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Firm Heterogeneity and Exports in The Netherlands: Identifying Export Potential

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Firm Heterogeneity and Exports in The Netherlands: Identifying Export Potential

Abstract

Stimulating firms to become exporters is of interest to policy makers, as exporters are in general more productive than non-exporters. However, selecting high export potentials is difficult in practice. The contribution of this paper is to characterize and identify these (high) export potentials. According to the Melitz (2003) model, potential exporters have to be productive enough to overcome the entry costs of foreign markets. Once firms pass this productivity threshold, they *all* export. Empirical evidence, however, indicates that a substantial share of high-productive firms does not export. In this paper, we focus specifically on this group of high-productive non-exporters. We employ a large micro-dataset for Dutch firms *both* in services and manufacturing for 2010-2014. Our findings are threefold. First, high productivity is an important, but not a sufficient condition for exporting. Firm size (substitute for productivity), import status, and foreign ownership are also important. Second, firm location is crucial. A location in peripheral areas prevents high productive firms from exporting; especially a location in the Northern part of the Netherlands reduces the probability to export. Third, the manufacturing sector differs from the services sector. Given that the median exporter in our sample is a services firm; this sector should be included in export research.

JEL-Codes: F120, F140.

Keywords: firm heterogeneity, export behavior, location.

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1 Introduction

Ever since the empirical work of Bernard and Jensen (1995, 1999), it is well-known that firms within industries not only differ with respect to export status, but that they also differ in various other dimensions such as productivity, employment, skill intensity, value added per worker, number of products, capital intensity, and many other firm characteristics (Bernard et al. 2007, see for a review of the theory Melitz and Redding, 2014, and for a review of empirical results Bernard et al. 2012). Firm heterogeneity rules. In general, when compared to non-exporting firms, exporting firms perform differently on all relevant aspects: they are more productive, pay higher wages, are more innovative, and are also capital-intensive. Moreover, exports are strongly concentrated within the group of large firms: in the USA the top 1% of largest firms captures some 80% of total exports; in Germany the top 1% captures some 60 % of total exports (WTO, 2008).

Encouraging non-exporters to become exporters is thus attractive from a policy perspective. Policy makers, however, need criteria to identify high export-potentials. The theoretical model developed by Melitz (2003) provides such a benchmark: firm productivity. In this model firms have to overcome foreign market entry costs. Once firms pass the productivity threshold, they all export. Empirical research, instead, indicates that this is not the case; high productive firms often do not export, while some low productive firms are able to enter foreign markets (Bernard et al., 2012).

The observation that productivity distributions overlap is the starting point of this paper. It turns out (see, for example, Mayer and Ottaviano, 2007) that productivity is an important but not a sufficient condition to enter a foreign market. This leads to the question which other factors determine a firm's export status and what is the relative importance of productivity. Answering these questions is not only of academic interest, as the welfare gains could be substantial. For example, Statistics Netherlands (2016) shows that between 2010 and 2015 the largest contribution in Dutch export growth was caused by new exporters (firms that did not export in 2010). The cumulative exports of this group amounted to €63 billion by 2015 (CBS, 2016, p. 37). Stimulating firms that are promising potential exporters, but who are not yet internationally active could thus be an important additional source of gains of trade and growth.

The focus of this paper lies with high productive firms that do not export, and investigates which factors might lead to these firms to abstain from exporting. We do not only compare high-productive exporters and non-exporters, but more generally look into the relevance of productivity and other potential determinants for a firm's export status, such as location. In addition we also investigate the possible determinants of so called switchers; firms that became exporters during our sample period.

Our main findings are threefold. First, high productivity is indeed an important, but not a sufficient condition for exporting. Other firm characteristics are (more) essential: firm size (substitute for productivity), import status and foreign ownership. Second, firm location is crucial. A location in peripheral areas prevents even high productive firms from exporting. In particular a location in the Northern part of the Netherlands is a drawback, whereas firms close to the border and firms in areas with a high exporter density are more likely to start exporting. On the basis of these findings we can select firms that could individual be targeted by policy. Third, the manufacturing sector differs from the services sector. More factors are important to the export decision for service firms, such as worker skill, various financial variables and the density of firms in their region. Given that the median exporter in our sample is a services firm, the current neglect of the services sector in export research appears unwarranted. The structure of the paper is as follows. In section 2 we motivate the method and research questions, and discuss related literature. Section 3 discusses the dataset, section 4 presents the main results and section 5 discusses some caveats. Section 6 presents our conclusions.

2 Related literature and method

The Melitz (2003) model has a clear intuitive appeal and straightforward empirical implications. A new firm, in a monopolistic competitive market, that considers entering the market is uncertain about its productivity level. Before entering the market it has to pay a market entry fee. Only after it has entered – and paid the sunk costs – it discovers its productivity level that is randomly allocated to the firm. Once the productivity level is revealed to the firm, it calculates whether that productivity level is high enough to cover production costs. If this not the case it exits the market.

The decision to enter the market depends on *expected* profits. As long as expected profits are positive, new firms will enter the market until expected profits equal the market entry costs (sunk

costs). By assuming that fixed production costs are higher in the export market than in the domestic market (setting up a sales network in a foreign market is more expensive than in a domestic market) a ranking of firms results. Some firms that draw a productivity level that is too small for the market exit, some firms that draw higher productivity levels survive in the domestic market but not necessarily in the export market and a small amount of firms will be productive enough to survive in the export market since they can afford the higher market entry costs.

Reducing trade barriers increases overall productivity, because it forces the less productive firms exit the market and it allows productive firms to expand their operations. The empirical findings in the literature generally suggest that there are relatively modest gains in productivity at the plant level, so that most of the aggregate productivity gains can be attributed to firm selection in favor of the most productive plants. Also, this empirical work answers the question of causality; does exporting make firms more productive, or do productive firms select into exporting? The findings point towards the latter; plant productivity causes firms to engage in international trade, whereas the increase in productivity at a firm level as a result of exporting are relatively small or insignificant (Wagner, 2007).

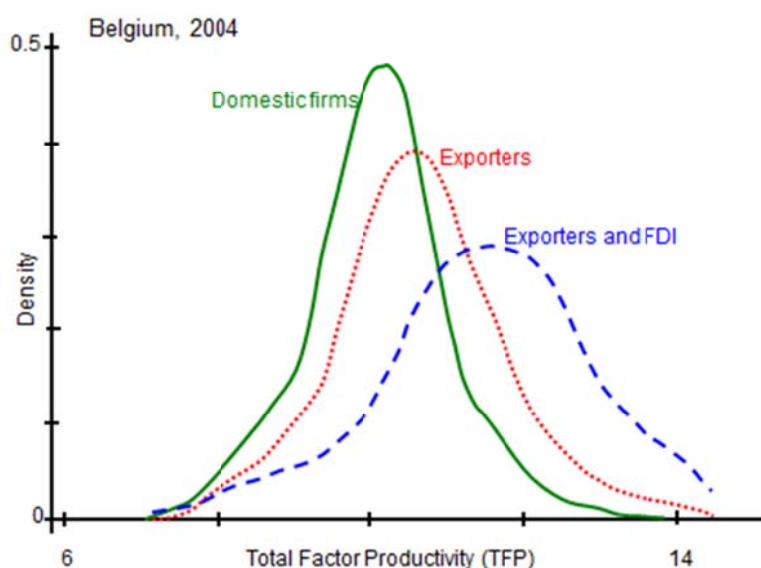
Comparative advantage of sectors remains a relevant concept in the sense that productivity increases are still the largest in sectors that have a comparative advantage. The underlying mechanism, however, is different from the standard Ricardian trade model; it is thus the entry and exit of firms with different productivity levels that cause sectors to become more productive and not, for example, innovation or investment in R&D. Estimates indicate that firm selection effects can be relatively large. Pavcnik (2002) finds that, following Chilean trade liberalization, roughly two-thirds of the 19% increase in aggregate productivity is caused by survival of the most productive firms. Similar results are found by Trefler (2004) following a reduction in trade barriers in Canada, or by Bernard et al. (2006) for trade barrier reductions in the US.

The central ideas from Melitz (2003) can easily be extended; firms first export to nearby markets and then markets that are further away, because fixed entry costs increase with distance (Holmes and Stevens, 2012).² Also different modes of entry can easily be incorporated, such as FDI by assuming that the market entry cost of becoming a multinational is higher than of exporting (Helpman et al., 2004).

² This line of reasoning resulted in a new derivation of the gravity model (Chaney, 2008)

What matters for our present purposes is that the driving force in all this is heterogeneity in firm productivity; all firms above a productivity cut-off survive and sell domestically, firms above an export productivity level sell both domestically and export. In practice the ranking of firms according to productivity is clearly discernible from the data (Bernard et al. 2012). What is also clear that for a large group of countries the respective firm productivity distributions overlap (see f.i. Van den Berg and Van Marrewijk, 2017 (figure 3), Melitz and Trefler, 2012 (figure 5), Altomonte et al., 2012 (figure 3), Mayer and Ottaviano, 2007, (Figure 4)). This implies that at the tails of the distribution, one observes firms that despite passing the productivity threshold do *not* engage in exporting (and/or enter more distant markets or engage in FDI). One interpretation of this stylized fact is that besides firm productivity other barriers to trade exist, be it in- or external to the firm, that prevents firms from becoming exporters at all, becoming exporters in more distant markets or from engaging in FDI. Figure 1 shows a representative outcome for Belgium (Mayer and Ottaviano, 2007).

Figure 1 Firm productivity in Belgium for domestic, exporting and exporting/FDI firms



Source: Mayer and Ottaviano, 2007, Figure 4, p.21

Figure 1 shows the ranking of firms from low to high total factor productivity (TFP) and how the three productivity density distributions overlap; implying that some very productive firms do not engage in exporting or FDI, but are only active domestically. The latter observation is the topic of

this paper; what other factors, besides firm productivity, determine the export decision and what is the relative importance of productivity? The Melitz (2003) model assumes that all firms are identical except with respect to their productivity. Our question is whether (non-) exporting firms differ systematically in other dimensions than just their productivity? If we can determine some of these dimensions, we can increase our knowledge with respect to factors that determine firms to become exporters. For policy makers this is potentially important if these barriers to trade could be addressed explicitly by an export stimulus policy, be it generic or target specific.

To answer our main questions, we estimate the following probit model (and variants thereof) that analyzes a firm's probability of exporting conditional on firm productivity:

$$P_r(X_{i,t} = 1 | Productivity_{i,t}) = F(\beta'Y + \delta_s + \delta_t + e_{i,t}) \quad (1)$$

Where $X_{i,t}$ is a dummy indicating if firm i is exporting at time t , (dummy equals 1 if firm exports), Y is a set of firm-specific explanatory variables, and we include sector fixed effects δ_s as well as time fixed effects δ_t ; $e_{i,t}$, is the error term. In our basic model firm productivity is among the set of explanatory variables, but our main interest will be in estimations where we will estimate (1) conditional on the productivity level or the export status of the firm two years earlier.

3 Data

3.1 Data description

Central to our analysis are firm-level data for the Netherlands. We combine administrative data from a number of sources. The General Business Register (GBR) maintained by Statistics Netherlands (CBS) includes information on sector, firm location and number of employees for every firm with operations in the Netherlands. Data on firm exports is taken from the value added tax declarations. Finally, financial data of the balance sheet and the income statements are taken from the corporate income tax declarations. Each of the three datasets covers the large majority of the Dutch firms in all sectors, apart from the financial sector, the agricultural sector and the non-profit sector. Finally, information on the location of the Ultimate Controlling Institutional unit is retrieved from Statistics Netherlands.

The above procedure results in 968,245 firm year observations for the 2010-2014 period. We pick this period because after 2009 various changes in definitions, which altered the coverage

of firms in the sample.³ We filter the data for unrealistic values, that is, firms that have negative imports or exports, negative assets, report exact the same values with respect to key variables like revenue and wages paid for two or more consecutive years, or have unrealistically high values for productivity (f.i. hundreds of millions of sales per worker).⁴ Furthermore, as in Groot and Van Weterings, (2013), we drop firms with less than 5 employees, firms in sectors with very few firms⁵ (e.g. mining) and firms in the utility or nonprofit sector (e.g. energy and schooling)⁶. The above procedure results in 226,100 firm observations for the period 2010-2014. The size requirement of 5 employees is by far the most stringent, and is responsible 91% of loss in the firm-years.⁷

Table 1 shows how the observations are distributed over the various sectors.⁸ For all firms in this sample we calculate TFP (see below), have detailed firm information and know their export status.

Table 1: Sector distribution; number of firm- year observations

NACE Rev. 2 sector	No. of obs.	Percent
C: Manufacturing	35,956	15.9
F: Construction	30,310	13.41
G: Wholesale and Retail trade	73,014	32.29
H: Transportation and storage	14,550	6.44
I: Accommodation and food services	13,448	5.95
J: Information and communication	13,600	6.02
M: Professional and technical activities	28,789	12.73
N: Administrative activities	16,433	7.27
Total number of observations	226,100	100

³ The data-loss however, is limited. The VAT declarations from which the export status is taken are only available from 2008 onwards, and cover substantially fewer firms in 2008 and 2009 compared to the later years

⁴ In order to correctly measure firm productivity using the Levinsohn & Petrin (2003) method, we also exclude firms which appear only once in the data and firms with incomplete spells. Furthermore, we also drop firms whose average wage per employee is above 500k a year or below 15k a year (which is significantly below the minimum wage).

⁵ We use 500 firm-years as (thus 50 firm observations on average per year) as the lower value for the NACE Rev 2. 2-digit sectors. Most sectors are well above this minimum

⁶ We exclude firms in the sectors NACE Rev. 2 sectors D,E and O-U

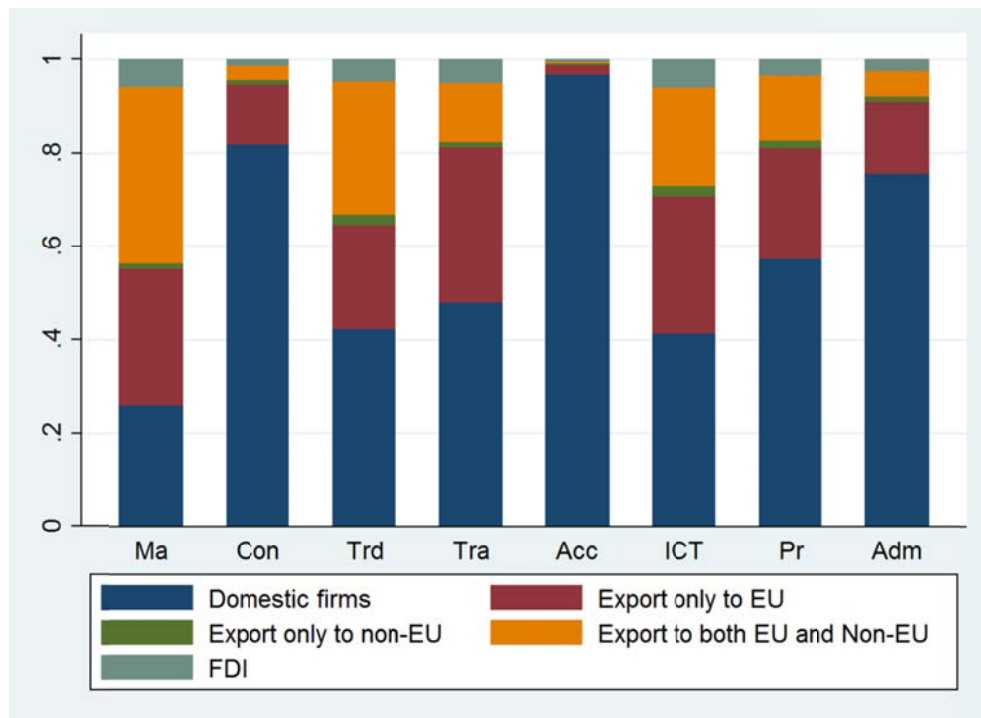
⁷ Specifically, 671,767 out of the 742145 lost firm-years is due to the requirement of at least 5 employees. All analyses are executed with STATA, 14.1.

⁸ For brevity, we only include the number of observations for NACE Rev.2 section. For a more detailed breakdown by 2-digit classification, see Appendix A.

3.2 Export description

Figure 2 provides some descriptive details about the degree of international activities of Dutch firms. We distinguish between non-exporters, exporting only to EU countries, exporting only to non-EU countries, exporting to both EU and non-EU countries and FDI (multinationality). As can be seen from figure 2, a relatively large percentage of the Dutch firms are internationally active. Nonetheless, a substantial amount of firms in all sectors are not internationally active, which is consistent with existing empirical findings. For the firms that do export, the resulting sectoral share of firms that export to non-EU countries relative to firms that export only to EU countries is typically smaller than one (with the exception of *manufacturing* and *wholesale and retail trade*), and only a very small fraction of firms is engaged in FDI (see also Bernard et al., 2012). These observations can be understood with the Melitz (2003) model and are consistent with the assumption that market entry becomes systematically more expensive with internationalization status.

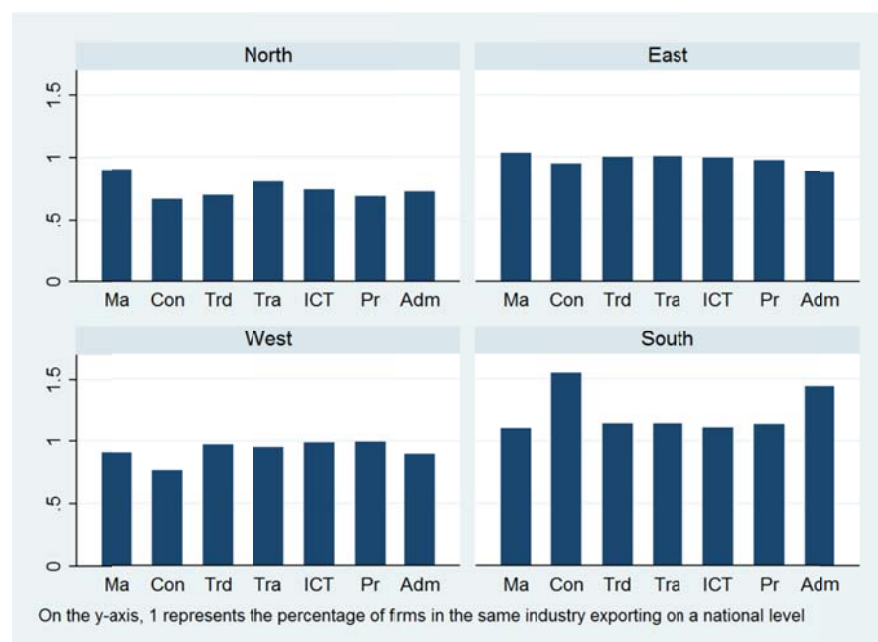
Figure 2: Export frequency by industry



Note: Firms by internationalization status. Labels are the following: (Ma = Manufacturing, Con = Construction, Trd = Wholesale and Retail trade, Tra = Transport and Storage, Acc = Accommodation and Food services, ICT = Information Technology, PR = Professional Services and Adm = Administrative services). If a firm engages in FDI (e.g., has taxable income from foreign operations) it is classified as FDI, regardless of import status.

Not only industry, but also firm location matters for export probabilities. As location we take the NUTS1 level that thus divides The Netherlands in 4 parts: North, East, South and West. The West contains the economic center of The Netherlands (the Randstad area), main Dutch airport and harbour and the 4 largest cities (Amsterdam, Rotterdam, The Hague and Utrecht). The other 3 regions border Germany (North, South and East) and/or Belgium (South). Substantial variation exists in the export-performance of the regions. Figure 3 shows the difference in the percentage of firms that exports by industry-location pair, compared to the national industry average.⁹ A value of 1 indicates the percentage of firms that exports in a certain industry in a certain province is the same as on the national level. Figure 3 shows clear differences in the export probabilities between provinces; firms in the North export less frequently then the national average in every single sector, whereas firms in the South have a higher than average export probability in every single sector. Moreover, the differences in industry-composition can only explain underperformance of regions to a limited extent. A region with a below average export performance in one industry, is also likely to have a below average export performance in all the other industries.

Figure 3 Regional differences in export behavior by industry



⁹**North** consist of the following provinces: Drenthe, Groningen, Friesland; **West** of: Zuid Holland, Noord Holland, Utrecht; **East** of: Gelderland, Flevoland, Overijssel; **South** of: Zeeland, Limburg, Noord-Brabant (Note, that we include Zeeland in the South and not in West as in NUTS1).

Note: Y-axis defined as $(\% \text{ of firms exporting}_r / \% \text{ of firms exporting}_i)$, where r is the region and i is the industry (Ma = Manufacturing, Con = Construction, Trd = Wholesale and Retail trade, Tra = Transport and Storage, ICT = Information Technology, PR = Professional Services and Adm = Administrative services).

Finally, in order to limit the amount of space, we will aggregate sectors into a *manufacturing* sector (NACE Rev.2 codes 10-33) and a *services* sector (NACE Rev.2 codes 41-53/ 58-63/ and 68-82) in the remainder of this paper.¹⁰

3.3 Productivity

A key variable in the analysis is firm productivity. We use the method as developed by Levinsohn and Petrin (2003) which is by now a standard method to measure TFP (and deals with the fact that the error term is most likely correlated with factor inputs). It measures TFP as a ‘residual’ – that is, that portion of output growth that is not explained by factor input growth, with the key variables capital and labor (see also Feenstra, 2016, for a discussion). As in Levinsohn and Petrin (2003), we use proxy variables to control for that part of the error term that could be correlated with factor inputs.¹¹ For labour input total wages are used and total material assets are used as capital input. Due to data availability, we employ the variable “costs of sales” as proxy variable instead of costs of energy as in Levinsohn and Petrin (2003).¹² The impact of this difference in proxy appears rather small, as the correlation is 0.97 for a subset of manufacturing firms for which we can calculate TFP based on both proxies.

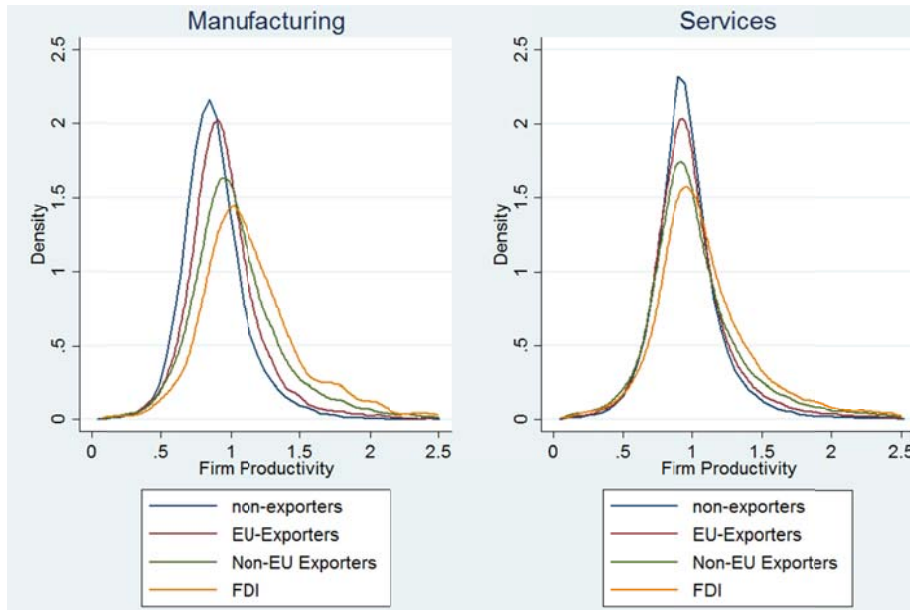
Figure 4 shows the distribution of firm productivity according to their internationalization status, both for manufacturing and services. The ranking of distributions for the case of Dutch firms is consistent with the findings in the literature; the distributions shift to the right (higher productivity) according to export status. More productive firms select into higher-cost market entry forms (see f.i. Helpman et al., 2004). The shift is more pronounced for manufacturing (left panel) than for services (right panel). The distributions overlap more than in most other papers, which is perhaps not so surprising given the high degree of international participation of Dutch firms.

¹⁰ This means from table 1, all sectors apart from “Manufacturing” and “Accommodation and food services” are grouped in the services sector. The manufacturing sector is simply the Nace Rev. 1 sector “Manufacturing”. Finally, we exclude “Accommodation and food services” in the remainder of this paper due to the extremely low export-intensity (less than 3% of the firms exports).

¹¹ As is common in the literature, we estimate the productivity by sector (NACE-2 classification).

¹² Possible alternatives for productivity are Unit Labor Costs (ULC), and Value Added per Worker. In general we find that the correlation between TFP and ULC is high (0.95). The correlation of TFP with Value added per worker is smaller, possibly because the latter measure does not distinguish between worker skills.

Figure 4. Productivity density distributions and export status



Note: in order to avoid sectoral differences in productivity from driving the results, productivity in this figure is defined as (firm productivity/average productivity of all firms in the same year in the same NACE2-sector).

3.4 Firm level variables

We broadly follow the empirical literature on firm heterogeneity and exports by employing as explanatory firm variables *firm productivity*, total sales, *worker skills* (measured as wage per worker), *liquidity* (dummy= 1 if short term assets are larger than short term debts), firm *debt* (long term debt/total assets), *capital intensity* (proxied by a firm's material assets divided by number of workers), *import status* (dummy equals 1 if firm imports) and *foreign ownership* (dummy equals 1 if firm is foreign owned).¹³ Productivity is the key variable in the Melitz (2003) model. Higher worker skills can be looked upon as increasing the export probability. With respect to capital intensity, we also want to establish if this has an impact on the likelihood of exporting. Since it is costly (and risky) to export we also want to control for the fact that the export status can depend on a firm's financial structure. The import status might matter because acquiring knowledge about foreign markets and doing business abroad is thought to be easier *ceteris paribus* if a firm is an importer. Being an importer reduces the cost of accessing a foreign market (due to the knowledge gained) and thus increases export probability. In a similar vein, foreign

¹³ Note that in the Melitz (2003) model there is a one-to-one correspondence between firm productivity and firm sales.

ownership might be relevant for the export status in the sense that foreign owned firms by definition have knowledge about foreign markets.

In addition we include firm *location* within the Netherlands (at NUTS1 level), as it is for instance well-known that location can be an important stimulus or barrier to trade. Location can for instance matter since it shapes a region's specialization structure and thereby impact its export potential or it could impact on a region's foreign market access (Brakman, Garretsen, Van Marrewijk, 2009). Most firms are located in the West, and one could hypothesize that firms in larger or more densely populated regions would find it relatively easy to gain knowledge about foreign markets through more extensive networks. The periphery is far less densely populated by the firms (see f.i. the numbers in Table 2 for the North). For The Netherlands being a peripheral location implies a relative large distance to the main international airport Schiphol (Amsterdam) or the port of Rotterdam. However, it also has off-setting effects in terms of market access, since the North, East and South, as opposed to the West, border Belgium and/or Germany. Note, that Figure 3 already hints at the potential importance of firm location; a location in the North seems to contribute negatively to export status, whereas a location in the South contributes positively.

Table 2 gives descriptive statistics for the explanatory variables; Appendix A5 provides the corresponding correlation matrix.

Table 2 Descriptive statistics for explanatory variables

Variable	No. of Obs.	Mean	Sd.	p1	p99
Log TFP	212652	.82	.44	-.22	2.0
Log Sales	212652	8.0	1.2	6.0	11.4
Log skills	212652	3.9	0.38	3.0	4.9
Log capital intensity	212652	2.8	1.7	-2.1	5.9
Firm debt	212652	0.22	0.26	0	1
<i>Firm dummies</i>					
Liquidity	212652	0.74	0.44	0	1
Import status	212652	0.56	0.5	0	1
Foreign owned	212652	0.065	0.25	0	1
<i>Internationalisation status</i>					
Exports in general	212652	0.49	0.5	0	1
Exports to EU	212652	0.48	0.5	0	1
Exports to outside EU	212652	0.25	0.44	0	1
FDI	212652	0.043	0.2	0	1
<i>Regional dummies and market access</i>					
North	212652	0.077	0.27	0	1
East	212652	0.22	0.41	0	1
South	212652	0.25	0.43	0	1
West	212652	0.45	0.5	0	1

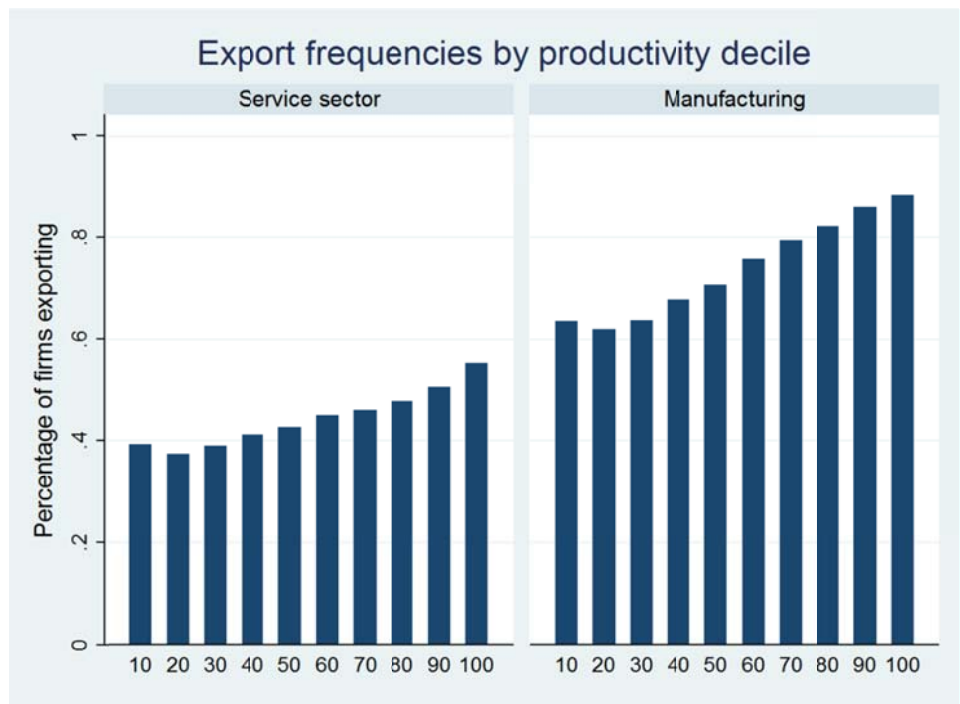
4 Estimation results

4.1 Cut-off value for productivity

As we argued in section 2, the cut-off values for productivity are the key factors to explain which firms do export in the Melitz (2003) related literature. The relationship between productivity and exporting is clearly present in our sample of firms as Figure 5 shows. Note that although a clearly demarcated productivity cut-off value is not visible, the share of exporting firms gradually increases as productivity increases from 0.35 in the first decile to 0.66 in the last decile.¹⁴

Given our measure of productivity, we identify a percentile in our distribution of productivity for which it holds that the majority of firms export. This percentile defines the cut-off. In our sample, we take the 7th productivity decile as the cut-off productivity level (which means that 30% of the firms in each NACE Rev.2 industry are more productive than the cut-off value), as more than 50% of all firms in this decile exports. Furthermore, the cut-off value of the 7th decile is similar to the cutoff used by Altomonte et al. (2012).¹⁵

Figure 5 Share of exporting firms per productivity decile for manufacturing and services



¹⁴ See Appendix A1-A3 for a disaggregation into the NACE Rev.2 1-digit industries.

¹⁵ Exploratory sensitivity analyses indicate that our results are robust with respect to this choice of the 7th decile as cut-off; see also Appendix C2.

Note: in order to prevent sectoral differences in productivity from driving the results, firms within each NACE 2-digit industry and year have been divided into productivity deciles. As a result, each decile shown in the figure has the identical NACE 2-digit industry-year composition.

4.2 *Exporters versus non-exporters*

Table 3 shows the probit results for equation (1), that is, exporters versus non-exporters. Column 1 and 2 show the results for the manufacturing sector. Column (1) shows that firm productivity has a significant effect on the export probability, which is in line with prior research. As more control variables are added in column (2), a few observations stand out. First, the coefficient for productivity drops markedly once we include other explanatory variables. In particular the inclusion of firm size causes a very substantial part of the productivity effect to disappear. To some extent this might be unsurprising, as (export) productivity and size are correlated, according to the Melitz (2003) model.¹⁶ Other firm specific variables, such as import status and foreign ownership have a positive effect on export probability. This suggests that earlier export experience and international contacts add to the probability of exporting.

From the locational dummies a location in South close to foreign markets adds to the export probability, whereas a location in the peripheral North or the densely populated West reduces export probability.

Columns 3 and 4 in table 3 repeat the analyses for the *services* sector. Column (3) shows similar results for the services sector when analyzing productivity; firm productivity is important for the export status, but the size of the coefficient drops again markedly once firm size is also controlled for. The others results in column (4) are different. For firms in the services sector not only foreign ownership, firm size and import status are important, as in the case of manufacturing firms, but also skill, capital intensity and liquidity add to the explanation. This finding is consistent with WTO (2016), which finds that for the service industry finance related variables tend to be more important than for manufacturing, especially for smaller firms. The influence of location is largely similar though: a location in the South adds to the probability of exporting, whereas a location in the North has a negative impact. Furthermore, being located in the densely populated region (the West) surprisingly enough has a negative impact on the export probability.

¹⁶ Although in practice the correlation is far from perfect. In our sample, the correlation is 0.48 (see table A5).

Table 3 Exporters versus non-exporters, 2010-2014¹⁷

Variable	Manufacturing		Services	
Log TFP	0.855***	0.0997*	0.454***	0.0417*
	-20.99	-2.08	-27.08	-2.21
Log sales		0.383***		0.202***
		-19.16		-28.7
Log skills		-0.01		0.194***
		(-0.21)		-11.35
Log capital intensity		0.0227*		0.0269***
		-2.13		-6.45
Firm debt		0.0716		0.0353
		-1.31		-1.45
Liquidity		0.0315		0.0743***
		-1.06		-5.81
Import status		1.121***		1.159***
		-35.37		-92.07
Foreign owned		0.292**		0.281***
		-3.06		-8.67
West		-0.170***		-0.0609***
		(-4.46)		(-3.69)
North		-0.244***		-0.243***
		(-4.39)		(-8.74)
South		0.208***		0.214***
		-5.03		-11.56
No. of obs.	33523	33523	166317	166317
R2	0.113	0.298	0.208	0.351

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level

Figure 6, illustrates that the model of table 3 (column 2 for manufacturing, and column 4 for services) has strong out-of-sample predictive power. The model has been calibrated for the period 2010-2012 and is subsequently applied to the observations in the years 2013 and 2014. As can be seen, the predicted values are extremely close to the actual probabilities that a firm exports. In both panels, the observations are close to the 45° line; the R-square is respectively 0.99 and 1.00. This is reassuring for policy purposes, as the predictive power of the model is high and the model is thus able to discriminate between exporters and non-exporters.

¹⁷ See appendix C1 for a more detailed location analysis for individual provinces.

Figure 6. Out of sample predictive power: Panel A – Manufacturing, Panel B- services¹⁸



4.3 *The export status of high productive firms*

Given the main goal of our paper, a crucial next step is to analyze the export status of firms that are all above the productivity cut-off value (the 7th productivity decile and higher); not all firms that meet the productivity cut-off export. Table 4 shows the results for our sample period 2010-2014, where columns (1) and (3) present the results for the firms below the productivity cut-off and columns (2) and (4) present the results for firms above the productivity cut-off.

For manufacturing (compare columns (1) and (2) in Table 4) size, import status and location are important for both groups, whereas foreign ownership is less important for high productive manufacturing firms. The results for the firm variables for the services sector are relatively similar between the groups above and below the productivity cutoff. A similar remark holds for the spatial dimension; the division between the Northern and the Southern part of The Netherlands is still visible in the data, but it holds for low and medium productive services firms

¹⁸ The coefficients from table 3 (column 2 and 4) are used to estimate the export probability for firms in 2013 and 2014. In order to construct the figure above, we have calculated and plotted for each probability group (say all firms with a 50% chance of exporting according to the model) the percentage of firms that indeed exports.

as well as for the most productive services firms. For high productive services and manufacturing firms, a peripheral location in the North cannot be compensated by productivity.

Table 4 Exporting in manufacturing and Services, conditional on meeting productivity cutoff, 2010-2014¹⁹

Variable	Manufacturing firms		Service firms	
	Low/medium productive	Highly productive	Low/medium productive	Highly productive
Log sales	0.380*** (17.38)	0.360*** (10.82)	0.207*** (25.72)	0.182*** (16.42)
Log skills	0.00517 (0.09)	-0.0617 (-0.71)	0.200*** (10.15)	0.187*** (6.83)
Log capital intensity	0.0104 (0.84)	0.0463** (2.65)	0.0176*** (3.57)	0.0414*** (6.45)
Firm debt	0.0830 (1.39)	0.0931 (0.87)	0.0310 (1.16)	0.0966* (2.18)
Liquidity	0.0183 (0.60)	0.0783 (1.08)	0.0622*** (4.54)	0.118*** (4.52)
Import status	1.073*** (31.18)	1.296*** (20.38)	1.127*** (78.24)	1.234*** (58.34)
Foreign owned	0.453*** (3.85)	0.126 (1.00)	0.379*** (9.86)	0.143** (2.96)
West	-0.181*** (-4.31)	-0.128 (-1.84)	-0.0571** (-3.05)	-0.0571** (-3.05)
North	-0.244*** (-4.01)	-0.264** (-2.67)	-0.203*** (-6.57)	-0.203*** (-6.57)
South	0.229*** (5.05)	0.148 (1.91)	0.230*** (11.02)	0.230*** (11.02)
No. of obs.	25173	10594	123701	52995
R2	0.284	0.286	0.338	0.381

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

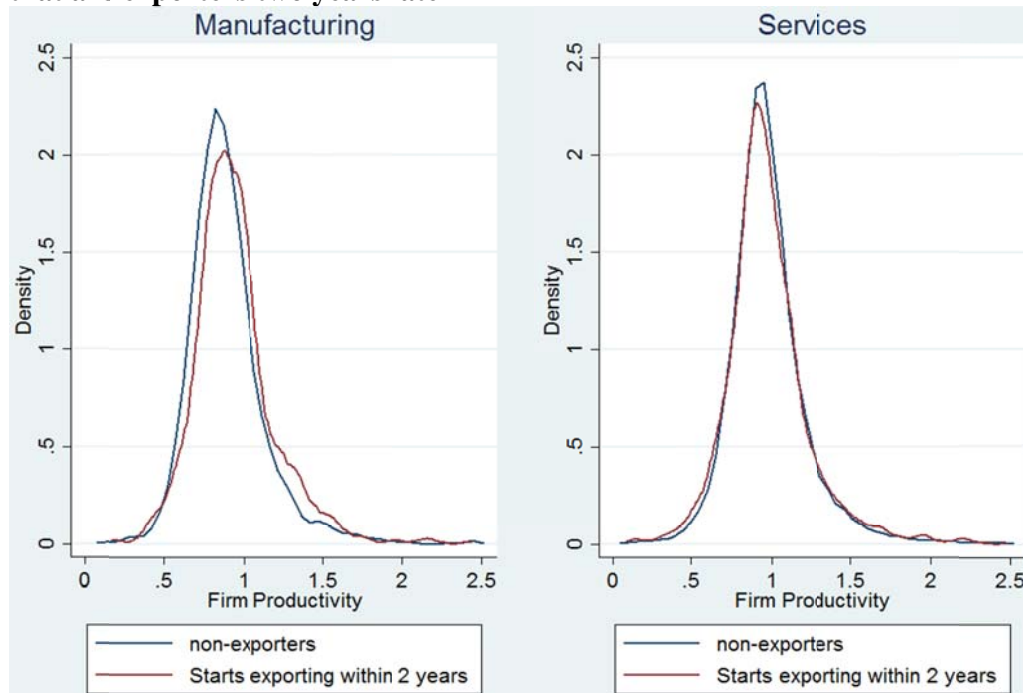
4.4 Export Dynamics

Until now we have not discussed the export dynamics. In this sub-section, we focus on firms that do not export at the beginning of the period and analyze which factors influence the decision to start exporting. Since a lag most likely exists between the export decision and actual exports, we focus on which factors contribute to the probability that a firm exports two years from now.²⁰ Figure 7 shows the productivity distributions for non-exporters and firms that start exporting for the first time within the next two years, both for manufacturing firms (left panel) and service firms (right panel). Although the firms that start exporting are somewhat more productive than non-exporters, the difference appears rather small, especially when compared to figure 6.

¹⁹ See Appendix 2 for some sensitivity analyses with respect to the productivity cut-off value; the results, in a qualitative sense, are robust.

²⁰ Since our balances reflect the end-of-year balance, we need to analyze exports in t+2 to allow for a 1 year lag.

Figure 7 Productivity density between non-exporters that remain non-exporters and those that are exporters two years later



Note: in order to avoid sectoral differences in productivity from driving the results, productivity in this figure is defined as (firm productivity/average productivity of all firms in the same year in the same NACE2-sector).

We can repeat the exercise of Table 4, and analyze which factors contribute to the decision to start exporting, conditional on productivity. Table 5 confirms the significance of the by-now usual suspects; firm size and import status are important in order to become an exporter for all firms, and so are foreign ownership and skill for the services sector. Location is especially important for the services sector, whereas it seems to play a smaller role for the manufacturing sector. The difference in the factors relevant to exporting between low/medium productive and high productive firms appears to be rather small. Furthermore, in order to *become* an exporter the contribution of productivity as such is limited (see table C3 in the appendix that provides information unconditional on productivity). Similar to earlier results, the effect of productivity on firm exports seems to be largely driven by the correlation between firm size and productivity. In the case of the decision to start exporting, firm productivity does not have an effect once firm size is controlled for.

Table 5: Dynamic export analysis, conditional on productivity

Variable	Manufacturing firms		Service firms	
	Low/medium productive	Highly productive	Low/medium productive	Highly productive
Log sales	0.172*** (3.87)	0.256** (3.21)	0.0988*** (7.25)	0.0940*** (4.84)
Log skills	0.0471 (0.40)	-0.265 (-1.39)	0.108** (3.14)	0.133** (2.69)
Log capital intensity	0.0289 (1.09)	-0.0363 (-0.91)	0.00708 (0.84)	0.0295** (2.62)
Firm debt	0.106 (0.84)	0.211 (0.82)	0.0355 (0.77)	-0.0407 (-0.53)
Liquidity	0.0718 (1.07)	-0.105 (-0.56)	-0.00732 (-0.31)	-0.0520 (-1.08)
Import status	0.367*** (5.56)	0.606*** (4.32)	0.380*** (14.37)	0.366*** (8.88)
Foreign owned	-0.0396 (-0.08)	-0.325 (-1.02)	0.326*** (4.17)	0.275** (2.77)
West	-0.167* (-2.03)	0.417* (2.29)	-0.0187 (-0.61)	-0.0562 (-1.14)
North	-0.182 (-1.66)	0.0856 (0.31)	-0.105* (-2.19)	-0.242** (-2.87)
South	0.0789 (0.83)	0.138 (0.71)	0.143*** (4.06)	0.163** (2.80)
No. of obs.	4271	917	42057	16240
R2	0.093	0.099	0.101	0.112

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. High-productive firms form slightly less than 30% of the observations, due to the fact that we only include non-exporters. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

Table C3 estimates the probability of exporting unconditional on productivity. The results are similar to the results above presented in Table 5. Finally, Appendix D provides an out-of-sample test based of the model in table C3, in which the model performs quite well.

4.5 Exporting to outside the EU

Finally, we repeat the dynamic exercise for the chance that firms start to export to *non-EU* countries. In the Melitz (2003) type of analyses, exports to the non-EU might be only possible for the most productive firms, as entering and exporting to more distant markets is more expensive and complex than exporting to EU markets. Table 6 shows which determinants affect the probability that firms which do not yet export to outside the EU, start doing so within the next 2 years.

Table 6 Determinants of exporting to outside EU, conditional on productivity

Variable	Manufacturing firms		Service firms	
	Low/medium productive	Highly productive	Low/medium productive	Highly productive
Firm exports to EU	0.675*** (11.64)	0.571*** (5.55)	0.556*** (19.98)	0.634*** (15.21)
Log sales	-0.0519 (-0.41)	-0.0700 (-0.30)	-0.134* (-2.53)	0.0787 (0.96)
Log skills	0.221*** (6.15)	0.247*** (4.75)	0.107*** (7.64)	0.0677*** (3.77)
Log capital intensity	0.0314 (0.34)	-0.324* (-2.30)	0.00794 (0.21)	0.0675 (1.48)
Firm debt	-0.0285 (-1.38)	0.0167 (0.67)	0.00704 (0.74)	0.0158 (1.48)
Liquidity	0.155 (1.57)	0.345* (2.09)	0.00337 (0.07)	0.00568 (0.08)
Import status	0.161** (2.78)	0.207 (1.56)	0.0213 (0.78)	-0.00846 (-0.18)
Foreign owned	0.254*** (3.89)	0.122 (1.07)	0.205*** (7.27)	0.236*** (5.74)
West	0.238*** (3.37)	0.151 (1.42)	0.0946** (2.84)	0.0576 (1.18)
North	0.0661 (0.66)	-0.0113 (-0.07)	-0.0845 (-1.52)	-0.165 (-1.87)
South	0.119 (1.71)	-0.145 (-1.30)	-0.0232 (-0.61)	0.0152 (0.28)
No. of obs.	9158	2491	59415	24199
R2	0.141	0.111	0.145	0.151

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. High-productive firms form slightly less than 30% of the observations, due to the fact that we only include non-exporters. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

The results differ markedly from earlier analysis for the spatial dummies. First of all, location does not seem to play a significant role for high-productive firms when it comes to exporting outside of Europe. For low and medium productive firms, a location in the densely urban regions of the West, which includes the major port of Rotterdam and Amsterdam airport, increases the probability that a firm starts exporting outside of the EU. The location in the South of the Netherlands, which in the previous analyses appeared very conducive to exporting, no longer has a positive effect. Even though the export intensity in general is highest in the South (see figure 3), it appears that firms encounter difficulties in taking the next step to sell their goods or services also outside of the EU. This finding is consistent with the findings of the WTO (2016) for small and medium size firms; these are most affected by a lack of access to good transport facilities and insufficient information about distant markets, as is most likely the case in peripheral locations. Finally, table C4 in the Appendix provides the information unconditional on the productivity cut-off, with results comparable to the results of Table 6.

4.6 Location

The results in the preceding paragraphs highlight the importance of location. Firms located in the North appear to face stronger export barriers than those located in the South or West, but it is unclear which location factors contribute to this outcome. To get a better grasp at the role of location in determining the export chances of a Dutch firm, we replaced the location dummies with specific location variables: distance to the foreign border (in km.), road density (on NUTS3 level, as a location specific measure of transport cost), distance to the main international airport (in km.)²¹, a specialization index (number of firms in own sector as a ratio of all firms in the same NUTS3 region; measuring location specific externalities), density of exporters (number of exporting firms in own industry/km² in the same NUTS3 region; a large density could facilitate export-market knowledge spill-overs) and the general density of firms (in the same NUTS3 region; knowledge spill-overs in general).²²

Furthermore, we add a market access variable to the Belgium and German market. Foreign market access is potentially important for firms in The Netherlands when it comes to serving or doing business on a foreign market as large parts are thus quite close (in actual travel time) to the German or Belgian border. Appendix B shows market access of locations in the Netherlands to the Belgium and German markets. We measure market access in terms of the number of foreign jobs that are within 90 km radius of a municipality (a simple distance decay function is applied). Table 7 provides the descriptive statistics of the regional variables.

Table 7 Descriptive statistics for regional variables

Variable	No. of Obs.	Mean	Sd.	p1	p99
Distance to border	212652	46	32	1.3	121
Highway density	212652	.21	.1	.04	.45
Distance to Schiphol	212652	75	45	4.8	180
Market Access Germany	212652	6.0	5.5	0	14
Market Access Belgium	212652	6.1	5.5	0	14
Regional Specialization	212652	.076	.066	.0016	.25
Density of exporters in same industry	212652	.1	.17	0	.84
Firm density	212652	2.3	1.6	.32	6

²¹ The correlation of distance to the international airport of Amsterdam and distance to the port of Rotterdam is high (0.8). Therefore, only the distance to the International Airport of Amsterdam is included in the analysis

²² These variables are well-known in empirical research in spatial economics, see f.i. Brakman *et al.* (2009) for a survey.

Table 8 repeats the exercise of Table 3, but instead of region dummies we now include detailed location specific variables.

Table 8: Influence of regional factors on probability of being an exporter

Variable	Manufacturing firms		Service firms	
Log sales	0.398*** (21.88)	0.397*** (21.78)	0.207*** (31.10)	0.207*** (31.10)
Log skills	-0.0104 (-0.21)	-0.0149 (-0.31)	0.194*** (11.35)	0.193*** (11.29)
Log capital intensity	0.0227* (2.14)	0.0249* (2.34)	0.0272*** (6.52)	0.0285*** (6.80)
Firm debt	0.0582 (1.07)	0.0706 (1.30)	0.0293 (1.21)	0.0338 (1.40)
Liquidity	0.0444 (1.54)	0.0414 (1.43)	0.0799*** (6.36)	0.0768*** (6.11)
Import status	1.119*** (35.30)	1.117*** (35.18)	1.159*** (92.05)	1.163*** (92.55)
Foreign owned	0.286** (3.01)	0.280** (2.94)	0.281*** (8.68)	0.285*** (8.76)
West	-0.170*** (-4.48)		-0.0609*** (-3.69)	
North	-0.246*** (-4.43)		-0.243*** (-8.75)	
South	0.209*** (5.05)		0.214*** (11.57)	
Distance to Border		-0.00327*** (-3.49)		-0.00351*** (-8.02)
Highway Density		-0.536 (-1.75)		-0.292* (-2.37)
Distance to Schiphol		-0.000380 (-0.56)		0.000493 (1.73)
Market Access Germany		0.00550 (1.16)		-0.00124 (-0.63)
Market Access Belgium		0.0118** (3.10)		0.00716*** (4.41)
Regional Specialization		1.950 (0.98)		1.448*** (4.46)
Density of exporters in same industry		2.641* (2.16)		0.219** (2.88)
Firm density		0.0149 (0.64)		0.0375*** (4.23)
No. of obs.	35956	35956	176696	176696
R2	0.300	0.301	0.352	0.352

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

A few observations stand out. First, the non-location results are robust for changes in location specific variables. This holds for both, manufacturing and services. Second, for location the distance to the border is important- the closer the better- and also a higher export firm density

increases the likelihood of exporting. The latter suggests that being part of a network of exporters helps to access a foreign market; export market knowledge spillovers seem important. In addition, market access to Belgium is important for all firms, whereas the German market access appears to be less important. For the service sector, the density of firms and regional specialization is also important. Also these variables point towards the importance of networks; both being close to own-sector/industry firms and firms in general are important. Together the location variables point towards the importance of local knowledge spill-overs that help to reduce entry barriers of foreign markets.

4.7 Policy

Based on the results one can identify those companies that are potential exporters. That is, firms which possess the characteristics identified as relevant to start exporting, but which do not export. Table 9 provides some details of this selection process.²³ We give one example of firm selection; manufacturing. Table E1 in the Appendix gives a complete overview of all sectors.

Based on the characteristics relevant for exporting in table C5 (column 3 for manufacturing and column 6 for services), we select non-exporting firms which meet all these characteristics. In table 9, the selection variables are our usual suspects, size (we select firms above average size), importer status, and export density (above average export density in the respective region). Each additional selection variable reduces the number of potential targets²⁴. Policy makers thus have an option to construct a very selective group or a more broadly defined group of firms. Note, however, that the number of potential exporters is small and could easily be targeted by policy makers.

Table 9 Firm Selection: Potential Exporters in the manufacturing sector²⁵

Selection Criteria	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Full sample of non-exporters in the year 2014	162	296	252	502	1212	13%	24%	21%	41%	100%
Selection on:										
Above average size	84	141	119	259	603	14%	23%	20%	43%	100%
+ Importer	44	73	77	115	309	14%	24%	25%	37%	100%
+ Above average exporter density	3	29	45	66	143	2%	20%	31%	46%	100%

²³ Note, that confidentiality considerations related to micro-firm data prevents us from listing individual firms.

²⁴ The order of selection matters, we start with the statistically most important variable; firm size

²⁵ The small sample in table 9 is due to the very high export intensities in the manufacturing sector (see figure 2).

For policy, two options seem worthwhile. First, some of the selection criteria could also be the target of policy itself. Variables such as export firm density, import status, foreign ownership point towards the importance of knowledge of foreign markets. Increasing the knowledge of foreign markets for a select group of firms is potentially promising. Efforts should be directed to firms who are identified in tables as Table 9, but do not export. Second, a more detailed understanding of the reasons why these potential exporting firms do not export is useful. Our analysis identifies which firms are potential exporters (and also very large groups which have hardly any chance of becoming an exporter), but it cannot shed light on the reasons why some promising firms do not engage in exporting. Contacting individual firms directly could be instructive to find out what exactly determine these barriers of trade. With the help of tables, like Table 9, policy makers know what kind of firms to target for such follow-up.

5 Qualifications

The previous analyses have consistently shown firm size and import status to be the two most robust and import factors in predicting a firms export status. The importance of import status in particular warrants further investigation, as this could be a potential channel through which policymakers can influence firm export behavior. Could stimulating firm imports be a viable way to provide firms with partners and experiences abroad, and thereby increase the export participation of firms? In order to assess this possibility, we examine the dynamics between import and export decisions. Do firms make these decisions simultaneously, or is there a pattern visible in which firms first start exporting and then start importing or vice versa?

Table 10 shows how the export and import behavior develops for a sample of firms which do not import or export in 2010 and which are observed for all years until 2015. As can be seen from the table, most firms which become internationally active in the first year (2011) either export or import. Only 15% of the firms which become internationally active simultaneously starts importing and exporting. When we analyze the figures for 2015, we can see that after 5 years a substantial amount of the firms (35%) became internationally active, which reflects the open nature of the Dutch economy. However, even then a full 25% of the firms started with either importing or exporting, whereas only 10% of the firms by that time both export and import. The findings suggest that while the probability that a firm starts exporting is certainly related to the

import status (see prior results), it is certainly not the case that all exporters also soon become importers or vice versa.²⁶

Table 10: Export and Import dynamics

	2011	2012	2013	2014	2015
Remains domestic	8,939	8,369	7,729	7,161	6,703
Imports	603	780	1153	1443	1651
Exports	547	756	774	836	904
Imports and Exports	206	390	639	855	1037
Total	10295	10295	10295	10295	10295

Note: table only includes firms which are observed for all 6 years (2010-2015) and which do not export or import in the year 2010.

6 Discussion and Policy Conclusion

According to the seminal contribution by Melitz (2003), exporting firms have to be productive enough to overcome the higher entry costs of foreign markets. The Melitz (2003) framework concludes that once firms are productive enough to overcome the higher entry costs of foreign markets they *all* export. However, we know from earlier empirical research that the productivity distributions of exporters and domestic firms overlap, high productive firms do not export, and some low productive firms are able to export. As exporters are more profitable, more innovative, pay higher wages, sell more than non-exporters, policy makers have an incentive to stimulate non-exporters to become exporters. Our analysis helps to identify systematically to identify these high-potential non-exporters.

First, we use a large Dutch panel-dataset which includes not only information on exports and productivity, but also on a range of other potential determinants of firm exports both for small and large firms. Furthermore, in contrast to most other literature, we perform our analyses also for the firms in the services sector. This inclusion is highly relevant, as the median Dutch exporter is a service firm. Secondly, we explicitly analyze the role of productivity in export decisions, for instance by making a distinction between ‘normal’ firms and highly productive firms. The following findings stand out.

²⁶ Productivity is important for becoming an exporter; so, investing in productivity before market entry could be a way to prepare oneself before the actual entry. Although we do not have explicit information on investments that contribute to efficiency, productivity or innovation we have indicative information on the relation between export probability and prior investments (in general). Using crude investment data indicate that the export probability, indeed, increases with prior investment (results available upon request).

First of all, productivity is a necessary, but not a sufficient condition for exporting. Other firm characteristics determine or add to the export probability; for the manufacturing sector import status and foreign ownership are the most important determinants of export behavior. These variables are also relevant for the services sector, but skills, capital intensity and liquidity also matter for the export probability. Existing exporters are in general slightly more productive than non-exporters, but such difference is not visible for firms when they start exporting. These findings stand in contrast with most of the literature, and suggest that learning by doing or scale benefits of exporting are an important reason why exporters are more productive than non-exporters, rather than selection effects. This difference might well be due to the fact that most of the literature only employs data on large manufacturing firms, whereas we have nearly exhaustive data on all firms. Alternatively the open nature of the Dutch economy combined with the high-quality international infrastructure might result in low the fixed costs of exporting (reflected by the fact that 49% of the firms in our sample exports), which reduces the necessity of productivity for profitable exporting.

Second, firm location is crucial. A location in peripheral areas prevents even high productive firms from exporting; especially a location in the Northern part of the Netherlands. Some location factors stand out. The distance to the border is important- the closer the better- and export firm density. The latter suggest that being part of a network of exporters helps to access a foreign market; export market knowledge spillovers seem important. In addition, for services market access in the South (Belgium), specialization and firm density affect exports positively. Also these variables point towards the importance of networks.

Third, we find that the factors which affect export status differ significantly between services and manufacturing firms. For manufacturing firms in general productivity (or size) and import status are important for their export status, whereas for firms in the service sectors additional factors are also relevant, such as worker skills, liquidity, capital intensity and foreign ownership are important to increase export probability. Given that the median Dutch exporter is actually in the service sector, the current neglect of the service sector in export research appears unwarranted.

Finally, based on our findings policy makers can explicitly target firms which possess all characteristics to be successful at exporting, but which do not yet export. Table 9 shows per sector and location those firms that are potentially successful exporters. The number of these

firms is limited. Policy makers now have two options; targeting export policies specifically on these groups, or to contact them in order to investigate which specific barriers of trade these firms face and try to help reduce these.

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8 Appendices

8.1 Appendix A: Descriptive statistics

Table A1: number of observations per NACE Rev.2 2-digit sector

Nace Rev.2 2-digit code and name		No. of obs.	Percentage	Cumulative
10	Manufacture of food products	3,982	1.76	1.76
13	Manufacture of textiles	772	0.34	2.1
16	Manufacture of wood and of products of wood and cork	1,323	0.59	2.69
17	Manufacture of paper and paper products	629	0.28	2.97
18	Printing and reproduction of recorded media	2,778	1.23	4.19
20	Manufacture of chemicals and chemical products	1,040	0.46	4.65
22	Manufacture of rubber and plastic products	1,766	0.78	5.44
23	Manufacture of other non-metallic mineral products	1,127	0.5	5.93
24	Manufacture of basic metals	483	0.21	6.15
25	Manufacture of fabricated metal products, except machinery and equipment	8,430	3.73	9.88
26	Manufacture of computer, electronic and optical products	1,230	0.54	10.42
27	Manufacture of electrical equipment	1,088	0.48	10.9
28	Manufacture of machinery and equipment	4,350	1.92	12.83
29	Manufacture of motor vehicles, trailers and semi-trailers	798	0.35	13.18
30	Manufacture of other transport equipment	682	0.3	13.48
31	Manufacture of furniture	1,907	0.84	14.32
32	Other manufacturing	1,060	0.47	14.79
33	Repair and installation of machinery and equipment	2,511	1.11	15.9
41	Construction of buildings	8,738	3.86	19.77
42	Civil engineering	2,345	1.04	20.8
43	Specialised construction activities	19,227	8.5	29.31
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	11,108	4.91	34.22
46	Wholesale trade, except of motor vehicles and motorcycles	39,668	17.54	51.77
47	Retail trade, except of motor vehicles and motorcycles	22,238	9.84	61.6
49	Land transport and transport via pipelines	9,842	4.35	65.95
50	Water transport	856	0.38	66.33
52	Warehousing and support activities for transportation	3,258	1.44	67.77
53	Postal and courier activities	594	0.26	68.04
55	Accommodation	2,982	1.32	69.36
56	Food and beverage service activities	10,466	4.63	73.98
58	Publishing activities	1,098	0.49	74.47
59	Motion picture, video and television programme production	809	0.36	74.83
61	Telecommunications	506	0.22	75.05
62	Computer programming, consultancy and related activities	10,108	4.47	79.52
63	Information service activities	1,079	0.48	80
69	Legal and accounting activities	6,731	2.98	82.98
70	Activities of head offices; management consultancy activities	6,427	2.84	85.82
71	Architectural and engineering activities; technical testing and analysis	8,291	3.67	89.49
72	Scientific research and development	904	0.4	89.89
73	Advertising and market research	4,636	2.05	91.94
74	Other professional, scientific and technical activities	1,800	0.8	92.73
77	Rental and leasing activities	1,749	0.77	93.51
78	Employment activities	6,673	2.95	96.46
79	Travel agency, tour operator and other reservation service and related activities	903	0.4	96.86
80	Security and investigation activities	846	0.37	97.23
81	Services to buildings and landscape activities	4,943	2.19	99.42

82	Office administrative, office support and other business support activities	1,319	0.58	100
Total		226,100	100.00	100.00

Figure A2: Share of exporting firms per productivity decile, various sectors



Figure A3 Share of non- EU exporting firms per productivity decile, various sectors



Figure A4: Share of firms per decile that engage in FDI, various sectors

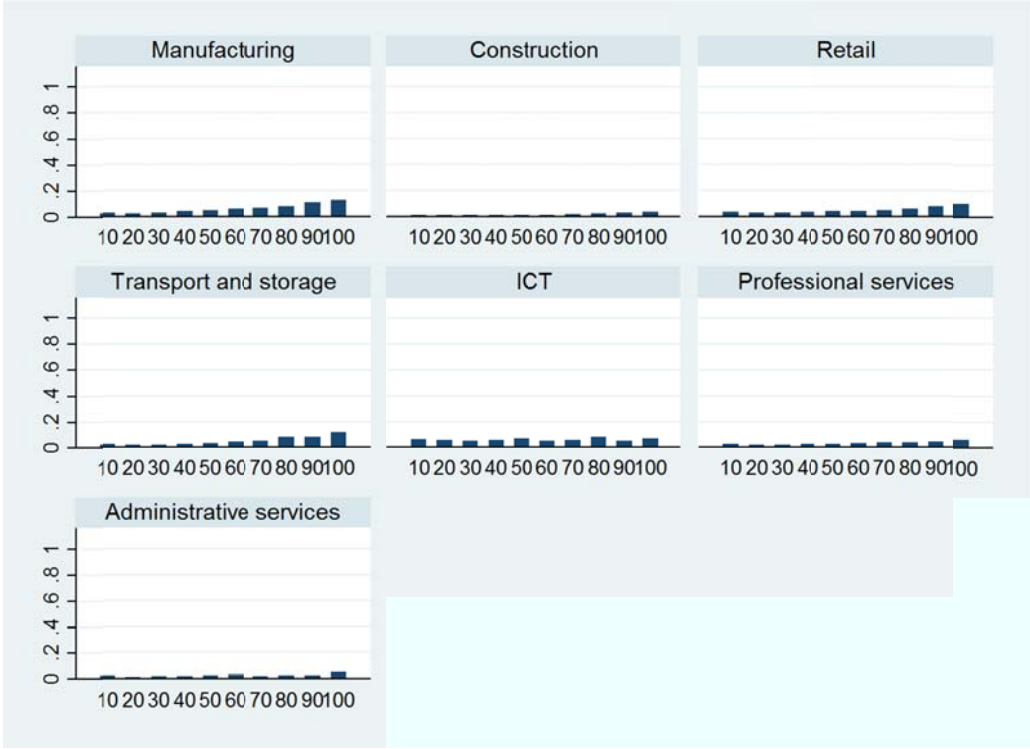
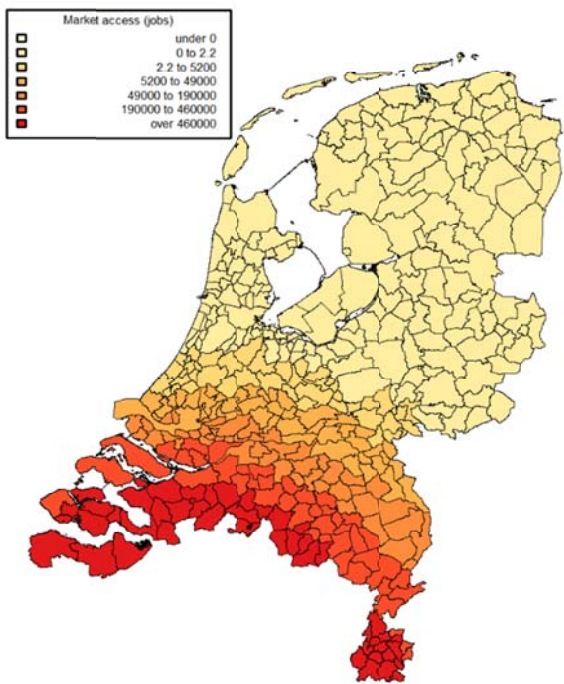


Table A5: Correlation matrix of key variables

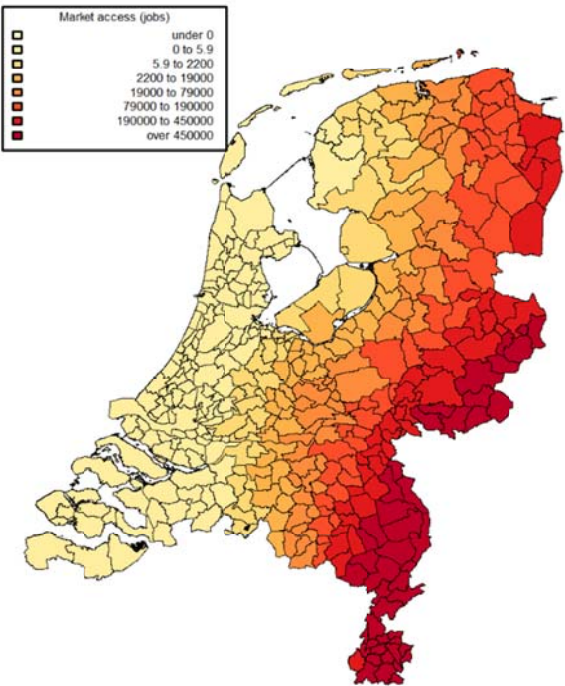
	Exports in general	Exports to outside EU	Imports	FDI	Log TFP	Log Sales	Log skills	Log capital intensity	Firm debt	Liquidity	Foreign owned	North	East	South	West
Exports in general	1.00														
Exports to outside EU	0.59	1.00													
Imports	0.52	0.39	1.00												
FDI	0.17	0.19	0.13	1.00											
Log TFP	0.26	0.26	0.29	0.10	1.00										
Log Sales	0.32	0.32	0.32	0.22	0.48	1.00									
Log skills	0.19	0.15	0.08	0.10	0.09	0.27	1.00								
Log capital intensity	0.12	0.10	0.17	0.04	0.24	0.19	0.07	1.00							
Firm debt	-0.01	-0.02	0.00	-0.02	-0.05	-0.03	-0.12	0.27	1.00						
Liquidity	0.10	0.10	0.10	0.03	0.20	0.12	0.11	-0.05	-0.14	1.00					
Foreign owned	0.19	0.18	0.17	0.08	0.14	0.27	0.19	-0.08	-0.10	0.04	1.00				
North	-0.06	-0.05	-0.04	-0.02	0.01	-0.02	-0.06	0.05	0.05	0.00	-0.04	1.00			
East	0.01	0.01	0.03	0.00	0.03	0.01	-0.04	0.06	0.05	0.00	-0.03	-0.15	1.00		
South	0.10	0.02	0.11	0.02	0.04	0.00	-0.03	0.03	0.01	-0.01	0.00	-0.17	-0.30	1.00	
West	-0.07	0.00	-0.10	0.00	-0.06	0.00	0.09	-0.10	-0.07	0.01	0.05	-0.26	-0.48	-0.53	1.00

8.2 *Appendix B Foreign Market Access*

Belgian market access (90km.)



German market access (90km.)



8.3 Appendix C: Sensitivity analyses

Table C1: Cross-section analysis based on provinces (NUTS2)

	Manufacturing firms		Service firms	
Log TFP	0.855*** (20.99)	0.103* (2.14)	0.454*** (27.08)	0.0428* (2.27)
Log sales		0.382*** (19.13)		0.203*** (28.82)
Log skills		-0.00806 (-0.17)		0.199*** (11.67)
Log capital intensity		0.0238* (2.23)		0.0270*** (6.48)
Firm debt		0.0718 (1.32)		0.0375 (1.54)
Liquidity		0.0313 (1.06)		0.0738*** (5.77)
Import status		1.123*** (35.31)		1.157*** (91.80)
Foreign owned		0.289** (3.01)		0.282*** (8.71)
North - Drenthe		-0.214* (-2.15)		-0.161*** (-3.38)
Friesland		-0.304*** (-3.89)		-0.328*** (-7.63)
Groningen		-0.0769 (-0.77)		-0.165*** (-3.55)
East - Flevoland		0.0537 (0.50)		0.00918 (0.19)
Overijssel		0.0596 (0.96)		0.0477 (1.62)
West - Noord-Holland		-0.214*** (-3.88)		-0.0606* (-2.57)
Utrecht		-0.0388 (-0.53)		-0.0833** (-2.94)
Zuid-Holland		-0.125* (-2.37)		-0.0138 (-0.62)
South - Limburg		0.263*** (3.54)		0.375*** (11.74)
Noord-Brabant		0.257*** (4.96)		0.191*** (8.22)
Zeeland		-0.0156 (-0.15)		0.138** (2.84)
No. of obs.	35956	35956	176696	176696
R2	0.113	0.301	0.208	0.353

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS2 region Region is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level

Table C2.1: Cross-section. Cutoff at 6th percentile (50% of firms above)

Variable	Manufacturing firms		Service firms	
	Low/medium productive	Highly productive	Low/medium productive	Highly productive
Log sales	0.361*** (14.46)	0.372*** (14.41)	0.212*** (22.46)	0.185*** (20.85)
Log skills	-0.0173 (-0.28)	-0.0312 (-0.47)	0.203*** (9.00)	0.184*** (8.25)
Log capital intensity	0.00726 (0.52)	0.0402** (2.91)	0.0129* (2.28)	0.0383*** (7.19)
Firm debt	0.0594 (0.91)	0.118 (1.49)	0.0123 (0.42)	0.0891* (2.56)
Liquidity	0.0145 (0.44)	0.0321 (0.65)	0.0548*** (3.64)	0.0964*** (4.96)
Import status	1.065*** (28.19)	1.198*** (25.66)	1.117*** (68.07)	1.199*** (71.86)
Foreign owned	0.589*** (4.77)	0.170 (1.54)	0.410*** (9.37)	0.205*** (5.02)
West	-0.155*** (-3.32)	-0.188*** (-3.59)	-0.0506* (-2.40)	-0.0725*** (-3.32)
North	-0.260*** (-3.82)	-0.242** (-3.14)	-0.197*** (-5.64)	-0.295*** (-7.92)
South	0.235*** (4.72)	0.177** (3.01)	0.237*** (10.12)	0.191*** (7.75)
No. of obs.	17953	18003	88313	88383
R2	0.281	0.281	0.327	0.372

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

Table C2.2: Cross-section. Cutoff at 1th percentile (90% of firms above)

Variable	Manufacturing firms		Service firms	
	Low/medium productive	Highly productive	Low/medium productive	Highly productive
Log sales	0.398*** (20.80)	0.334*** (6.14)	0.208*** (29.80)	0.150*** (7.92)
Log skills	-0.0110 (-0.22)	-0.0792 (-0.54)	0.198*** (10.96)	0.184*** (4.35)
Log capital intensity	0.0200 (1.80)	0.0379 (1.54)	0.0247*** (5.56)	0.0375*** (3.86)
Firm debt	0.0760 (1.37)	0.0302 (0.17)	0.0359 (1.44)	0.101 (1.38)
Liquidity	0.0265 (0.91)	0.400** (2.79)	0.0720*** (5.59)	0.126** (2.67)
Import status	1.102*** (34.22)	1.420*** (12.26)	1.144*** (87.22)	1.303*** (36.47)
Foreign owned	0.407*** (4.17)	-0.123 (-0.70)	0.307*** (8.90)	0.153* (2.13)
West	-0.170*** (-4.36)	-0.117 (-1.01)	-0.0598*** (-3.49)	-0.0782 (-1.72)
North	-0.256*** (-4.51)	-0.121 (-0.59)	-0.234*** (-8.13)	-0.332*** (-4.00)
South	0.226*** (5.30)	0.0580 (0.47)	0.215*** (11.18)	0.202*** (3.93)
No. of obs.	32366	3376	159034	17662
R2	0.294	0.285	0.347	0.385

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

Table C3: Factors that contribute to a firm starting to export

Variable	Manufacturing sector		Services sector	
Log TFP	0.325** (3.12)	0.0827 (0.73)	0.111** (3.13)	-0.0572 (-1.52)
Log sales		0.184*** (4.71)		0.105*** (9.23)
Log skills		-0.0258 (-0.26)		0.111*** (3.95)
Log capital intensity		0.00499 (0.23)		0.0147* (2.17)
Firm debt		0.158 (1.41)		0.00233 (0.06)
Liquidity		0.0339 (0.54)		-0.00717 (-0.33)
Import status		0.417*** (7.06)		0.375*** (16.87)
Foreign owned		-0.150 (-0.57)		0.305*** (5.00)
West		-0.0628 (-0.85)		-0.0298 (-1.15)
North		-0.133 (-1.32)		-0.139*** (-3.33)
South		0.0646 (0.76)		0.145*** (4.85)
No. of obs.	5188	5188	58297	58297
R2	0.046	0.083	0.076	0.103

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. The drop in observations compared with earlier tables is more pronounced for the manufacturing sector than services, as the percentage of existing exporters is far higher in the manufacturing sector. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

Table C4: Determinants of exporting to outside EU

Variable	Manufacturing firms		Service firms	
Firm exports to EU countries	0.756*** (15.82)	0.650*** (12.43)	0.686*** (31.55)	0.579*** (24.55)
Log TFP	0.363*** (4.36)	-0.0180 (-0.20)	0.0993** (2.81)	-0.0418 (-1.12)
Log sales		0.229*** (7.58)		0.0922*** (8.20)
Log skills		-0.0768 (-0.98)		0.0266 (0.90)
Log capital intensity		-0.0154 (-0.92)		0.0103 (1.42)
Firm debt		0.195* (2.24)		0.00705 (0.17)
Liquidity		0.166** (3.05)		0.0122 (0.51)
Import status		0.220*** (3.75)		0.218*** (9.18)
Foreign owned		0.0920 (0.74)		0.0410 (0.90)
West		0.204*** (3.38)		0.0819** (2.90)
North		0.0337 (0.38)		-0.106* (-2.19)
South		0.0456 (0.75)		-0.0126 (-0.40)
No. of obs.	11672	11672	83767	83767
R2	0.105	0.133	0.134	0.146

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included; NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. The drop in observations is due to the exclusion of existing non-EU exporters and due to the exclusion of observations in the year 2014 (as we do not have export-data for 2016). * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

Table C5: Factors that contribute to a firm starting to export.

Variable	Manufacturing sector			Services sector		
Log TFP	0.325** (3.12)	0.0827 (0.73)	0.0703 (0.62)	0.111** (3.13)	-0.0572 (-1.52)	-0.0591 (-1.56)
Log sales		0.184*** (4.71)	0.190*** (4.81)		0.105*** (9.23)	0.106*** (9.35)
Log skills		-0.0258 (-0.26)	-0.0448 (-0.45)		0.111*** (3.95)	0.109*** (3.85)
Log capital intensity		0.00499 (0.23)	0.0108 (0.49)		0.0147* (2.17)	0.0155* (2.29)
Firm debt		0.158 (1.41)	0.162 (1.46)		0.00233 (0.06)	0.00820 (0.21)
Liquidity		0.0339 (0.54)	0.0337 (0.54)		-0.00717 (-0.33)	-0.00653 (-0.30)
Import status		0.417*** (7.06)	0.407*** (6.84)		0.375*** (16.87)	0.377*** (16.93)
Foreign owned		-0.150 (-0.57)	-0.179 (-0.67)		0.305*** (5.00)	0.306*** (5.00)
West		-0.0628 (-0.85)			-0.0298 (-1.15)	
North		-0.133 (-1.32)			-0.139*** (-3.33)	
South		0.0646 (0.76)			0.145*** (4.85)	
Distance to Border			-0.00457* (-2.35)			-0.00325*** (-4.70)
Highway Density			-0.752 (-1.29)			-0.0605 (-0.31)
Distance to Schiphol			-0.00152 (-1.20)			-0.00000608 (-0.01)
Market Access Germany			-0.00993 (-1.04)			-0.00306 (-0.96)
Market Access Belgium			-0.00334 (-0.42)			0.00365 (1.38)
Regional Specialization			3.340 (0.91)			-0.0416 (-0.07)
Density of exporters in same industry			4.876* (2.00)			0.270 (1.75)
Firm density			0.0305 (0.61)			0.0245 (1.61)
No. of obs.	5188	5188	5188	58297	58297	58297
R2	0.046	0.046	0.090	0.076	0.103	0.104

Note: sector (NACE 2-digit) and year (2010 to 2014) dummies are included, NUTS1 region East is dropped as spatial dummy. Standard errors are clustered on a firm level. The drop in observations compared with earlier tables is more pronounced for the manufacturing sector than services, as the percentage of existing exporters is far higher in the manufacturing sector. * represents significance at 5% level, ** at 1% level and *** at 0.1% level.

8.4 Appendix D: out of sample testing for dynamic model.

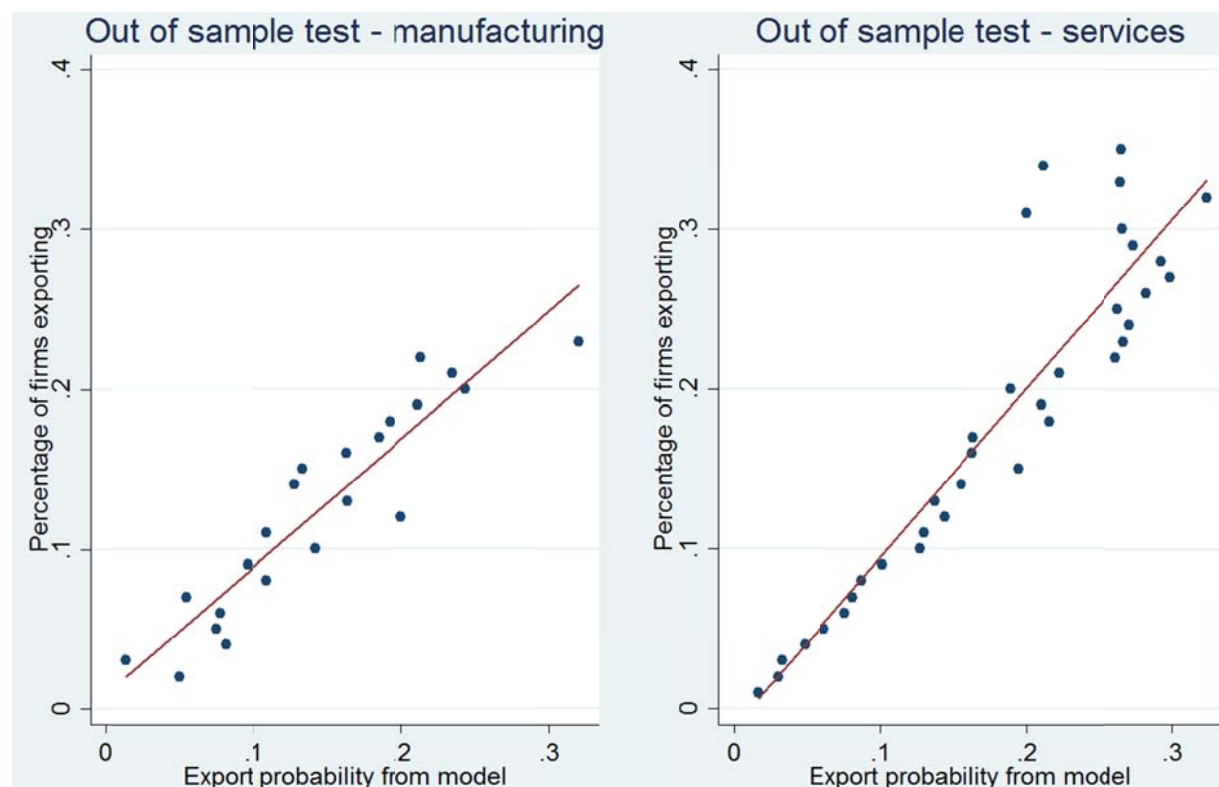
In order to assess the relevance of the estimated model for policy purposes, we perform an out of sample test in which we examine how well the model can predict the future exporters.

Specifically, we estimate a model identical to specification of table C3, which predicts the probability that a non-exporter exports in $t+2$, for the years 2010 and 2011. The coefficients from this regression are used to estimate the probability that non-exporters in 2012 and 2013 will be exporting 2 years later (in 2014 and 2015 respectively).

The figure below shows the predicted probabilities (x-axis) compared with the realization (y-axis). In order to construct the figure above, we have calculated and plotted for each probability group (say all firms with a 20% chance of starting to export according to the model) the percentage of firms that actually started exporting. As the number of firms per probability percentile grows very small in the tails, we used 50 observations per probability percentile as the cut-off value for the points in the scatterplot.

It becomes clear from the figure that our model works rather well, the export probabilities estimated by the model are in line with the export decisions of firms. Unfortunately, it is not possible to identify firms with a “certainty of exporting”, as the highest export probability is around 30%. Nonetheless, a large majority of the firms lies between the 0 and 10% export probability, which thus can be excluded as interesting targets for policy aimed at improving export performance.

Figure D1: Out of sample predictive power. Panel A – Manufacturing, Panel B- services



Appendix E: firm selection

Table E1: Firm selection

Construction	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	387	872	773	1756	3788	10%	23%	20%	46%	100%
Selection on:										
Above average size	194	443	365	891	1893	10%	23%	19%	47%	100%
+ Importer	56	157	137	212	562	10%	28%	24%	38%	100%
+ Above average worker skills	32	91	86	133	342	9%	27%	25%	39%	100%
+ Above average capital per worker	23	53	44	71	191	12%	28%	23%	37%	100%
+ foreign owned	1	0	0	0	1	100%	0%	0%	0%	100%

Wholesale and Retail	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	472	998	938	2198	4606	10%	22%	20%	48%	100%
Selection on:										
Above average size	267	526	479	1030	2302	12%	23%	21%	45%	100%
+ Importer	130	233	262	532	1157	11%	20%	23%	46%	100%
+ Above average worker skills	68	132	141	310	651	10%	20%	22%	48%	100%
+ Above average capital per worker	42	69	78	141	330	13%	21%	24%	43%	100%
+ foreign owned	0	0	5	7	12	0%	0%	42%	58%	100%

Transportation and Storage	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	109	200	244	536	1089	10%	18%	22%	49%	100%
Selection on:										
Above average size	48	99	110	286	543	9%	18%	20%	53%	100%
+ Importer	5	21	31	74	131	4%	16%	24%	56%	100%
+ Above average worker skills	5	14	14	57	90	6%	16%	16%	63%	100%
+ Above average capital per worker	2	6	10	37	55	4%	11%	18%	67%	100%
+ foreign owned	0	0	1	3	4	0%	0%	25%	75%	100%

ICT	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	69	153	121	471	814	8%	19%	15%	58%	100%
Selection on:										
Above average size	25	67	54	260	406	6%	17%	13%	64%	100%
+ Importer	9	15	20	83	127	7%	12%	16%	65%	100%
+ Above average worker skills	4	9	11	54	78	5%	12%	14%	69%	100%
+ Above average capital per worker	4	7	4	23	38	11%	18%	11%	61%	100%
+ foreign owned	0	0	1	1	2	0%	0%	50%	50%	100%

Professional services	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	200	455	447	1362	2464	8%	18%	18%	55%	100%
Selection on:										
Above average size	89	219	205	717	1230	7%	18%	17%	58%	100%
+ Importer	18	31	28	131	208	9%	15%	13%	63%	100%
+ Above average worker skills	7	19	19	80	125	6%	15%	15%	64%	100%
+ Above average capital per worker	7	11	8	41	67	10%	16%	12%	61%	100%
+ foreign owned	0	0	0	7	7	0%	0%	0%	100%	100%

Administrative services	Number of firms					Percentage of firms				
	North	East	South	West	total	North	East	South	West	total
Non-exporters in the year 2014	155	374	371	1169	2069	7%	18%	18%	57%	100%
Selection on:										
Above average size	79	181	175	598	1033	8%	18%	17%	58%	100%
+ Importer	18	26	41	121	206	9%	13%	20%	59%	100%
+ Above average worker skills	9	18	23	88	138	7%	13%	17%	64%	100%
+ Above average capital per worker	7	14	16	59	96	7%	15%	17%	61%	100%
+ foreign owned	0	0	0	2	2	0%	0%	0%	100%	100%