladesh to the Netherlands could be closed completely (implying an increase in the index of 87), this would boost the export probability by 8.7%-points.

In sum, the four different export proxies are not only qualitatively important, but also have a substantial quantitative impact on the (average) export probability in our sample. Naturally, these estimates should be interpreted with care, as they cannot simply be added to arrive at a total impact of fixed export costs on the export probability. In this thought experiment we

[14] Even though the different impacts between the extensive and intensive margin seem large, it should be noted that the variation in the dependent variables is also very different between the two models (cf. Table 1).

[15] A possible explanation for such a positive correlation might be that unobserved managerial ability - which arguably positively affects both the export decision and export volumes - enters the error terms in both models.

only consider partial impacts, but a change in one of these variables most likely also induces a change in the others. Indeed, the high correlation between them was the reason not to include them simultaneously in the model.

4.2 Multi-product firms

As we illustrated in Section 3, the importance of fixed export costs is likely to increase with the size of the product portfolio, e.g. because fixed export costs are product-specific (Bernard et al., 2009; Brambilla, 2009; Arkolakis and Muendler, 2010). Now that we have established which of our proxies qualify as (components of) fixed export costs, we can consider whether their economic impact indeed increases with the size of the product portfolio.

To this end, Table 5 repeats the analyses in Table 4 while including an interaction between each measure of fixed export costs and the (log of the) number of exported products in the extensive margin (as well as the individual log number of products).[16,17]

The coefficient estimates of the "control" variables are comparable to those in Table 4, although the extensive margin coefficients of GDP and distance are slighly higher in absolute magnitude. The individual effect of the (log) number of products is positive and significant as expected (cf. Arkolakis and Muendler, 2010), indicating that firms with a larger product-portfolio are also more likely to serve a particular market. In particular, the first pair of regression results (with *voice* as the fixed cost proxy) suggests that a 10% increase in the average number of exported products increases the export probability towards a particular market by 0.8%-points, and the export volume by 9.2%.

[16]To be more precise, for each firm we compute the *average* number of products it exports to a country in its destination portfolio. Hence, the number of products is firm-specific rather than firm-country specific. The reason for doing so is twofold: first, the number of firm-country products likely is endogeneous to the country-specific export decision. Second, taking logs in this case only leaves us with the sample of exporters to a particular country while dropping all non-exporters (which export zero products). This means we would lose all zeroes on the left-hand-side of model (3).

[17]Adding interactions in nonlinear models is not without problems, as discussed in Norton et al. (2004). Specifically, in a standard probit regression, the marginal effect of the interaction term can take on different values depending on the value of the other covariates, and the reported standard errors on the estimated coeffients are invalid. We follow the procedure and methodology outlined in Norton et al. (2004) to compute coefficients on the interaction terms in Table 5. This methodology computes the value of the interaction term and its correpsonding significance level for each observation and relates it to its position in the probability distribution. In Table 5 we report the mean value of the implied marginal effects and their standard errors. Graphs showing the different marginal interaction effects for each observation and their computed z-statistics are available upon request.

<< **INSERT TABLE 5 ABOUT HERE** >>

The final two rows of the extensive margin regressions report the impact of the different fixed export cost proxies, and their interaction with the (log) number of products. Again consider the estimates in the first column, with *voice* as the fixed cost proxy: the non-interacted fixed cost variable now captures the impact of fixed cost for a firm exporting a single product (on average) to a country. Conducting a similar exercise as before, the estimated coefficient implies that single product (SP) exporters are 9.9%-points more likely to export to Syria if that country improved its institutional quality to the level of Norway (i.e. $(1.55+1.77)\times 0.030$).[18] Yet for a median multi-product (MP) firm (that exports an average of 3 products to a country), this number increases by 1.7%-points (i.e. $[1.55+1.77]\times[\log(3)\times 0.011]$).

Similar conclusions hold for the other fixed export cost proxies. Continuing this example, we can redo the thought experiments of Section 4.1. This yields that, compared to SP firms, median MP firms are 1.9%-points more likely to export to Iran, 1.9%-points more likely to export to Bangladesh, and 1.7%-points more likely to export to Bangladesh if these countries could fully improve regulatory quality, reduce corruption, and close the cultural gap with the Netherlands, respectively.

Given that MP exporters only export 2 products more than SP exporters, these estimated increases in export probability following institutional improvement are quite substantial. Or stated differently, the additional fixed costs that are incurred on each exported product are rather sizeable. It thus is clear that the economic impact of reducing fixed export costs can become quite substantial for MP exporters. This might explain the widely documented fact that many firms are indeed SP exporters (Bernard et al., 2007; Mayer and Ottaviano, 2008; Eaton et al., 2008). However, given that MP (and multi-country) exporters are responsible for the large majoriy of trade value, reducing these export barriers can lead to substantial export increases.

[18] This figure is slightly above that estimated in Table 4 due to the fact that all non-exporters (i.e. firms not engaged in exports at all) are dropped from the sample.

5 Conclusion

In this paper we set out with two goals in mind: first, to uncover some salient empirical components of fixed export costs, and second, to investigate if the impact of these costs increases with the size of a firm's export product portfolio. Our results indicate that poor institutional quality can form an important impediment for a firm's export decision, but does not affect the subsequent export volume decision. In particular, weak voice and accountability of government, poor regulatory quality, excessive levels of corruption, and large cultural gaps are all important deterrents to export decisions. Furthermore, we find that the implied export costs increase quite substantially with the size of the export product portfolio.

Given the importance of multi-product (and multi-country) firms in aggregate export flows, the result that their export decisions are severely deterred through fixed export costs, and poor institutional quality in particular, is an important result. It suggests that future trade policy may have to start broaden its scope beyond more traditional approaches - such as lowering tariffs and transport costs - to encompass broader policy areas that aim to improve insitutional quality in foreign countries. Although the gain from such a policy reorientation could potentially be large if it indeed stimulates more (and new) multi-product firms to venture abroad, the very nature of these policies and the barriers that they aim to reduce also suggest that reshaping policy in this way will not be easy and will require a long-term perspective.

We end by pointing out some limitations of this study: first and foremost, our empirical analysis only incoroporates the largest firms in the Netherlands. Given that the number of multi-product and multi-country exporters is clearly overrepresented in this sample, our results and conclusions are difficult to generalize to the larger population of firms in the Netherlands. If the large majority of (small) exporters in the Netherlands are all single-product exporters, our results suggest that fixed export costs are not very important in determining their export patterns.

Also, the fact that we only consider firms in the Netherlands might bias our results, given the high degree of openness of the Dutch economy. The extent to which this might bias our results is not clear: on the one hand, Dutch firms might have extensive export experience, suggesting that our estimates are conservative. On the other hand, the Dutch economy might

be overrepresented by multi-product firms, suggesting that we may be overestimating the importance of fixed export costs.

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Table 1: Descriptive Statistics

	Mean	St. Dev.	Min	Median	Max
Exp_{ik}	0.19	0.39	0	0	1
Log exports	12.1	2.92	0	12.3	21.7
Log productivity	4.5	0.65	0	4.46	8.65
Log no. of products	3.14	1.50	0	3.22	7.18
Log GDP	10.3	0.93	8.21	10.2	13.0
Log distance	3.6	0.43	2.24	3.72	4.28
Log remoteness	9.9	0.03	9.86	9.9	10.0
Tariffs	9.49	4.72	2.30	8.30	26.8
Voice	0.11	0.89	-1.75	0.08	1.55
Regulation	0.12	0.88	-1.61	-0.11	1.93
Corruption	41.4	22.2	10	33	97
Ipr	2.41	1.64	1	2	5
Documents	8.59	3.29	1	8	20
Time	31.2	19.1	5	26	102
Culture	53.7	25.5	1.39	61.7	91.9

Values computed for the years 2006 and 2007.

Table 2: Export market hierarchies (2007)

Country	Simple ranking	Top 10 hierarchy	Complete hierarchy
Germany	653	318	21
Belgium	649	301	11
United Kingdom	578	290	5
France	578	289	4
Switzerland	515	283	1
Italy	507	283	1
Spain	496	281	0
Denmark	484	277	0
United States	476	269	0
Poland	458	249	0

The simple ranking denotes the number of firms exporting to a particular market. The top 10 hierarchy denotes the number of firms that stick to an export market hierarchy within the top 10 of export destinations. The complete hierarchy denotes the number of firms that stick to an export market hierarchy within the entire group of (sample) countries.

Table 3: Determining fixed export costs

Fixed cost proxy	Margin	Exclusion restrictions						
		Voice	Regulation	Corruption	IPR	Documents	Time	Culture
Voice	Ext	.	0	+	0	+	+	+
	Int	.	0	0	0	0	0	0
Regulation	Ext	+	.	+	+	+	+	+
	Int	+	.	0	0	0	0	0
Corruption	Ext	+	0	.	+	+	+	+
	Int	0	0	.	0	0	0	0
IPR	Ext	+	+	+	.	+	+	+
	Int	+	+	+	.	+	0	0
Documents	Ext	0	0	0	0	.	0	0
	Int	-	0	-	0	.	0	0
Time	Ext	-	0	-	-	-	.	-
	Int	-	-	-	-	-	.	-
Culture	Ext	+	+	+	+	+	+	.
	Int	+	0	+	0	0	0	.

Rows show the fixed costs proxy, and columns which of these proxies functions as the exclusion restriction in the extensive margin decision. Ext = extensive margin; Int = intensive margin. +: positive significant effect, 0: no significant effect, -: negative significant effect.

Table 4: Quantifying fixed export costs

	F=Voice		F=Regulation		F=Corruption		F=Culture	
Log productivity	0.032^{***}	0.741^{***}	0.032^{***}	0.651^{***}	0.033^{***}	0.719^{***}	0.035^{***}	0.668^{***}
	(0.001)	(0.065)	(0.001)	(0.053)	(0.001)	(0.079)	(0.002)	(0.060)
Log GDP	0.108^{***}	2.030^{***}	0.103^{***}	1.691^{***}	0.106^{***}	1.937^{***}	0.114^{***}	1.703^{***}
	(0.006)	(0.251)	(0.064)	(0.198)	(0.007)	(0.287)	(0.006)	(0.225)
Log distance	-0.161^{***}	-2.961^{***}	0.144^{***}	-2.446^{***}	-0.159^{***}	-2.811^{***}	-0.171^{***}	-2.534^{***}
	(0.013)	(0.364)	(0.014)	(0.325)	(0.014)	(0.425)	(0.014)	(0.323)
Log remoteness	0.259	-1056	0.094	-2.079	0.187	-1258	0.175	-1909
	(0.180)	(1.932)	(0.175)	(1.884)	(0.171)	(1.899)	(0.185)	(1.988)
Tariffs	-0.001	-0.047^{***}	-0.000	-0.036^{***}	-0.002^{***}	-0.045^{***}	-0.001	-0.038^{***}
	(0.001)	(0.011)	(0.001)	(0.011)	(0.001)	(0.013)	(0.001)	(0.014)
Fixed export costs	0.024^{***}		0.037^{***}		0.0005^{**}		0.001^{***}	
	(0.006)		(0.006)		(0.000)		(0.0002)	
Heckman's Lambda		2.808^{***}		1.863^{***}		2.546^{***}		1.992^{***}
		(0.643)		(0.513)		(0.772)		(0.581)
(Pseudo) R2	0.19	0.21	0.20	0.21	0.20	0.21	0.18	0.20
Obs. Probability	0.19		0.19		0.19		0.21	
Pred. probability	0.14		0.14		0.15		0.18	
No. of observations	178,473	33,660	178,473	33,660	177,022	33,646	156,708	32,515

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors within parentheses. The fixed export cost proxies are *Voice* (column 1), *Regulation* (column 2), *Corruption* (column 3), and *Culture* (column 4). The first column in each model reports the extensive margin probit regression ($Prob(Exp = 1)$) whereas the second column reports the intensive margin GLS regression while correcting for sample selection.

Table 5: Fixed export costs and multi-product firms

	F=Voice		F=Regulation		F=Corruption		F=Culture	
Log productivity	0.029***	0.590***	0.029***	0.572***	0.030***	0.582***	0.032***	0.582***
	(0.002)	(0.034)	(0.002)	(0.031)	(0.002)	(0.033)	(0.002)	(0.034)
Log GDP	0.131***	1.856***	0.128***	1.756***	0.130***	1.805***	0.145***	1.768***
	(0.007)	(0.121)	(0.007)	(0.108)	(0.007)	(0.121)	(0.008)	(0.114)
Log distance	−0.214***	−2.778***	−0.199***	−2.614***	−0.213***	−2.687***	−0.240***	−2.689***
	(0.016)	(0.204)	(0.017)	(0.205)	(0.017)	(0.206)	(0.012)	(0.191)
Log remoteness	0.372*	-0.222	0.168	-0.693	0.257	-0.400	0.305	-0.525
	(0.207)	(1.908)	(0.196)	(1.911)	(0.195)	(1.921)	(0.224)	(1.961)
Tariffs	-0.001	−0.042***	-0.001	−0.039***	−0.003***	−0.040***	-0.002	−0.041***
	(0.001)	(0.010)	(0.001)	(0.010)	(0.001)	(0.010)	(0.001)	(0.011)
Log no. of products	0.084***	0.923***	0.083***	0.866***	0.069***	0.893***	0.079***	0.898***
	(0.003)	(0.056)	(0.002)	(0.048)	(0.003)	(0.056)	(0.004)	(0.052)
Fixed export costs	0.030***		0.042***		0.0005***		0.001***	
	(0.007)		(0.007)		(0.000)		(0.003)	
... × Log no. of products	0.011***		0.011***		0.001***		0.0004***	
	(0.003)		(0.002)		(0.000)		(0.0000)	
Heckman's lambda		1.698***		1.450***		1.562***		1.547***
		(0.202)		(0.175)		(0.208)		(0.177)
(Pseudo) R2	0.39	0.26	0.40	0.26	0.39	0.26	0.39	0.26
Observed probability	0.23		0.23		0.23		0.25	
Predicted probability	0.12		0.12		0.12		0.15	
Observations	149199	33660	149199	33660	147986	33646	131004	32515

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors within parentheses. The fixed export cost proxies are *Voice* (column 1), *Regulation* (column 2), *Corruption* (column 3), and *Culture* (column 4). The first column in each model reports the extensive margin probit regression ($Prob(Exp = 1)$) whereas the second column reports the intensive margin GLS regression while correcting for sample selection.

Table 6: Export destinations of Dutch firms

Albania	Central African Republic	Georgia	Kazachstan	New Zealand	Spain
Algeria	Chad	Germany	Kenya	Nicaragua	Sri Lanka
Angola	Chile	Ghana	Kyrgyzstan	Niger	Sweden
Argentina	China	Greece	Latvia	Nigeria	Switzerland
Armenia	Colombia	Guatamala	Lesotho	Norway	Syria
Australia	Costa Rica	Guinea-Bissau	Lithuania	Pakistan	Thailand
Austria	Croatia	Guyana	Luxembourg	Paraguay	Togo
Azerbaijan	Guyana	Haiti	Macedonia	Panama	Trinidad and Tobago
Bangladesh	Cyprus	Honduras	Malawi	Papua New-Guinea	Tunisia
Belgium	Czech Republic	Hungary	Malaysia	Peru	Turkey
Belize	Denmark	Iceland	Mali	Philippines	Uganda
Benin	Dominican Republic	India	Malta	Poland	Ukraine
Bolivia	Ecuador	Indonesia	Mauritius	Portugal	United Kingdom
Bosnia-Herzegovina	Egypt	Iran	Mauritius	Russia	United States
Botswana	El Salvador	Ireland	Mexico	Rwanda	Uruguay
Brazil	Estonia	Israel	Moldavia	Senegal	Venezuela
Bulgaria	Ethiopia	Italy	Mongolia	Sierra Leone	Vietnam
Burkina Faso	Fiji	Ivory Coast	Morocco	Slovak Republic	Zambia
Burundi	Finland	Jamaica	Mozambique	Slovenia	
Cameroon	France	Japan	Namibia	South Africa	
Canada	Gabon	Jordan	Nepal	South Korea	

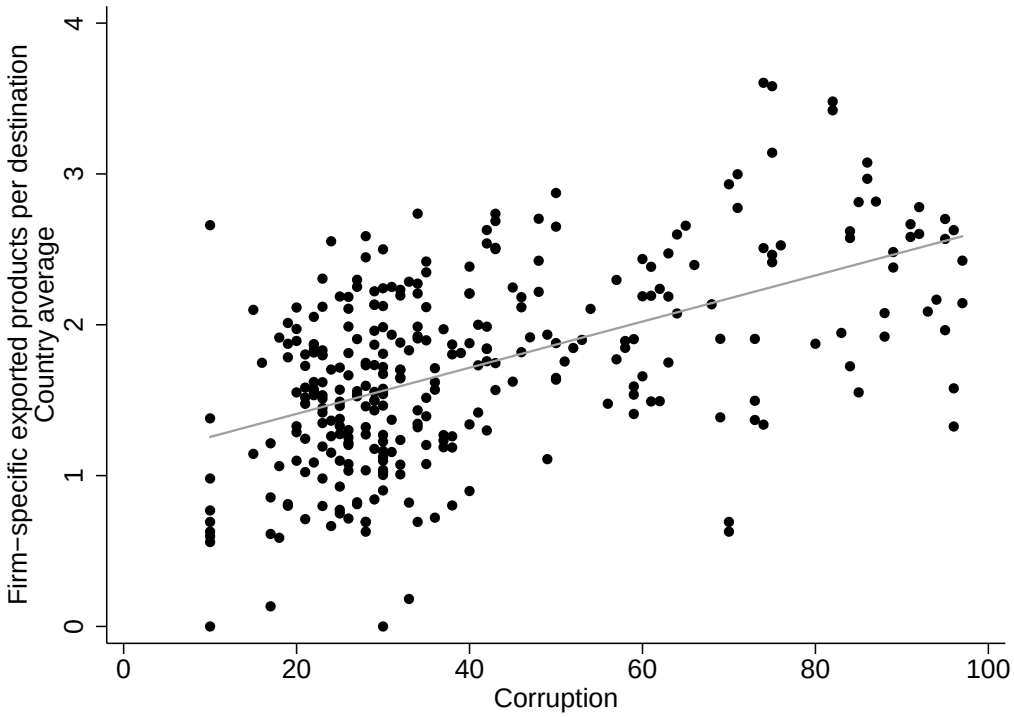

Figure 1: Corruption and export product portfolio size

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