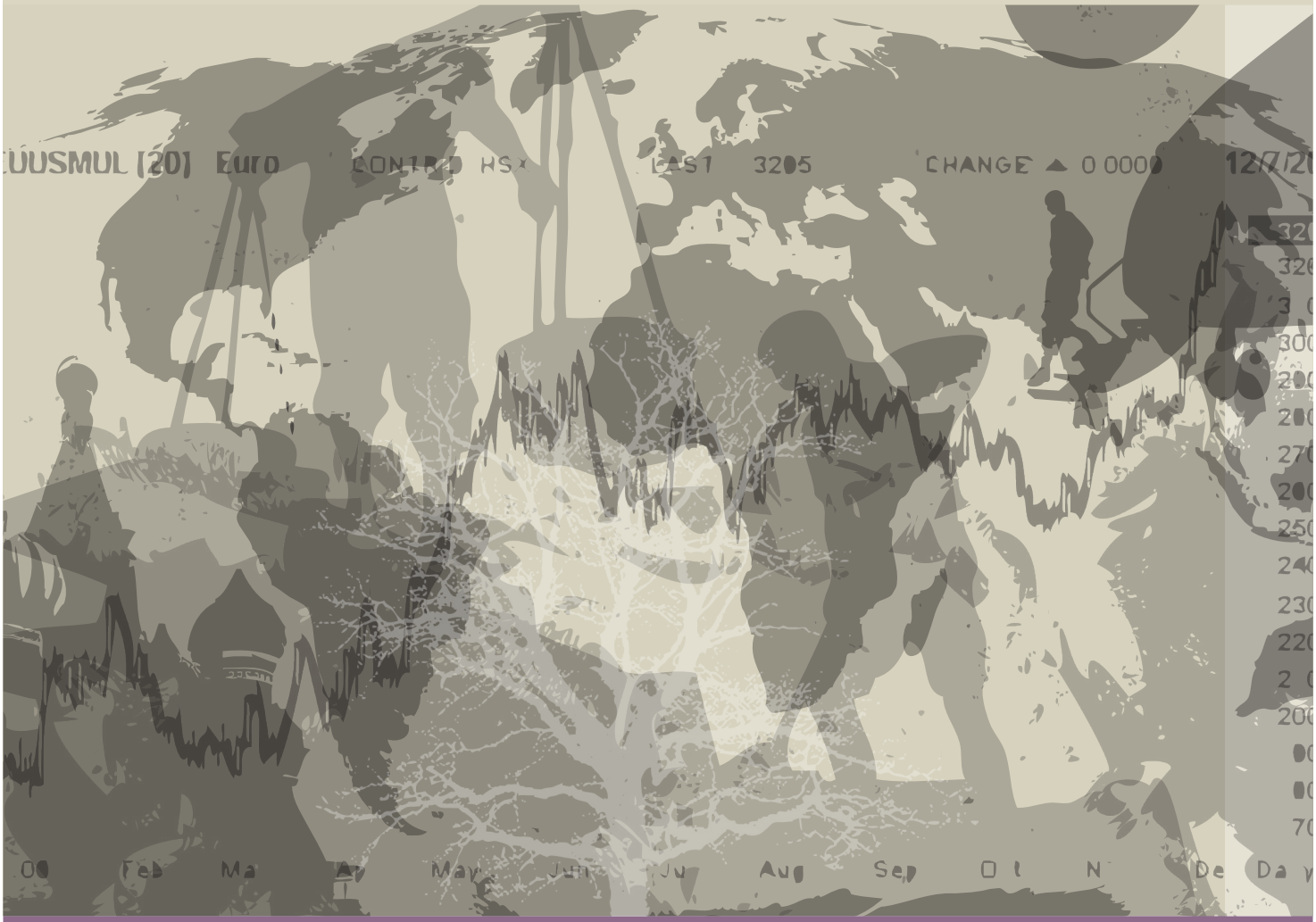
Norwegian Institute of International Affairs

Customs brokers as facilitators in international trade

Hege Medin



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Abstract

Recent studies suggest that firms can reduce fixed trade costs by hiring intermediaries like trading companies. I argue that customs brokers – a type of intermediary rarely studied in economics before – can play a similar role. Using panel data of Norwegian trade transactions, I show that such brokers are commonly used to clear goods through customs. I find indications of lower sunk costs as well as fixed trade costs for firms that hire such services. However, engaging brokers can be risky, and traders in high-risk products like food are more likely to self-declare. Results are similar for importing and exporting, indicating that customs brokers facilitate both modes of trade.

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1. Introduction

A recent strand in economic research concerns how intermediaries like trading companies facilitate international trade by making it possible for firms unable to handle all trade-related issues by themselves to participate in international markets. This, in turn, can boost aggregated trade flows. I argue that another type of intermediary – customs brokers – can play a similar role.

Building on the seminal Melitz (2003) model of international trade, scholars like Ahn et al. (2011) and Crozet et al. (2013) have proposed theoretical models in which exporting firms avoid paying high fixed costs of export at the expense of higher variable ones by using an intermediary like a trading company to sell their goods abroad. These models predict that larger firms exporting sizeable values to more profitable and accessible markets are less likely to use trade intermediaries, because such firms earn enough profits to cover the fixed costs of exporting by themselves. Empirical studies for selected countries generally show that trading companies like wholesalers and retailers account for significant shares of trade.[1] Further, such companies account for larger shares of trade in markets with lower profitability and accessibility,[2] and using them is negatively associated with several indicators of firm profitability.[3]

Similarly, there are likely to be fixed costs of clearing goods through customs that can be reduced by hiring brokers. Grainger (2008) points out that many of the costs of complying with trade and customs procedures are fixed, as they involve, for instance, 'purchase of specialist IT systems and employment of dedicated staff' (p. 26).[4] The costs are likely to be higher for producing firms than for brokers, since the latter specialise in customs-clearing services. If brokers do offer trade facilitation for firms that hire their services, we should expect from recent theories that firms with lower trade values will be more inclined to use brokers.

I study this prediction using an exhaustive panel of Norwegian manufacturing firms' trade transactions containing information on usage of customs brokers. All exported or imported goods must pass through customs and be declared. A manufacturing trader can choose between handling the customs declaration by itself [henceforth: *self-declare*] or engaging the services of a broker to do this. The data reveal that outsourcing of customs brokerage is very common.[5] To

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[1] For example, Bernard et al. (2010) found that 9% of US export value and 16% of import value were accounted for by wholesalers or retailers in 2002. From a sample of Eastern European and Central Asian firms, McCann (2013) found that almost 30% of manufacturing exporters exported at least some of their output via a trading company.

[2] E.g. Ahn et al. (2011), Crozet et al. (2013), Bernard et al. (2010), and Bernard et al. (2015).

[3] E.g. Ahn et al. (2011), Abel-Koch (2013), McCann (2013), Grazzi and Tomasi (2016).

[4] The research presented in this paper is partly based on depth-interviews with two representatives from the Directorate of Norwegian Customs. These confirm the findings of Grainger (2008) informing, that declarants in Norway must purchase special software, complete an electronic form and familiarise themselves with the regulations. A separate form is to be completed for each declaration, and relevant certificates (like health certificates for food) must be obtained. Further, declarants must hold customs credit, and must calculate and pay taxes and duties, etc. The interviews were conducted by the author in January 2016.

[5] I refer to intermediaries handling customs clearance as *customs brokers,* recognising that these firms can actually provide a broader range of services. For example, international freight forwarders (IFF) often handle customs clearance; see e.g. Frémont (2009). Although the main service sold by IFFs involves organising transport,

my knowledge, customs brokers have rarely been studied in economics before, and this is the first article to document the use of customs brokers in a large population of firms. [6]

There have been two types of empirical studies of the trade facilitating role of intermediaries; both define the intermediary as a trading company. Studies of the first type compare firms that *do not use* intermediaries with the intermediary firms as such; those of the second type compare them with firms that *do use* intermediaries. The present study is of the latter type, as I compare manufacturing firms that self-declare with those that hire brokers. To my knowledge, other studies of this type have been based solely on data from the World Bank's Enterprise Surveys (Enterprise Surveys, 2012, henceforth: *ES-data)*. However, these data have their limitations. They are based on interviews of samples of firms, rather than register data, and therefore yield less accurate information. They are generally cross-sectional and hence provide limited possibilities for correcting for unobserved heterogeneity or dynamic effects. They also do not contain information on partner countries. My data allow for these issues to be addressed. Thus, in addition to providing evidence of a new type of intermediary and focusing on a country not previously studied in this regard, I also offer several contributions to the literature on trade intermediaries more generally.

Firstly, I study the use of trade intermediaries at a highly disaggregated level and show that there is a positive correlation between the value involved in a single declaration and the probability of self-declaring it. However, that correlation may be spurious. Unlike other studies, I therefore control for unobserved (in addition to observed) characteristics of firms, countries, and the combination of the two by aggregating the data and using the panel dimension. A firm's country-specific trade value is found to be positively associated with probability of self-declaring. These findings indicate that customs brokers facilitate firms' trade by reducing their fixed country-specific costs of customs clearance and possibly also their fixed costs of handling each declaration.

Secondly, I distinguish between fixed and sunk trade costs. The models of Ahn et al. (2011) and Crozet et al. (2013) are static and do not make this distinction. With few exceptions, most empirical studies have also been static. However, the fixed costs of clearing goods are likely to involve a sunk element, such as the costs of acquiring information about regulations applying to various markets. If brokers not only offer services involving lower fixed customs-clearing costs, but also lower sunk ones, they have an additional trade-facilitating role. Sunk trade costs induce persistence in trade (see e.g. Bernard and Jensen, 2004), and if firms can avoid such costs by hiring brokers, they can more easily shift their trade between markets according to changing expectations as to profits. The panel dimension of my data enables this to be studied, and I find indications of higher sunk costs with self-declaring than with broker-use.[7]

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customs clearance is also a source of income: In their survey of freight forwarders handling Norwegian exports, Andersen and Eidhammer (2009) found that about 10–15% of the revenue was reported to come from services other than transport, distribution and storage. Customs handling was the largest component of such other services.

[6] There are some studies of non-representative samples of firms in the business literature; see section 2.24.

[7] This is indicated by the greater probability of self-declaring today if the trader self-declared in the last period. Also McCann (2013) finds indications of higher sunk costs for firms that do not use intermediaries, by comparing persistence in trading directly to persistence in trading via other companies. However, his analysis is based on selected Eastern European and Central Asian firms from the ES-data, with information on exports for at least two

Thirdly, I study risk differences between products. The quality of the service an intermediary provides may vary, and it is often not possible to specify all details in a contract or enforce all parts of a contract formally. Using a model where firms can choose between selling through self-owned or independent wholesale-companies in the destination country, Felbermayr and Jung (2011), predict that subsidiaries rather than independent intermediaries will be used when contract enforceability is low. Similarly, it can be less risky to self-declare than to outsource customs brokerage. Whereas Felbermayr and Jung (2011) focus on risk in partner countries, I focus on risky products, studying customs clearance in and out of one specific country. Producers often know their products better than brokers do, and may hence be less liable to make mistakes that result in goods getting held up in customs. If the likelihood of committing errors and/or the consequences of doing so are greater for certain products, the inclination to use brokers may be lower. For one class of products – food – delays may prove especially costly due to their often perishable nature. And indeed, I find that food producers are more likely to self-declare, which supports the hypothesis of a less prominent role for trade intermediaries when risk is higher.

Fourthly, I study effects for both importers and exporters. Most studies, whether theoretical or empirical, have focused solely on how intermediaries facilitate exports. In line with a few other studies, I find that effects are very similar for the two modes of trade, which indicates that trade intermediaries like customs-brokers may play an equally important role in facilitating imports as well as exports. [8]

In the following, Section 2 describes the data and provides descriptive statistics, Section 3 studies how customs-brokers act as trade facilitators, and Section 4 offers some conclusions.

years. These data have their limitations, including no possibilities of correcting for unobserved heterogeneity, as the panel is too short. Furthermore, Ahn et al. (2011) use ES-data for Ghana to study how firms' previous use of trading companies affects their use today. However, their approach differs from mine. They do not study persistence in use of intermediaries, but find indications of firms being more likely to export directly if they have previously exported via a trading company. The study reported by Bernard et al. (2015) is also based on panel data; however, these authors do not study firms' use of intermediaries, but compare aggregated trade flows by producing firms against those of wholesalers and retailers. They show that there is more wholesale export of products with a higher indicator of product-specific sunk costs. Also Blum et al. (2010) employ panel data, but they study growth features of wholesalers, not sunk costs.

[8] Grazzi and Tomasi (2016) find that trading companies facilitate both imports and exports. Their study compares firms that trade through companies with those that do not, in several developing countries, using early waves of the ES data. This is similar to the findings reported in Bernard et al. (2010), who compare trade by producers and trading companies in the USA.

2. Prevalence of broker-use

2.1 Description of data

My data is an exhaustive panel of all trade transactions of manufacturing firms importing and exporting goods to and from Norway between 2003 and 2013.[9] These data are provided by Statistics Norway and are based on information from the customs declaration forms that firms are legally obliged complete and submit. In one declaration, various products from various countries of origin can be cleared, but they must all be shipped from/to the same country at the same time (reported as month) and be cleared by the same actor. There are likely to be fixed costs of handling each declaration, as a separate form must completed every time. Importantly, the data contain information on whether the trading manufacturer [henceforth: *trader*] handles a given declaration itself or hires an intermediary – a broker – to do this. These data are combined with data on characteristics of traders, such as value added per employee, taken from the structural business statistics of Statistics Norway. All results reported here are based on the subsample of traders on which information on these characteristics is available. [10]

Empirical studies of trade intermediaries in economics fall into one of two categories; in contrast to the present study, both study domestically located intermediaries that are trading companies like wholesalers or retailers. Studies in the first category compare producers that do not use trading companies with the trading companies themselves. Such studies are typically based on customs declaration data, but since firms that sell or buy through domestically located trading companies are not reported in the official trade statistics, these studies do not contain information about the firms that do use intermediaries.[11] Studies in the second category compare the producers that do not use trading companies with those that do. These studies are based on the *ES-data*, which survey the firms that trade via domestically located companies as well as those that do not, but not the intermediary used.[12]

My study is closer to the second category. However, studying customs brokers rather than trading companies provides an advantage over both categories: I can include information on all three types of firms – traders who do not use intermediaries ('self-declarants'); the intermediaries used (the customs brokers); and those traders who do use intermediaries – because the broker-user, not the broker, is listed as the trading firm in the statistics. I now present descriptive statistics on the characteristics of these three types of firms.

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[9] Raw oil and natural gas are excluded; further, a transaction must have a minimum value of 1 000 NOK (119 = USD in year 2016) to be registered.

[10] This leads to loss of about 3% of the declarations (for importers and exporters alike), 10% of the exporting firms and 14% importing firms.

[11] Studies of this type include Bernard et al. (2010); Ahn et al. (2011), Crozet et al. (2013), Bernard et al. (2015), and Akerman (2016).

[12] Examples include McCann (2013); Ahn et al. (2011), Abel-Koch (2013), and Grazzi and Tomasi (2016).

2.2 Characteristics of brokers

Table 1 displays number of declarations and trade value for all sample years pooled together. Column 2 shows the total; column 3 shows what is handled by brokers. There are in total 814 brokers serving the traders in the sample, with the vast majority of them (90%) serving both importers and exporters. What type of firms are these brokers? The data contain a unique identifier for each broker, making it possible to determine the sector affiliation (provided by the balance-sheet data). Unfortunately, there is information on the brokers' sector affiliation for only about two thirds of the import declarations and one half of the export declarations (column 4). This subsample indicates that most declarations are handled by brokers in the logistics sectors (see column 6). About 80% of these brokers are freight forwarders.

Table 1. Number of declarations and trade value handled by brokers and self-declared

	Total	Handled by brokers				Self-declared
		of all types	where info on sector exists	in services sectors	in logistics sectors	
# of declarations						
Importers	6 575 156	6 256 039	4 014 669	3 979 817	3 944 397	319 117
Exporters	5 957 656	3 955 809	2 026 723	1 928 321	1 910 951	2 001 847
Value of trade (mill real 2014 NOK)						
Importers	1 484 315	1 370 096	1 008 821	990 706	966 486	114 219
Exporters	2 192 686	1 447 235	757 135	686 057	660 864	745 451

Note: Total for years 2003–2013. Trade values in mill real 2014 NOK.

Table 2 shows various characteristics of the brokers in the sample, such as the number of declarations and trade value conducted in the course of one year (displayed as mean and median values of all broker-year observations in columns 2 and 3, respectively). Columns 4 and 5 show the same characteristics for the traders. [13] We see that each broker accounts for far more trade than does each trader, and the number of traders each broker serves is generally much larger than the number of brokers each trader uses (see *# of firms used/served*). Whereas the median trader trades only a few products with a few countries, the median broker handling import declarations does so for 13 countries and 50 products at the HS6 level. For exporting, the corresponding figures are 14 and 24, respectively. Brokers also tend to handle a wider range of products than do traders. At least half of the brokers used in importing handle products from 10 out of 21 different chapters in the customs tariff list, whereas the median exporter handles 7. Thus, brokers seem far less specialised as regards countries and products than are traders – hardly surprising, as brokers focus on services related to customs clearance and can therefore be expected be familiar with regulations for a wider range of products and countries than traders. There are also likely to be economies of scope where the fixed costs of each declaration decline with the number of declarations, products and countries handled, as the procedures and regulations are similar. These findings are consistent with lower fixed customs clearing costs for brokers than for manufacturing traders, and indicate that traders can reduce fixed customs-clearance costs by hiring brokers.

[13] As shown by other studies (see e.g. Bernard et al., 2012), most trading firms generally account for low trade values, whereas a small group of firms accounts for the major part of trade: thus the mean values are much greater than the median. Table 2 shows that the same holds for brokers.

Some of these results are similar to those found in studies comparing intermediaries that are trading companies with producers that trade directly. For example, Ahn et al. (2011), Akerman (2016) and Bernard et al. (2010) find that, respectively, Chinese, Swedish, and US wholesalers trade greater numbers of different products than do producers.[14] Ahn et al. (2011) also find that they trade with more countries. However, the findings are ambiguous with respect to trade value: whereas Ahn et al. (2011) find that wholesalers trade higher values, Bernard et al. (2010) and Akerman (2016) find the converse.

Table 2. Characteristics of traders and brokers

	Brokers		Traders		Traders that self-declare					
					always		never		sometimes	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
	Importers									
# of declarations conducted	1 497	264	98.8	11.0	9.21	1.00	64.9	9.00	398	93.0
Trade value	328	66	22.3	0.35	0.68	0.02	14.3	0.27	93.2	9.32
# of partner countries	17.5	13.0	5.24	3.00	1.06	1.00	4.65	3.00	10.5	8.00
# of different products (HS6)	150	50.0	16.9	6.00	1.34	1.00	13.6	5.00	45.5	23.0
# of different products (aggr.)	9.02	10.0	3.70	3.00	1.25	1.00	3.39	2.00	6.38	6.00
# of sample years active	8.11	9.00	7.38	8.00	3.13	1.00	7.20	8.00	9.09	11.0
# of firms used/served	124	23.0	7.81	4.00	0.00	0.00	6.75	4.00	17.3	13.0
Share of decl. self-declarered			0.01	0.00	1.00	1.00	0.00	0.00	0.13	0.00
Share of trade self-declarered			0.02	0.00	1.00	1.00	0.00	0.00	0.15	0.00
# of firm-year observations	4 199		66 582		77		59 742		6 763	
# of firms	749		14 438		51		13 466		921	
	Exporters									
# of declarations conducted	987	222	173	10.00	14.4	1.00	91.1	7.00	697	148
Trade value	358	62.1	63.5	0.62	0.82	0.07	35.8	0.43	242	18.8
# of partner countries	21.3	14.0	6.90	3.00	1.58	1.00	5.55	2.00	15.6	9.00
# of different products (HS6)	70.0	24.0	9.59	4.00	3.42	1.00	8.30	3.00	18.0	9.00
# of different products (aggr.)	7.77	7.00	2.58	2.00	1.32	1.00	2.39	2.00	3.84	3.00
# of sample years active	8.11	9.00	7.28	8.00	2.29	1.00	7.02	7.00	9.03	11.0
# of firms used/served	42.4	12.00	5.13	2.00	0.68	0.02	4.62	2.00	8.42	5.00
Share of decl. self-declarered			0.06	0.00	1.00	1.00	0.00	0.00	0.43	0.25
Share of trade self-declarered			0.06	0.00	1.00	1.00	0.00	0.00	0.44	0.29
# of firm-year observations	4 176		34 531		59		29 827		4 645	
# of firms	733		7 814		43		7 130		641	

Note: Figures are means and medians for all firm-year observations in the sample. Trade value is given in millions constant (year 2014) NOK. # of different products are given for two different levels of aggregation. HS6 refers to 6-digit product categories in the Harmonised System, whereas aggr. refers to the 21 main chapters in the customs tariffs (2002 versions in both cases).

2.3 Characteristics of traders

Comparison of columns 2 and 3 in Table 1 shows that it is very common to outsource customs clearing to brokers. A large majority of imports are broker-handled: 95% of declarations and 92% of trade value. In exporting, self-declaring is more common, but even here two thirds of declarations as well as trade value are broker-handled.

When we focus on traders and not single declarations, the use of customs brokers appears even more dominant. The sample contains a total of 14 898 traders, of which almost all import, and

[14] Ahn et al. (2011) do not have direct information on firms' sector affiliation, but define a firm as a trade intermediary when its name contains the Chinese character for 'exporting', ' importing', and/or 'trading'.

about half export. In columns 6–11 in Table 2, the traders are categorised according to whether they never, always, or sometimes self-declared during the sample period. The Table shows characteristics for the traders within each category; also the share of declarations and trade value that are self-declared in the course of one year is displayed.

The vast majority of traders sampled let customs brokers handle all their trade declarations. From *# of firm-year obs.*, we see that, of all active traders in a given year, only 10% of the importers and 13% of the exporters switched between self-declaring and using brokers in the course of all the sample years. Traders within this group stand out. They trade much more than do others, their median annual traded value being almost 30 times greater than that for all traders. The number of declarations, partner countries and traded products is also considerably larger (but still not as large as those for the brokers). In addition, traders in this group participate in trade for fairly long periods (see *# of sample years active*). Within this group, broker-use is more common than self-declaring, especially true among importers, where more than half let brokers handle all their declarations during a given year (even though they may self-declare in other years). For exporters in this group, on the other hand, self-declaring is fairly common – the median trader self-declares 25% of its declarations and 29% of its trade value in the course of one year.

There is also group of traders who always self-declare, but these are very few and appear to be outliers trading very small values for a short period, thus I do not find them important. [15] Except for this small group of traders, the descriptive statistics are in accordance with larger fixed costs of self-declaring than broker-use, as it is generally only the largest firms that self-declare. This point is further analysed in Section 3.[16]

Also studies of non-representative sample of firms from the business literature indicate widespread use of customs brokers. Lieb and Bentz (2002) found that of the 500 largest US manufacturers in 2002, 65% reported using third-party logistics services (3PL); customs brokerage was the service most commonly outsourced (67% of the 3PL users). Leahy et al. (1995) define the use of 3PL as 'the use of an outside company to perform all or parts of another company's material management or product distribution' (p. 5). They note the increasing use of such services, consistent with the findings in Lieb and Bentz (2002). Langley et al. (2004) report results from a survey conducted in 2004 among firms in North America, Western Europe, Asia-Pacific, and Latin America. Firms were (non-randomly) selected from a few manufacturing sectors as well as from the wholesale/retail/distribution sector. The percentage of firms using 3PL ranged from 67 to 84 in the different regions; customs brokerage and clearance were among the activities most frequently outsourced.[17]

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[15] In fact, more than half of these traders conducts only one declaration containing one product to/from one country, and together they account for only 0.01 (0.02) % of all import (export) transactions in the course of the whole sample period. Thus, there are also likely to be some errors in the reporting of declaration mode here.

[16] Table 2 also shows the large differences between exporters and importers. Exporters trade much higher values and submit more declarations than do importers. The median traded value is almost than twice as high for the former than the latter.

[17] Among 3PL users, the share of firms outsourcing these activities ranged from 34% to 88%, depending on the region.

3. Customs brokers as trade facilitators

We now turn to the trade facilitating role of brokers. The theories of Ahn et al. (2011) and Crozet et al. (2013) concern exporters, but similar predictions may hold for importers if there are fixed costs to importing that can be reduced by hiring intermediaries. This is likely to be the case as regards customs clearance, as procedures are similar for clearing goods into as well as out of Norway. If anything, clearing import should be more complicated and thus involve higher fixed costs, as regulations related to tariffs and other trade-policy measures apply mainly when bringing goods into a country, not out of it. To compare the trade-facilitating role of brokers in imports and exports, I conduct all analyses for both modes of trade.

3.1 Trade value and fixed costs

Following the reasoning in Ahn et al. (2011), if fixed costs of customs-clearing can be reduced by hiring brokers, we should expect a sorting pattern where traders in large values self-declare and small ones hire brokers. However, traders do not necessarily do one or the other – in Section 2.3 we saw that some traders switch between the two modes of customs clearing, and that almost none always self-declare. With separate fixed costs of handling each declaration, there could be an incentive to self-declare when the declaration is large (in terms of high value), and to hire brokers when it is small. To check for this, I define an indicator variable *Declaration_SD* equal to 1 if the customs declaration is self-declared and 0 if it is handled by a broker. I regress *Declaration_SD* on the (log of) declaration value using a probit model. [18]Table 3 displays the results, with coefficients as well as average partial effects (APEs). The results clearly show that large declarations, in importing as well as exporting, are more likely to be self-declared and less likely to be handled by brokers. A doubling of the declaration value is associated with an increase in the probability of self-declaring by 0.9% points for importers, and 1.8% points for exporters. Evaluated relative to the percentage of self-declarations (see Table 1), the effect is considerably greater for importers, indicating an increase in the probability of self-declaring by 18%. For exporters, the increase is only 5%.

[18] Throughout the article, I use the binary logarithm instead of the natural one or the one with base 10 for log transforming variables. This is to ease the interpretation of partial effects – the APE of a binary log transformed variable shows the effect of doubling the original variable.

Table 3. Probability of self-declaring. Probit estimation.

	Importers			Exporters		
	APE	Coeff	Std. error	APE	Coeff	Std. error
Declaration value	0.009	0.091 ***	0.012	0.018	0.048 **	0.022
Constant		-3.091 ***	0.192		-1.206 **	0.357
# obs		6 575 156			5 957 656	
Log likelihood		-1 239 812			-3 779 622	
P. R^2		0.029			0.006	

Note: APE = average partial effects. P. R^2 =pseudo R^2. Standard errors are clustered at firm-level. Year dummies are included, but not reported. ***, **, * indicate significance level at 1%, 5% and 10%, respectively.

However, this correlation might be spurious, perhaps stemming from characteristics of traders and countries related to other factors than trade value. Firstly, and in line with Ahn et al. (2011), we should correct for characteristics of traders that may affect profitability from trade, such as productivity and size. Secondly, some parts of the costs of customs clearance are likely to be country-specific: as regulations may be similar for the same country, but differ between other countries. In line with Crozet et al. (2013), we should therefore correct for factors that affect the profitability of trade with a particular country, such as market size, regulatory differences and exchange rate movements. Thirdly, we should correct for factors specific to the trader and the country combined. Some of these factors – like characteristics of the trader's product portfolio in a given country – may be observed, but others may not. For example, some traders may have employees well-versed in the regulations applying to specific countries and may therefore be more inclined to self-declare when trading with those countries.

To make the data tractable for further analyses, I aggregate up to trader-country-year level and define two indicator variables, *SelfDecl* and *Broker*, to be analysed. The first is equal to 1 if trader *i* self-declared at least one of its declarations to/from country *j* in year *t*, whereas *Broker* equals 1 if a broker was used. Note that a trader may conduct more than one declaration to/from the same country in the same year, so both indicator variables may be equal to 1 for the same observation.

I now combine the Norwegian trade data with characteristics of partner countries, such as GDP. Observations for countries where this information is missing are excluded. The percentage of trader-country combinations lost due to this is 2.9 for importers and 5.5 for exporters. [19]

I start by regressing these two variables on the traders' trade value from/to a particular country, *TradeValFiCo*, without controlling for other factors. As before, a probit model is used. The results, displayed under the Probit heading in Table 4, clearly demonstrate a positive correlation between trade value and tendency to self-declare, and a negative correlation with the tendency to use a broker, also at this more aggregated level.

Next I add controls and estimate the following equations to control for unobserved heterogeneity at the levels of the firm, the country, and the combination of the two.

Equation 1

[19] Country-level variables are taken from the World Development Indicators (2017). For some countries, exchange rates are missing, and I then I use data from the Central Bank of Norway instead.

$$DeclMode_{ijt} = a + b_1\, TradeValFiCo_{ijt} + b_2\, TradeValFi_{it} + b_3\, NoProdFiCo_{ijt} + b_4\, NoProdFi_{jt} + b_5\, Food_{ijt} + b_6\, ForOw_{it} + b_7\, Productivity_{it} + b_8\, NoEmp_{it} + b_9\, GDP_{jt} + b_{10} CGDP_{jt} + b_{11}\, Exch_{jt} + b_{12}\, FTA_{jt} + b_{13}\, EEA_{jt} + e_{it}$$

DeclMode refers to either *SelfDecl* or *Broker*. Definitions of the variables are listed in Table A1 Appendix A, which also contains summary statistics (listed under *Whole sample*). All continuous variables are given in binary logarithms, to reduce the influence of outliers in the upper ranges.

Eq. (1) is estimated using a Correlated random effects probit [henceforth: *CRE probit*] model similar to that in Chamberlain (1980, section 4). (See also see Wooldridge 2012, pp. 615–616 for details.) The model allows for unobserved heterogeneity; the error term is split into time-invariant elements specific to trader-country groups (a_{ij}) and remaining noise (ε_{ijt}), distributed as Normal[0, σ_ε^2]:

Equation 2

$$e_{ijt} = a_{ij} + \varepsilon_{ijt}$$

Unlike in a standard random effects model, the unobserved heterogeneity, a_{ij}, and the explanatory variables are allowed to correlate. However, the correlation is not unrestricted; it is assumed that the a_{ij}'s are normally distributed conditional on the explanatory variables, so that:

Equation 3

$$a_{ij} = \lambda_0 + \boldsymbol{\lambda_1 z_{ij}} + \alpha_{ij}$$

where $\mathbf{z_{ij}}$ is a vector of the explanatory variables' average over years.[20] α_{ij} is distributed as Normal[0, σ_α^2], and assumed independent of $\mathbf{z_{ij}}$. We can now insert for Eq. (3) and (2) and estimate Eq. (1) using a standard random effects probit model, where $\boldsymbol{\lambda_1}$ and σ_α^2 will be estimated in addition to the b's. To further correct for unobserved heterogeneity, I also include country dummies. The APEs are calculated according to Wooldridge (2012, pp. 616–617).[21]

[20] Chamberlain (1980) uses all observations of all zij in all time periods instead of their time-invariant means. Since the panel is highly unbalanced, and to save computation time, I have chosen to operate with means.

[21] Essentially, each coefficient is multiplied by $(1 - \rho)^{1/2}$, where ρ, is the proportion of total variance contributed by σ_α^2: $\rho = \sigma_\alpha^2/(1 + \sigma_\alpha^2)$.

Results from the estimations are shown under the CRE probit heading in Table 4.[22] They clearly demonstrate that there is still a positive correlation between the probability of self-declaring and the country-specific trade value. Moreover, there is still a negative correlation between the probability of using a broker and the country-specific trade value for importers. For exporters, there is no such correlation. However, I have also included the trader's total trade value (*TradeValFi*) in the regression as a firm control; for both exporters and importers, a higher value is associated with lower probability of using a broker.

Also note that the APEs are somewhat smaller in the CRE probit model, further underlining the importance of accounting for both observed and unobserved characteristics of traders and countries and the combination of the two. The APEs indicate that a doubling of a trader's country-specific traded value is associated with an increase in the probability of self-declaring to that country by 0.3 percentage points, for importers and exporters alike. Evaluated relative to the share of observations that are self-declared in the sample (see Table A1 in Appendix A), this involves increases in the probability of self-declaring by, respectively, 9.0% and 1.9%. The negative effects on the probability of using brokers are small, and indicate decreases of less than 0.3 percentage points as well as in per cent from doubling the traded value (country-specific and/or total).

These results show that there is a sorting pattern where larger traded values at the trader-country level are more likely to be self-declared. Other scholars have found similar patterns at the firm-level, but studying wholesale intermediaries rather than customs brokers-intermediaries; firms with larger total traded values are more likely to trade directly instead of through trading companies (see e.g. Ahn et al., 2011; Abel-Koch, 2013; McCann, 2013; Grazzi and Tomasi, 2016). The results are consistent with brokers facilitating trade by offering lower fixed costs of customs-clearance for firms that hire their services. Without the possibility of hiring brokers, some of these firms might not have been able to participate in international trade, at least not in certain markets. The results are similar for importers and exporters, as regards significance and size of the APEs. In percentage terms, the effects are greater for importers. These results indicate the importance of developing models of trade intermediation in imports.

[22] In the regressions, a few observations have been dropped from the sample. This is due to the dummy for the country in question predicting the dependent variable perfectly (i.e. no variation in DeclMode for traders with the country). However, summary statistics do not differ greatly among the regression subsamples, as relatively few observations are lost.

Table 4. Probability that a trader in Norway self-declares and uses brokers when trading with a given country. Static probit models.

	DeclMode=*SelfDecl*								DeclMode=*Broker*							
	Probit				CRE probit				Probit				CRE probit			
	APE	Coeff		Std. error	APE	Coeff		Std. error	APE	Coeff		Std. error	APE	Coeff		Std. error
	Importers															
TradeValFiCo	0.008	0.11	***	0.01	0.003	0.12	***	0.01	-0.001	-0.04	***	0.01	-0.001	-0.05	***	0.01
TradeValFi					0.001	0.03		0.04					-0.001	-0.09	*	0.05
NoProdFiCo					0.004	0.13	***	0.02					0.008	0.80	***	0.08
NoProdFi					-0.001	-0.02		0.09					0.003	0.25	*	0.14
Food					0.015	0.50	***	0.12					-0.010	-0.80	***	0.21
ForOwn					-0.002	-0.07		0.21					0.002	0.20		0.19
Productive					-0.001	-0.02		0.04					-0.001	-0.05		0.05
NoEmpl					0.001	0.05		0.09					-0.002	-0.15		0.15
GDP					0.018	0.63		0.56					-0.013	-1.24	**	0.55
CGDP					-0.023	-0.84		0.54					0.011	1.10	**	0.56
Exch					-0.001	-0.02		0.03					0.000	0.03		0.06
FTA					0.009	0.29	**	0.13					0.000	0.16		0.19
EEA					0.007	0.27		0.18					1.000	0.02		0.25
Constant		-3.75	***	0.11						2.88	***	0.00				
# obs		340 648				340 046				340 648				339 851		
Log p. l.		-47 842				-23 401				-20 594				-11 565		
rho		0.10				0.88				0.01				0.92		
	Exporters															
TradeValFiCo	0.026	0.11	***	0.01	0.003	0.14	***	0.02	-0.008	-0.05	***	0.01	0.000	-0.02		0.01
TradeValFi					0.003	0.13		0.11					-0.002	-0.09	**	0.04
NoProdFiCo					0.005	0.21	***	0.05					0.012	0.48	***	0.05
NoProdFi					-0.001	-0.05		0.08					0.003	0.11	*	0.06
Food					0.026	0.97	**	0.42					-0.019	-0.66	***	0.22
ForOwn					0.005	0.21		0.31					-0.006	-0.23		0.14
Productive					-0.001	-0.05		0.07					0.001	0.03		0.04
NoEmpl					0.005	0.19		0.12					0.000	-0.01		0.06
GDP					0.003	0.13		0.58					0.002	0.09		0.32
CGDP					-0.001	-0.02		0.52					-0.002	-0.08		0.27
Exch					0.000	-0.02		0.04					0.000	0.01		0.02
FTA					0.000	0.00		0.13					0.000	-0.01		0.08
EEA					0.003	0.12		0.17					-0.001	-0.03		0.11
Constant		-2.91	***	0.13						2.09	***	0.13				
# obs		226 739				226 726				226 739				226 835		
Log p. l.		-97 852				-36 570				-73 688				-34 777		
rho		0.08				0.96				0.02				0.88		

Note: CRE = Correlated random effects. APE = average partial effects. Log p. l.=log pseudo likelihood. Std. errors are clustered at the firm level. Year dummies are included in all regressions. In addition, country dummies and the average over time for each independent variable are included in the CRE probit analysis. ***, **, * indicate significance at the 1%, 5% and 10% level respectively.

We now turn to the two other estimation models, which yield similar results. The control variables are discussed in Section 3.3.

Although the CRE probit model resembles a fixed effects model in that it allows for correlation between a_{ij} and the explanatory variables, assumptions must be made about the correlation structure. A fixed effects model, on the other hand, would allow for a fully flexible correlation structure. As a sensitivity analysis, I therefore estimate Eq. 1 using a fixed effects logit analysis (see e.g. Wooldridge 2012, pp. 619–622 for a description). However, this model has the disadvantage of not being able to produce meaningful APEs. Thus, it is not possible to assess the economic significance of the results, only their statistical significance. Note also that the fixed-effects logit analysis will focus solely on changes within a given trader-country combination over time, rather than on differences between traders and countries. Only a minor share of the traders in the sample – those who switch between self-declaring and using brokers in a given country – will be included in the analysis, since only these contribute to the estimation results. [23]In consequence, the subsamples of traders and countries included in the analyses will vary across the different estimations for the two modes of declaration and trade. Table A1 in Appendix A presents summary statistics for each of the four subsamples. These subsamples are considerably smaller than the whole sample, and their summary statistics are different. [24]

The results are shown in Table A2 in Appendix A. Despite the large reduction in the sample size and the focus solely on within-effects, the results are very similar to those of the main analysis. The only difference of interest is that the estimated coefficient for *TradeValFi* in the estimation of *Broker* is no longer significant for importers. Therefore, any bias from misspecification of the correlation structure between a_{ij} and the explanatory variables does not appear severe for the estimated effects of trade value. Below, I demonstrate that the results are robust to another specification as well.

3.2 Persistence in choice of declaration mode and sunk costs

The models of Ahn et al. (2011) and Crozet et al. (2013) are static and do not distinguish between fixed and sunk costs of trade. However, at least part of the fixed cost of self-declaring is likely to be sunk. For example, gaining familiarity with the regulations applying to goods from/to a specific country may be a one-time investment, at least in the short run. In this case, brokers may facilitate trade also by reducing the sunk costs to trade, not only fixed costs.

The literature on sunk costs to trade has noted that with such costs there will be persistence in trade, because firms which have already paid the sunk cost will expect higher profits from trading in the future that those who have not (see e.g. Bernard and Jensen, 2004). In the presence of market specific sunk costs, firms will to a lesser extent redirect their trade between different markets according to changing profit conditions (Maurseth and Medin, 2017). Similarly,

[23] Likewise, trader-country observations that appear only once will be dropped from the analysis.

[24] As shown in section 2.3, traders who switch between broker-use and self-declaring are larger and also more inclined to self-declare. It is therefore not surprising that the average trade value is much greater in the regression subsamples than for the sample as a whole. Also, the share of observations that self-declare (the mean of the SelfDecl-variable) is much larger, whereas the share of observations using brokers (the mean of the Broker-variable) is considerably lower. These deviations are not problematic, however, as they are a consequence of the focus on variation within traders and countries over time, and not variation across traders.

persistence in a specific mode of customs clearing may indicate that there are sunk costs involved with that mode. I therefore estimate a dynamic version of Eq. (1) where lagged *DeclMode* is included as an explanatory variable. A significantly positive estimated effect will indicate persistence in the declaration mode in question.

When a lagged dependent variable is included in the equation, the assumption of strict exogeneity underlying the random effects probit model is violated since there is, by construction, a correlation between the error term and the lagged dependent variable. Importantly, the *initial conditions* problem must to deal with.[25] I apply a method proposed by Woodridge (2005), henceforth referred to as *Dynamic CRE probit* due to the similarity with the CRE probit model described above.[26] It entails adding to the expression for the unobserved heterogeneity in Eq. (3) a part containing the first observation of *DeclMode_lag*, *DeclMode0*, so that:

Equation 4

$$a_{ij} = \lambda_0 + \boldsymbol{\lambda_1 z_{ij}} + \lambda_2 DeclMode0 + \alpha_{ij}$$

where $\mathbf{z_{ij}}$ contains the time-averages of all exogenous variables (but not *DeclMode_lag*). α_{ij} is now assumed to be independent of both $\mathbf{z_{ij}}$ and *DeclMode0*. Using (4) instead of (3), we can again use a standard random effects probit estimation, where now also λ_2 will be estimated. The APEs can be calculated in a similar manner as in the correlated random effects model (see Wooldridge, 2012 p. 628–629 for details).

Note that in this model, only trader-country observations with trade in at least two consecutive periods are included, as it is only for these observations we have information on lagged declaration mode. This yields a sample size smaller than in the static analysis; summary statistics are given in Table A1 in Appendix A.

[25] The problem concerns how to treat the first observation of the lagged dependent variable, DeclMode0. If we treat it as exogenous, i.e. include it as an explanatory variable for DeclMode in year 1, it must be uncorrelated with aij in order for the estimated coefficients to be unbiased. That is not likely to be the case. See Wooldridge (2012, pp. 626–627) for discussion and details.

Table 5. Probability that a trader in Norway self-declares and uses brokers when trading with a given country. Dynamic CRE probit model.

	Importers						Exporters					
	DeclMode=*SelfDecl*			DeclMode=*Broker*			DeclMode=*SelfDecl*			DeclMode=*Broker*		
	APE	Coeff	Std. error	APE	Coeff	Std. error	APE	Coeff	Std. error	APE	Coeff	Std. error
DeclMode_lag	0.101	1.466 ***	0.083	0.026	1.016 ***	0.118	0.091	1.700 ***	0.154	0.025	0.734 ***	0.075
DeclModeOt_lag	0.000	-0.006	0.121	-0.001	-0.039	0.188	0.007	0.262	0.179	0.004	0.155	0.145
TradeValFiCo	0.004	0.129 ***	0.013	-0.001	-0.044 ***	0.012	0.004	0.151 ***	0.019	0.000	-0.011	0.011
TradeValFi	-0.002	-0.055	0.037	-0.001	-0.037	0.041	0.001	0.049	0.050	-0.001	-0.054	0.042
NoProdFiCo	0.004	0.130 ***	0.022	0.013	0.748 ***	0.088	0.005	0.203 ***	0.043	0.013	0.503 ***	0.050
NoProdFi	-0.001	-0.019	0.069	0.003	0.172	0.112	-0.001	-0.048	0.086	0.001	0.028	0.060
Food	0.013	0.366 ***	0.136	-0.011	-0.531 **	0.230	0.020	0.723 **	0.330	-0.012	-0.401 *	0.229
ForOwn	-0.005	-0.155	0.120	0.002	0.101	0.141	0.008	0.302	0.324	-0.007	-0.272 *	0.158
Productive	-0.001	-0.020	0.035	-0.002	-0.096 **	0.047	0.000	0.000	0.057	0.002	0.058	0.045
NoEmpl	-0.001	-0.024	0.073	-0.002	-0.138	0.165	0.002	0.094	0.093	0.001	0.040	0.071
GDP	0.008	0.224	0.480	-0.013	-0.736	0.577	0.003	0.121	0.252	-0.007	-0.267	0.322
CGDP	-0.017	-0.501	0.458	0.017	0.916	0.569	-0.003	-0.130	0.253	0.000	-0.001	0.281
Exch	0.000	0.002	0.031	0.000	0.010	0.056	-0.001	-0.023	0.024	0.000	0.015	0.020
FTA	0.009	0.267 *	0.148	0.001	0.043	0.172	0.000	-0.005	0.085	0.000	0.012	0.086
EEA	0.011	0.318	0.196	-0.004	-0.214	0.236	0.001	0.056	0.137	0.001	0.034	0.118
# obs	209 129			209 123			141 737			141 698		
Log p. l.	-9 355			-5 239			-10 859			-17 813		
rho	0.265			0.662			0.385			0.663		

Note: Dynamic CRE = Dynamic correlated random effects, estimated according to descriptions in the text. APE = average partial effects. Log p. l.=log pseudo likelihood. Std. errors are clustered at the firm level. Year and country dummies are included, but not reported. Lagged variables are lagged one year. ***, **, * indicate significance level at 1%, 5% and 10%, respectively.

Results, APEs as well as coefficients, are shown in Table 5. Again, results are similar for importers and exporters. The estimated coefficient for lagged *DeclMode* is positive and significant for *SelfDecl* as well as for *Broker*. This may indicate that there are sunk costs in both modes of handling customs declarations. However, from the APEs we see that persistence is stronger in self-declaring than broker-use, and this may indeed mean that sunk costs are larger in the former than in the latter. In fact, having self-declared the previous year is associated with an increase in the probability of self-declaring this year, by as much as 10 percentage points for importers and 9.1 for exporters. Evaluated relative to the share of observations in the sample who self-declare, this implies increases of the probability of self-declaring by as much as 277% and 44% for importers and exporters, respectively. In contrast, having hired a broker the previous year is associated with much smaller increases in the probability of hiring a broker this year – less than 3 percentage points (and %) for importers and exporters alike. These patterns are consistent with brokers reducing not only the fixed costs of customs clearing, but also the sunk costs. If traders can avoid sunk costs by engaging brokers, they can more easily shift their trade between markets according to changing expectations as to profits. Thus, my results indicate that brokers have an additional trade facilitating role. [27] These dynamic effects should be built into models of trade intermediation.

Finally, the estimated effects from trade value are very similar to those from the CRE probit analysis, in terms of both significance and size. This indicates that the results from that analysis are robust to yet another alternative specification, in addition to the fixed-effects logit analysis described above. Omitting the lagged dependent variable does not seem to produce any severe bias in the estimated effect of trade value on the probability of self-declaring and using brokers.

3.3 Control variables

The results from the dynamic CRE probit analysis prove to be similar to those from the two other analyses undertaken and thus robust to alternative model specifications (see Table 3 in section 3.1. and Table A2 in the appendix).[28] Generally, only the control variables capturing attributes of the traders' product portfolios are significant; these will be the main focus here.

The fixed costs of customs clearance may vary across products. Although this is not explicitly considered in the theories mentioned above, following the same logic as for country-specific costs, we should expect firms that trade in products with higher fixed costs to be more likely to use intermediaries. [29] Representatives from the Directorate of Norwegian Customs[30] emphasises one type of product as being complicated: food products. Clearing food involves stricter legislation and more documentation related to matters like possible health issues, and the

[27] In addition to lagged declaration mode, I include an indicator variable equal to 1 if lagged DeclMode for trader i was equal to 1 for any of the other countries it traded with (DeclModeOt_lag). This is to capture that part of the sunk costs of self-declaring could be common for all countries, like the costs of buying specialised software. The estimated coefficients are not significant, however.

[28] The fixed-effect logit model cannot be used to check the sensitivity of the results from the dynamic model, as there is no known way of addressing the endogeneity of the lagged dependent variable adequately. Wooldridge (2012, pp. 625–627) discusses various methods for dealing with this endogeneity.

[29] Crozet et al. (2013) find indications of more exports by wholesalers in markets where a certain indicator capturing country-product specific fixed trade costs is higher.

[30] See footnote 4 for reference.

declarant must be familiar with a larger set of regulations. This could give an incentive for food-traders to use brokers.

On the other hand, hiring brokers may also be risky. Errors may occur in relation to, for instance, classification of goods, or having the correct documents and licences. Such errors can prove costly – they can result in requirements for extra documentation, re-calculation of fees, and other tedious delays, so that goods get held up in customs. It can be difficult for a trader to specify all possible eventualities in a contract with a broker. Moreover, the representatives from the Directorate say that the self-declarants typically know their products better than brokers do, so they may be better able to answer inquiries from the customs authorities promptly and correctly. Due to the perishable nature of food products, delays can have severe consequences, so there may be an incentive for self-declaring.

To test for such effects, I include an indicator variable equal to 1 if the trader's main traded product to country *j* is a food product (*Food*). The results show that food-traders are more inclined to self-declare, regarding both import and export. Changing the *Food*-variable from 0 to 1 is associated with an increase in the probability of self-declaring: about 1.3 percentage points for importers and 2 percentage points for exporters (corresponding to increases of approx. 36% for importers and 9.8% for exporters). Food traders are less likely to use brokers; trading in food is associated with a decrease of slightly more than one percentage point (and 1%) in the probability of hiring brokers, for both importers and exporters. [31]

These results show no indications that trade intermediaries facilitate food trade in particular. By contrast, Bernard et al. (2010) found that wholesalers in the USA accounted for a larger share of trade in agriculture-related sectors than in other sectors. The results are, however, in accordance with there being a less prominent role for trade intermediaries as regards risky products, similar to what Felbermayr and Jung (2011) found for risky markets.

Not only product type, but also the number of different products traded can matter for the choice of declaration mode. Separate fixed costs of self-declaring may accrue for each product a trader self-declares from/to a given country, for instance because regulations vary. The total fixed costs of customs clearing may then increase with the number of different products traded, which may provide incentives for traders with diverse product portfolios to use brokers. For example, McCann (2013) finds that multiproduct firms export a higher share of their total through trading companies. On the other hand, the opposite may hold if there are economies of scope, so that the cost of self-declaring an additional product decreases with the number of different products traded. [32] As different product may be listed in one and the same declaration, this may well be the case. Patterns in the data support both hypotheses; and again, the results are similar for importing and exporting. Trading a larger variety of products (differentiated at the HS6 level) to a certain country is associated with a higher probability of using brokers, as well as self-declaring

[31] For exporters, the effect is only weakly significant in the dynamic CRE probit estimation. However, it is significant at the 1% level in the two static analyses.

[32] Various studies of multi-product firms have held that there are economies of scope in trading different products. Firms face a fixed cost for trading each type of product they produce, but the cost of trading an additional type declines if the firm already trades other types (see e.g. Bernard et al., 2011). Also similar is the model presented in Akerman (2016), where wholesalers possess a technology involving economies of scope in the number of different products exported.

(see *NoProdFiCo*). This may reflect the fact that traders with large product portfolios more often switch between the two modes of clearing goods (see Table 2). The effects are only moderate: a doubling of the number different products traded is associated with increases in the probability of self-declaring of about 0.5 percentage points for both importers and exporters, which corresponds to increases of 12% and 2.5%, respectively. The increase in the probability of using brokers is around 1.4 percentage points (and %).

The remaining controls capture the characteristics of traders and countries separately. They generally emerge as not significant. [33] This contrasts existing studies: Those that compared trade by trading companies with trade by producers often found the first to be negatively associated with various indicators of profitability and accessibility in partner countries (e.g. Ahn et al., 2011; Crozet et al., 2013; Bernard et al., 2010; Bernard et al., 2015). Studies comparing firms that use trading companies with those that trade directly have often found indications of a sorting pattern, where the first tend to be smaller, less productive, and have low trade values than the latter. The smallest firms operate solely on the domestic market. However, none of these studies say anything about individual firms' choices of using intermediaries in different partner countries – which I do. Indeed, I find a sorting pattern where several indicators of profitability at the trader-country level are negatively associated with use of intermediaries. However, once these are corrected for, there are few additional effects from indicators of trader and country profitability separately.

[33] There are a few exceptions: for importers, the estimated coefficient in front of productive is small but significantly negative in the dynamic estimation of Broker. The result is consistent with the theory put forward by Ahn et al. (2011), that less-productive firms are more likely to use intermediaries. It is not significant in the static estimations, however. Furthermore, some country-level variables are significant in the two static analyses, but not the dynamic one. For importers, the estimated coefficient for GDP is small but significantly negative in the estimation of Broker, whereas that for FTA is significantly positive, as well as being of a non-negligible size in the estimation of SelfDecl. This is also consistent with theories put forward by e.g. Crozet et al. (2013), that firms are more inclined to use intermediaries in smaller markets and less inclined to use them in markets where trade costs are low. Finally, the estimated coefficient for GDP per capita is significantly positive, but small, in the estimation of Broker for importers. As all these results are sensitive to the model specification, and most of them are small, I do not consider them as being particularly important. Note also that time-invariant country-specific variables like distance are captured by country dummies in the two CRE probit analyses and by the fixed effects in the logit analysis – so including them as controls is redundant.

4. Concluding remarks

This study has focused on customs brokers, a type of intermediary in international trade rarely examined in economics. Recent economic theories hypothesise that intermediaries like trading companies can facilitate trade by offering the opportunity of reducing fixed trade costs for firms that use them. As a result, firms with low trade values will use intermediaries. I have found indications of a similar role for customs brokers; clearing goods through customs is likely to involve fixed costs which can be reduced by hiring brokers rather than self-declaring.

This study draws on an exhaustive panel of the trade transactions of Norwegian manufacturing firms, with information on the use of brokers. Descriptive statistics show that brokers handle larger trade values, more declarations and a greater variety of products and countries than the manufacturing traders do. This is consistent with lower fixed costs of customs clearance for brokers than for traders, as there are likely to be economies of scope in customs clearing. Moreover, brokers specialise in that activity. Descriptive statistics also show that the vast majority of traders engage brokers to clear their goods through customs: generally, only the companies with the largest trade values self-declare. This was further confirmed in econometric analyses where I controlled for observed and unobserved characteristics of traders, countries, and the combination of the two; and found that traders with large country-specific trade values are more inclined to self-declare.

The results indicate that hiring customs brokers allows smaller companies that perhaps would otherwise not be able to engage in international trade to do so. Whereas policymakers concerned with international market participation often emphasise ensuring sound business conditions for producing firms, my results indicate that having well-functioning intermediary sectors is also highly relevant. Furthermore, it can be important to continue efforts aimed at streamlining and simplifying customs procedures, also in a highly developed country like Norway.

The analyses further show that brokers are likely to facilitate trade by offering not only lower fixed costs of customs clearing, but also lower sunk costs. Moreover, patterns were similar for importers and exporters. Previous models of the trade-facilitating role of intermediaries have generally been static, and with the focus on exporting, not importing. The results underline the need for developing dynamic models, and models suitable for studying imports in addition to exports.

Not only customs brokers and trading companies, but also other types of intermediaries, like distributors, transporters, shipping agents, and marketing agents, may be crucial for the ability of producing firms to sell and buy in international markets. Future research should study the facilitating role of these. Another important theme is how developments in new digital methods, such as blockchain technology, can facilitate trade, perhaps changing the need for customs brokers and other intermediaries in the future.

Appendix A

Table A1. Summary statistics and variable definitions

Variable	Static model						Dynamic model		Variable definition
	Whole sample		FE Logit, subsamples for used in estimation of				Whole sample*		
			SelfDecl		*Broker*				
	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	
SelfDecl	0.04	0.18	0.40	0.52			0.04	0.21	Dummy=1 if trader *i* self-declares at least one declaration to/from country *j* in year *t*
Broker	0.99	0.90			0.64	0.52	0.99	0.89	Dummy=1 if trader *i* uses broker on least one declaration to/from country *j* in year *t*
SelfDecl_ot							0.08	0.25	Dummy equal to 1 if *SelfDecl*=1 in at least one country other than *j* in year *t*
Broker_ot							0.96	0.96	Dummy equal to 1 if *Broker*=1 in at least one country other than *j* in year *t*
TradeValFiCo	5.45	9.55	15.0	11.48	7.84	17.1	7.69	13.4	Trade value of trader *i* to country j in year *t*, in mill. real (year 2014) NOK
TradeValFi	137	331	270	524	261	587	169	406	Trade value of trader *i* to country j in year *t*, in mill. real (year 2014) NOK
NoProdFiCo	4.86	3.46	10.8	4.30	3.20	3.42	6.32	4.31	Number of products (at the hs 6-digit level) trader *i* trades with country *j* in year *t*
NoProdFi	47.6	28.9	90.8	41.5	84.2	33.9	54.3	32.5	Number of products (at the hs 6-digit level) trader *i* trades in year *t*
Food	0.05	0.08	0.12	0.09	0.23	0.11	0.05	0.08	Dummy=1 if the main product of trader *i* trades to/from country *j* in year *t* is a food product
ForOwn	0.16	0.23	0.24	0.34	0.20	0.32	0.18	0.26	Dummy equal to 1 if trader *i* is foreign owned in year *t*
Productiv	826	907	974	940	991	963	822	927	Value added per employee of trader *i* in year *t*, in mill. real (year 2014) NOK
NoEmpl	109	163	258	252	253	222	125	184	Number of employees in trader *i* in year *t*
GDP	13 104	9 171	11 957	8 284	10 535	8 495	13 394	9 784	GDP of country *j* in year *t*, in 1 000 mill. real (year 2014) NOK
CGDP	0.25	0.22	0.25	0.20	0.20	0.20	0.26	0.23	GDP per capita of country *j* in year *t*, in mill. real (year 2014) NOK
Exch	4.72	4.30	4.61	4.13	4.30	4.37	4.79	4.37	Real exchange rate between NOK and the foreign currency of country *j* in year *t*
FTA	0.05	0.09	0.05	0.10	0.09	0.11	0.04	0.09	Dummy equal to 1 if country *j* is not part of EEA but had another free trade agreement with Norway in year *t*
EEA	0.74	0.62	0.76	0.57	0.59	0.58	0.78	0.65	Dummy equal to 1 if country *j* is part of EEA in year *t*
# of firms	14 427	7 765	731	515	278	391	9 302	4 582	
# of countries	160	171	87	150	86	148	138	161	
# of trader-country	98 418	62 997	2 295	3 258	1 113	3 792	51 793	33 909	
# of obs	340 656	226 856	16 962	22 013	7 272	25 562	209 568	141 887	

Note: *Includes only observations with trade in at least two consecutive periods

Table A2. Probability that a trader in Norway self-declares and uses brokers when trading with a given country. Static fixed effects logit model.

	Importers				Exporters			
	DeclMode=*SelfDecl*		DeclMode=*Broker*		DeclMode=*SelfDecl*		DeclMode=*Broker*	
	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error
TradeValFiCo	0.241 ***	0.022	-0.078 ***	0.022	0.233 ***	0.029	-0.032	0.020
TradeValFi	0.032	0.090	-0.123	0.089	0.145	0.097	-0.155 **	0.069
NoProdFiCo	0.290 ***	0.046	1.376 ***	0.150	0.393 ***	0.089	0.871 ***	0.105
NoProdFi	-0.118	0.191	0.529 *	0.280	-0.075	0.158	0.203 *	0.104
Food	0.952 ***	0.204	-1.288 ***	0.319	1.337 ***	0.428	-1.093 ***	0.355
ForOwn	-0.153	0.464	0.377	0.335	0.398	0.535	-0.382	0.251
Productive	-0.031	0.080	-0.122	0.081	-0.089	0.149	0.060	0.084
NoEmpl	0.146	0.184	-0.297	0.267	0.384 *	0.212	-0.022	0.112
GDP	1.448	1.083	-2.281 **	0.990	0.332	0.600	0.216	0.696
CGDP	-1.957 *	1.035	1.926 *	1.016	-0.032	0.489	-0.259	0.572
Exch	-0.054	0.070	0.027	0.102	-0.041	0.063	0.050	0.045
FTA	0.735 **	0.287	0.419	0.335	0.007	0.176	0.041	0.167
EEA	0.756 *	0.390	0.097	0.429	0.249	0.211	-0.061	0.207
# obs	16 962		7 274		22 022		25 585	
Log p. l.	-5375		-2306		-7369		-9266	
P. R^2	0.11		0.17		0.14		0.08	

Note: Log p.l.=log pseudo-likelihood, P. R^2=Pseudo R^2. In all estimations, standard errors are clustered at the firm level, and year dummies are included. In the fixed effects model, fixed effects are at the trader-country level, and trader-country observations with no variation in the dependent variable over time are automatically omitted from the analysis. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively.

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