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Cod stories:

Trade dynamics and duration for Norwegian cod exports

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Abstract: In recent years, trade dynamics have been receiving increased attention, and the general literature indicates that commodities are different. In this paper, the duration of trade relationships for Norwegian export firms to various markets is investigated for six product forms of one commodity, cod. The results indicate that the duration of most trade relationships is very short, and shorter than what is normally reported in the literature. Still, the substantial variation in duration by product form and factors influencing it, indicates heterogeneous dynamics for each supply chain even for slight differences in the characteristics of a commodity. Moreover, the short duration of trade relationships in the supply chains for Norwegian cod indicates that they remain very traditional food supply chains, with few attempts at reducing transaction costs through vertical coordination or relationships.

Keywords: seafood, cod, duration, customs data, trade

JEL Classification : F10, F14, C41

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1. Introduction

The role of firms and products has received increased interest in the international trade literature during the last decade. One main finding is that trade flows, to a large extent, are driven by firm entry and exit between markets (Eaton et al., 2008, Bernard et al., 2007). An important strand of this literature, starting with Besedeš and Prusa (2006ab), investigates the duration of trade relationships. They show that trade duration is much more volatile than standard trade theory would predict. Moreover, they report that export growth mainly occurs through survival and deepening of existing trade relations, *i.e.*, expansion along the intensive margin, and that trade duration tends to be shortest for commodities. However, in this literature little attention has been given to commodities beyond the dummy identifying the group of goods in Besedeš and Prusa (2006b). One exception is Straume (2017) who studies duration of salmon exports. He argues that it is important to study trade for specific products to allow nuances in different supply chains to appear, and to prevent averaging from washing out all product-specific characteristics. This paper investigates factors which influence trade duration for exports of one commodity, cod, the most important fisheries species in Norway (as well as in the northern Atlantic). However, since it is not a homogenous commodity, the supply chains for six product forms will be investigated.

Cod has been traded for at least a millennium (Hannesson, Salvanes and Squires, 2010; Kvamsdal, 2016), and it is the leading product in one of the main segments of the whitefish market (Asche, Roll and Trollvik, 2009). It is also a typical representative of a species in an increasingly globalized seafood market in that there are strong commodity aspects to the product in that there are little branding and origin does not matter much (Tveteras et al, 2012), but it is also heterogenous and is exported in several product forms, varying from traditional products and supply chains such as dried and dried salted cod to highly modern supply chains for fresh fillets. While the supply chains differ and although different product forms and quality attributes influence price level (Sogn-Grundvag, Larsen and Young, 2014; Lee, 2014; Asche, Chen and Smith, 2015; Blomquist, Bardolino and Waldo, 2016; Bronnmann and Asche, 2016; Hammerlund, 2016), there is still a global market for cod with a common price determination process (Gordon and Hannesson, 1996; Asche, Gordon and Hannesson, 2002; 2004; Nielsen, 2005; Bronnmann, Ankamah and Nielsen, 2016; Pettersen and Myrland, 2016).

Features that have been found to be important with respect to trade costs are mode of transportation (Behar and Venables, 2011) and perishability (Hornok and Koren, 2015), and with the different product forms, these are likely to be important also for cod. Storable products such as dried and dried salted cod tend to be freighted by boat, and can use scale (larger vessels) as a means to overcome higher trade costs associated with longer distances. Perishable products like fresh fillets are carried by truck, which brings about higher trade costs. Consequently, distance as a proxy of trade cost is important. Our approach will largely follow Besedeš and Prusa (2006ab), but we use firm-to-country data rather than the more aggregated country-to-country data commonly used in the literature. A Cox-model is used to investigate which factors affect the duration of trade, following the approach in the general literature.

In line with results of previous studies (Besedeš and Prusa, 2006a, 2006b; Nitsch, 2009), we find that a large share of trade relations are short-lived.[1] Negative duration dependence is present, *i.e.*, if a trade relationship survives over one period, the possibility for failure decreases significantly. The probability of failure in a trade relationship decreases with the size of the exporting firm, unit value and the shipment frequency of the exporter to the destination.

The paper is organized as follows. In Section 2, a brief overview of the relevant literature is offered. The data is described in Section 3. Section 4 presents the empirical approach and results, and is followed by a concluding Section 5.

2. Literature review

Analysis of the duration of trade relationships as well as factors influencing the survival and termination of such relationships commenced with Besedeš and Prusa (2006ab). Besedeš and Prusa (2006a) report that trade duration for most US imports even at the aggregated country-to-country level are relatively short, with numerous entries and exits that create substantial dynamics. Using trade data at the 7-digit level from 160 different trading partners for the 16 years 1972 to 1988, they estimate survival functions using the Kaplan-Meier estimator, and find an average survival rate of 67% for the first year. The median duration is between two

[1] Hence, trade duration can be regarded as an additional source of uncertainty to the two commonly listed categories: price uncertainty (Dahl and Oglend, 2014; Asche, Misund and Oglend, 2016) and production uncertainty (Asche and Tveteras, 1999; Tveteras, 1999; Tyholdt, 2014).

and four years when exporting a product to the US. Using the classification into the homogenous or differentiated groups of Rauch (1999), Besedeš and Prusa (2006b) use the same data to investigate whether there are differences in trade duration between homogenous commodities and more differentiated products. They estimate that the hazard rates for commodities are at least 23 % higher than for differentiated products, indicating that trade relationships are shortest for commodities. Besedeš and Prusa (2006b) specify a proportional Cox-model, using the model of Rauch and Watson (2003), to investigate important factors for trade dynamics. Their results indicate that trade relationships involving commodities start out with larger initial purchases, and last for a shorter time than trade relationships with differentiated products.

Nitsch (2009) uses a similar approach to investigate the duration of import relationships to Germany using import data at the 8-digit product level for the period 1995-2005. He finds that these relationships last for 1 to 3 years, and hence are relatively short-lived, as also observed for the US. Nitsch (2009) uses a Cox-model to investigate the effect on trade durations of a number of variables such as unit value, GDP, GDP per capita, market share, and common language. The duration of import relationships to Germany depends on export country as well as product characteristics, market structure, and size of the initial transaction.

There is a vast literature discussing the importance of the extensive and intensive margin of trade (Hummels and Klenow, 2005; Helpman, Melitz and Rubinstein, 2008). By decomposing growth in exports into three parts; establishment of new relationships, higher intensity in existing relationships, and the survival of existing relationships, Besedeš and Prusa (2011) show that these margins are also important for trade duration. Using export data for 46 countries at the 4-digit level for 1975-2003, they again report that most trade relationships have short durations with a median of 1-2 years. Moreover, when comparing export survival in East Asia, Central America, Mexico, Africa, South America, and the Caribbean, they find similar median durations in all regions. Their results emphasize the importance of survival of trade relationships. "*Survival of export relationships is a necessary requirement for trade deepening and export growth, as poor survival prevents deepening from taking place"* (Besedeš and Prusa, 2011, p. 372).

Esteve-Pèrez *et al.* (2012) use firm-to-country level data to investigate the duration of trade relationships. Their study looks at Spanish firm-level data for the period 1997-2006, and shows that the median duration of a trade relationship is about two years, with an exit rate of 47% after the first year. Brenton *et al.* (2009) investigate the stability of export relationships from developing countries over the period 1985-2006. They find that exports from low-income countries are associated with substantially lower survival rates than those for high-income countries. In addition, Besedeš (2008), Jaud *et al*. (2009), Cadot *et al*. (2013) and Besedeš and Prusa (2011) investigate patterns in duration in the exports of developing countries. Straume (2017) focuses on a single product, fresh salmon, using firm-to-country level data from Norway for the period 1999-2011. This allows for the inclusion of more firm-specific variables in the analysis. He finds a mean survival time of 5 years for trade relationships for export of fresh salmon at the firm-country level. Standard gravity-variables are found to have a significant impact on the duration of trade and, furthermore, the probability of failure increases in markets with strong competition.

Export experience may also matter for survival of trade relationships. Carrère and Strauss-Kahn (2017) show that, for developing countries that want to form new trade relations with OECD countries, export experience is important for survival in the first two years. Albornoz *et al.* (2016) also find that firms' survival increases with relevant exporting experience.

3. Industry and data

We use custom data that are collected and provided by Statistics Norway. We have information on each export transaction from Norwegian firms to different destination markets for the period 2004-2014. The dataset includes the id of the exporting firm, the destination country, volume, weight, value, and transportation mode for each shipment. We focus on six different products of cod: dried salted, whole fresh, whole frozen, fresh fillets, dried, and wet salted. They are all among the twenty largest seafood products exported from Norway, the world´s second largest exporter of seafood after China (FAO, 2016). Figure 1 presents total export values by product form, while tables 1 and 2 report some descriptive statistics.

Figure 1 shows that, by export value and over the time period of our analysis, dried salted cod is by far the most important product form with an export share of about one third. However, the two most unprocessed products, fresh and frozen whole cod have lately increased their export shares at the expense of most other products, and are currently close in value to dried. Taking into consideration that the whole fish product forms fetch the lowest prices, their quantity shares are even higher. Dried cod, the other traditional product, has a relatively stable export share over time (about 10 %), but also with a declining tendency in the last years of our sample period. While salted cod, mainly an intermediary product in the production of dried salted cod, has been second to its end product in export share over time, it has recently lost position to whole cod. The export share of fresh fillets has varied around 6 %.

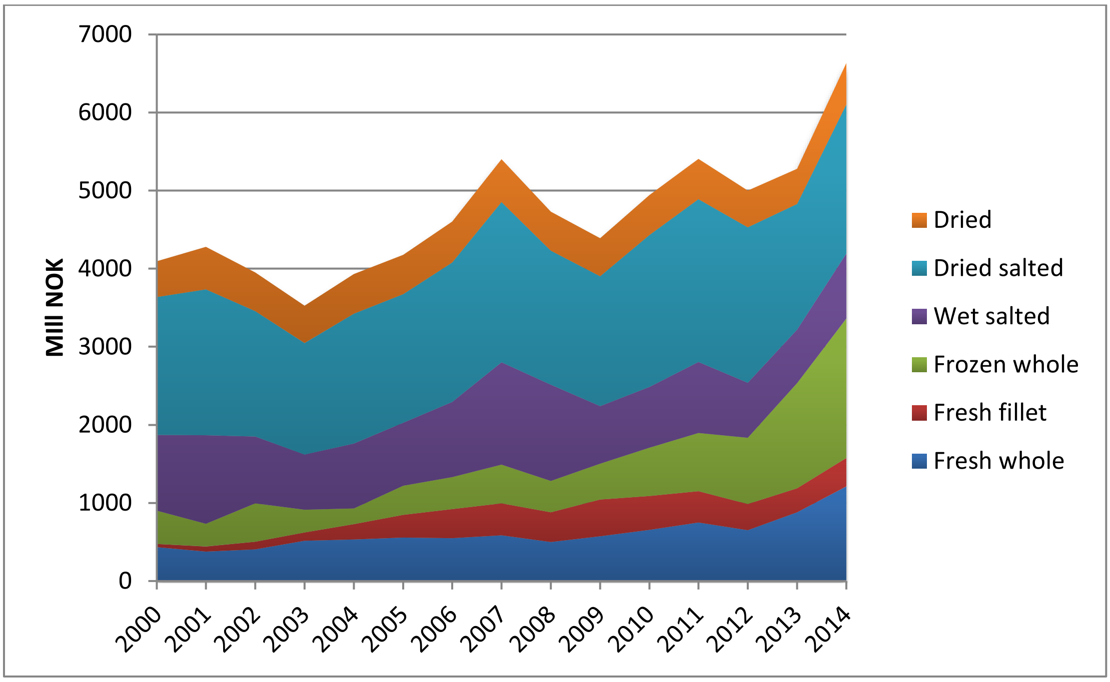
It is well recognized that in seafood markets the demand for fresh unprocessed product forms is expanding (Roheim, Gardiner and Asche, 2007; Asche, Chen and Smith, 2015; Gobillon, Wolff and Guillotreau, 2016), and it is not accidental that farmed fish tends to be exported as fresh (Asche, 2008). Our data suggest that whole fresh cod fits into this niche. This is a highly perishable product that primarily goes to wealthy countries in close geographical proximity to Norway (Table 2). Truck is the main mode of transportation under this setup, also indicating that the average shipment size is low (Table 3).

However, it is recognized that modern conservation technologies decrease the importance of proximity to the stocks in seafood processing (Asche, Roheim and Smith, 2016). This contributes to explaining the surge in export of whole frozen cod, mainly driven by Chinese demand (see Table 2). China exploits its comparative advantage in cheap labor to process this low price commodity into higher paid cod products such as fillets (Zhang, Tveterås and Lien, 2014).[2] A similar scenario applies for Poland, the third largest export market for whole frozen cod.

Wet salted cod is mainly an intermediary in the production of dried salted cod, with Portugal as the leading importer (see Table 2). However, Table 2 shows that Portugal is also the second largest importer of whole frozen cod, which combined with the declining export share of wet salted cod may support the finding of Asche, Menezes and Dias (2007) that Portuguese processors have partially shifted from wet salted to frozen cod as their input. Furthermore, the large export share to Denmark of whole fresh cod and fresh fillets may indicate that a substantial part of fresh exports are reprocessed or enter into the supply chains of Danish food exporters.[3]

[2] Note that average shipment size for whole frozen cod is very large (see Table 1), *i.e.*, economics of scale in shipping by boat is exploited in particular to China.
[3] Denmark has a long tradition of processing Norwegian fish (Asche, 2008) and is in general a large food exporter.

Figure 1. Norwegian export value for cod by product form



Source: Statistics Norway

Table 1: Descriptive statistics, by product form

Product:	# obs	# exporters	# destinations	Average unit value (NOK)	Average shipment value (NOK)	Average shipment size (kg)
Dried salted	25,072	175	64	51.5	799,774	16,269
Whole fresh	131,311	306	57	30.3	45,304	1,961
Whole frozen	8,519	216	51	20.4	899,756	48,734
Fresh fillets	46,788	154	39	69.9	79,660	1,148
Dried	8,072	135	66	125	620,944	4,911
Wet salted	14,820	173	40	35.1	626,106	17,995

Source: Statistics Norway.

Table 1 shows that whole fresh cod is the product exported by the majority of firms, followed by whole frozen and dried salted cod. Dried cod is the product with the lowest number of exporting firms, but with the largest number of destination markets. The fresh fillet of cod, on the other hand, is the product that ranks lowest in diversity of destination markets.

From Table 1 we also see that there is large variation between the products in average unit value. This variation can mainly be explained by different processing levels and raw fish intensity. Dried cod is by far the most valuable cod product measured by unit value, a feature that is largely due to the drying process removing most moisture. Asche, Menezes and Dias (2007) show that prices for the different product forms are much more closely aligned if one controls for the moisture differences (*i.e.*, raw fish intensity).

Table 2: Largest destination markets by product. 2004-2014.

Product:	Largest destinations markets (by value)	Share of total export value	Average unit value (NOK)
Dried salted	Portugal	57 %	47.5
	Brazil	24 %	53.7
	Italy	4.5 %	49.5
Whole fresh	Denmark	58 %	23.0
	France	10 %	25.0
	UK	5.7 %	20.0
Whole frozen	China	42 %	17.7
	Portugal	11 %	21.0
	Poland	9.7 %	17.8
Fresh fillets	Denmark	46.3 %	66.1
	France	31.7 %	46.3
	UK	10.3 %	72.1
Dried	Italy	81 %	137.0
	Nigeria	8 %	79.0
	Croatia	4 %	119.0
Wet salted	Portugal	62.5 %	34.8
	Spain	20 %	34.4
	Greece	8 %	34.0

Source: Statistics Norway

An important feature is that all product forms have a dominant main market. Furthermore, the three largest markets receive more than 60% of the exports for all product forms. Table 2 reports the three largest destination markets, ranked by value, for the different products in our dataset. While there are only a few main markets for each product, there is a large geographical spread. Denmark, UK and France are, with their close geographical proximity to Norway, the main markets for fresh products. As previously noted, China is the most important market for whole frozen cod, followed by Portugal and Poland. For dried salted and wet salted cod, Portugal is the leading importer, followed by Brazil for dried salted and Spain for wet salted. Italy is by far the largest marked for dried cod, the most traditional cod product (Hannesson, Salvanes and Squires, 2010), while Nigeria is the second most important market. The price difference between the two largest markets for dried cod is notable, suggesting very different qualities. This is to some extent indicated also for other product forms, as there are substantial price differences by market for several of the product forms.

In addition to the export data, standard gravity variables (GDP, GDP/capita, distance) are included as variables in our empirical model that follows in the next section[4]. Distance is taken from the CEPRII-database, and the GDP-data from the World Bank Development Indicators. Table 3 reports descriptive statistics for the independent variables[5].

Table 3: Descriptive statistics

	Mean	Min	Max
Distance	1,596	417	17991
GDP (billions USD)	646	.37	14796
GDP per capita (thousands)	26	.2	87
Destination vol. (tons)	450	.01	48424
Exporter size (tons)	100	.01	19072
Unit value (NOK/kg)	39.60	1	198
# shipments	4.2	1	1675

Source: Statistics Norway

4. Determinants of export survival

Our method to investigate the duration of trade relationships will largely follow Besedeš and Prusa (2006a,b). If N is a measure of the number of consecutive years a trade relationship between a firm and a destination market is active, the survival function follows as:

(1) $$S(t) = \Pr(N \geq t)$$

The hazard function gives the probability that the trade relationship fails after t periods, given that it has survived up to time t:

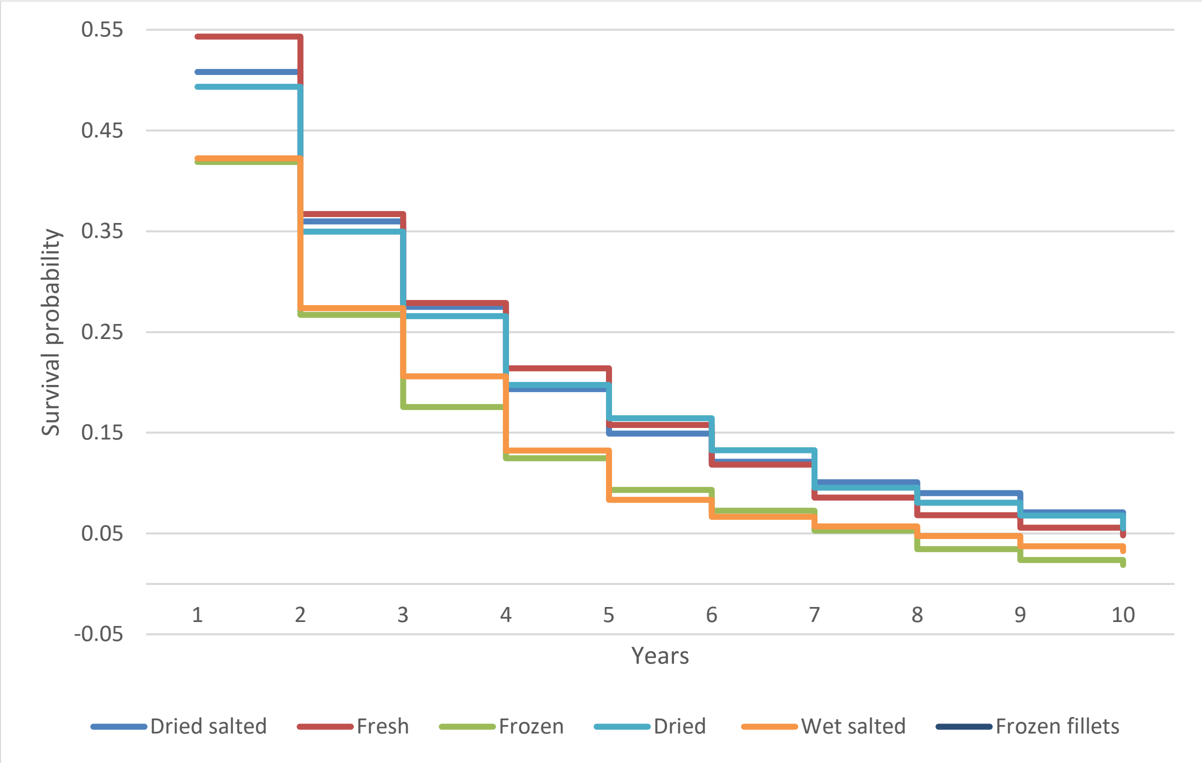
(2) $$\delta(t) = \Pr(N = t | N \geq t)$$

[4] For an introduction to the gravity model and aggregate trade flows see e.g. Tinbergen (1962), Krugman (1980), McCallum (1995), and Anderson and van Wincoop (2003). Natale (2015) provides an application of the gravity model to seafood markets.

[5] The firm specific independent variables are further described in section 4.

Figure 2 below reports the survival functions for the different cod products estimated using the Kaplan-Meyer estimator.

Figure 2. Estimated survival functions



Note: the survival functions are calculated using transaction level data provided by Statistics Norway.

The downward slope of the survival functions indicates that the longer a relationship has existed, the lower the probability of failure becomes (this is known as negative duration dependence). We see that for the first few years the drop in survival probability from one year to the next is much larger than what is observed for the last few years. The estimated survival functions indicate that a remarkably large share of trade relations ceases to exist after the first years. Table 4 below reports the survival rates for 1, 3 and 5 years for the different products.

Table 4: Survival rates by product form

Product:	1-year survival	3-year survival	5-year survival
Dried salted	0.50	0.27	0.15
Whole fresh	0.54	0.28	0.15
Whole frozen	0.42	0.18	0.10
Fresh fillets	0.42	0.14	0.05
Dried	0.49	0.27	0.17
Wet salted	0.42	0.21	0.08

From Table 4 it is evident that the survival rates differ between product forms. The longest five-year survivals are found for the traditional products, dried cod and dried salted cod, and for whole fresh cod. These are all higher end products more or less ready for consumption. Typically, the intermediary product forms, whole frozen and wet salted cod, have lower survival rates, while the shortest five-year survival is found for exports of fresh fillets. Straume (2017) finds a mean survival rate of 5 year for trade relatinships involving export of fresh salmon. From table 4 it is evident that the mean survival time for trade relationships of products of cod is shorter than what is the case for fresh salmon.

To investigate potential factors determining the survival of export relationships we estimate hazard rates using a standard Cox (1972) model:

(3) $$h(t, x, \beta) = h_0(t)e^{x\beta} ,$$

where h_0 represents the baseline hazard function, *t* denotes survival time, *x* is a set of independent variables and β is a vector containing the coefficients.

Our set of independent variables are both market- and firm-specific. First, we include a set of market-specific gravity variables; geographical distance to the destination market, GDP, GDP per capita and total import volume from Norway to the specific destination market. This follows the standard approach in the literature, with geographical distance included as a proxy for transportation costs, GDP as a measure of the size of the destination economy, and GDP per capita as a measure of income level in the destination market. Second, we include firm-specific variables such as the size of the exporter (measured by total export volume), the average unit price obtained by the exporter, and the yearly number of shipments by the exporter to the destination market. [6] Finally, a set of dummies are included. The EU-dummy adjusts for destination markets that are within the EU. We use a multiple spells dummy to adjust for trade relationships that first die, but re-emerge after some time. The truck dummy measures the effect on the survival probability of using truck relative to other transportation modes. The base category for the product dummies is dried salted cod. We include fixed year effects to control for time trends.

Table 5 reports the results from the Cox-regressions for the full sample as well as for the full sample adjusted for left-censored observations[7]. All reported coefficients are hazard rates. These are larger than one when a higher value of the associated variable will increase the probability of failure of the trade relationship, and are less than one when the variable increase the probability of a longer duration of the trade relationship. Hence, the stars in the table indicate whether the parameter is significantly different from one.

[6] The 5 largest firms export 25 % of the total volume, and the 10 largest account for 40 % of the total volume.

[7] In this setting left-censored observations refers to all trade relationships that are active in 2004. We have no information on how many years prior to the start of the dataset these relationships has existed.

Table 5: Estimated hazard rates, full sample

	Full sample	Adjusted for left-censoring
ln Distance	1.0239	1.0311
	(0.021)	(0.023)
ln GDP	0.9710***	0.9610***
	(0.009)	(0.010)
ln GDP per capita	0.9906	0.9962
	(0.018)	(0.019)
ln Destination vol.	0.9842***	0.9852***
	(0.004)	(0.004)
Exporter size	0.9603***	0.9642***
	(0.004)	(0.005)
Unit value	0.9292***	0.9348***
	(0.022)	(0.023)
# shipments	0.5546***	0.5446***
	(0.014)	(0.017)
Dummy, EU	1.1158***	1.1146**
	(0.044)	(0.048)
Dummy, multiple spells	1.2780***	1.1767**
	(0.066)	(0.081)
Dummy, truck	0.9051***	0.8596***
	(0.031)	(0.035)
Dummy, fresh	1.2617***	1.2124***
	(0.051)	(0.057)
Dummy. frozen	1.1877***	1.1697***
	(0.054)	(0.059)
Dummy, fresh fillets	1.3810***	1.2571***
	(0.062)	(0.066)
Dummy, dried	0.9453	0.9513
	(0.051)	(0.055)
Dummy, wet salted	1.1906***	1.1774***
	(0.056)	(0.064)
Observations	9,363	6,114
Year dummies	Yes	Yes

White-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results reported in Table 5 indicate that the probability of failure of a trade relationship is significantly lower in larger destination economies and large markets as measured by total export volume. However, somewhat surprisingly, distance does not seem to be very important. A possible reason may be the dominance of the largest market in each product category, making the product dummies to pick up this effect. All firm-market specific variables are statistically significant and tend to reduce hazard rates. Large firms obtaining high unit values (*i.e.*, high quality), with frequent shipments, have the highest probability for survival. Trade towards EU-countries increases the hazard rates. This is not a surprise, as the EU is a main market for cod with keen competition and less reason to build long-term relationships. Supply chains were truck is used as the transportation has a lower probability of failure in the relationship.

This is similar to what is reported by Straume (2017) for salmon, and most likely reflects the deeper relationships that is nessesary to maintain a steady supply of seafood products which is highly perishable, and that cannot be transported by boat or air. All products with the exception of dried cod, have a lower probability of a lasting trade relationship relative to dried salted cod. It hence becomes interesting to further investigate product-specific hazard rates.

In Table 6 we report the results from the same model estimated at product level, for each product. For three of the product forms there is now a distance effect. For whole fresh and frozen cod distance reduces the likelihood of a lasting relationship, as expected given their role as intermediary products. The opposite applies for dried salted cod, which is somewhat surprising. A possible explanation is that lasting relationships are important in Brazil, the second largest market. For the "high-end" product forms, dried salted cod, dried cod and fresh fillets, income level at destination reduces the probability of failure in trade relationships. An explanation for this feature may be that this is a high end product, as is the case in Portugal (Asche, Menezes and Dias, 2007). A higher income level reduces the trade duration for whole frozen cod, not surprisingly, given that the main importers of whole frozen use it for reprocessing. The total import volume in the destination markets are not important for the probability of survival with the exception of wet salted cod, which most likely reflects the decline in imports to Portugal.

The results indicate that firm size is an important success factor for firms seeking to establish long-lasting trade relationships. Firm size has a significant positive effect on survival rates for all product categories except wet salted cod. Increased unit value results in a lower probability of failure for whole cod, suggesting that quality may be important (e.g., unit price tends to increase with the size of the fish). The number of shipments is a significant element in the firms' intensive margin of trade. As the number of shipments increases, the firm's trading activity increases along the intensive margin and the probability of failure decreases for all products in our analysis. This effect is substantially stronger than the effect from firm size and unit value. This supports Hornok and Koren (2015) in that trade flows for food are different, and since fresh fish normally has more frequent shipments it may suggest that the perishability of the fish is an issue. As expected, the presence of multiple spells increases the probability of failure in trade of dried salted and whole fresh cod. For whole fresh cod and wet salted cod, the probability of failure decreases when truck is used as transportation mode.

Table 6: Estimated hazard rates by product form

	Dried salted	Whole fresh	Whole frozen	Fresh fillets	Dried	Wet salted
ln Distance	0.865***	1.112**	1.064**	1.090	0.958	0.977
	(0.040)	(0.054)	(0.033)	(0.070)	(0.052)	(0.039)
ln GDP	0.973	0.969	0.948***	1.023	1.057	0.968
	(0.020)	(0.022)	(0.016)	(0.033)	(0.036)	(0.022)
ln GDP per capita	0.869***	0.982	1.076**	0.887**	0.924*	0.930
	(0.036)	(0.044)	(0.039)	(0.042)	(0.041)	(0.041)
ln Destination volume	1.017	0.994	0.996	1.019	0.977	0.982*
	(0.014)	(0.011)	(0.009)	(0.015)	(0.015)	(0.010)
Exporter size	0.962***	0.943***	0.961***	0.971***	0.935***	0.985
	(0.010)	(0.009)	(0.008)	(0.010)	(0.014)	(0.010)
Unit value	0.941	0.812***	0.909***	1.076	0.856	0.978
	(0.053)	(0.049)	(0.033)	(0.069)	(0.083)	(0.062)
# shipments	0.372***	0.596***	0.437***	0.708***	0.345***	0.499***
	(0.033)	(0.020)	(0.035)	(0.031)	(0.048)	(0.038)
Dummy, largest market	1.100	0.939	0.912	0.950	1.254	1.110
	(0.137)	(0.075)	(0.127)	(0.104)	(0.186)	(0.130)
Dummy, multiple spells	1.256*	1.230**	1.173	1.156	1.283	1.087
	(0.156)	(0.118)	(0.162)	(0.163)	(0.196)	(0.166)
Dummy, transport mode	0.987	0.888**	0.897	1.069	0.883	0.835*
	(0.113)	(0.050)	(0.104)	(0.078)	(0.144)	(0.078)
Observations	1,873	2,758	1,449	1,045	1,086	1,152
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

White-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When we compare the results in table 6 to the results in Straume (2017) we find several interesting differences between trade duration for Cod and Salmon. In the case of fresh salmon increased distance to the destination market has a negative impact on the probability for survival, for cod this result only holds for two of the six products; whole fresh and whole frozen. For these two cod products we also see in table 6 that increased unit value significantly lower the proabability for failure, Straume (2017) finds no significant effect on unit value for the survival probability. Another interesting difference between salmon and cod is that while Straume (2017) finds no significant impact from GDP on the survival probability, several of the cod products exhibits evidence for longer duration in the trade relationships hen the destination country is a big economy or a rich country.

The survival rates reported here is also shorter than what is found more generally. For instance, Besedes and Prusa (2006a) reports average survival rates at the HS10-level are 0.66 for 1-year survival, and 0.48 for 4-year survival for the duration of imports to the US from a large number of origins. Besedes and Prusa (2006b) reports survival rates for a large number of products, and again the survival rates for the products investigated in this paper is generally lower. It is worthwhile to note that Besedes and Prusa (2006b) emphasize that agricultural products are anticipated to have higher hazard rate than differentiated products. They estimate a 4 % higher hazard rate for agricultural products than for differentiated products.

5. Conclusion

Besedeš and Prusa (2006b) suggest that trade dynamics for commodities are different from other types of products, and Hornok and Koren (2015) indicate that food is different. This paper indicates that this holds true for Norwegian exports of cod. Moreover, while the general conclusions from the studies using large data sets essentially hold, there are nuances for every product and product form of cod, as the trade dynamics are different for each, as are the factors that influence the dynamics.

For all six product forms of cod investigated in this paper, at least 45% of the trade relationships fails after the first year. Moreover, just a tiny fraction, less than 10% of the relationships have a duration of ten years. Hence, there is strong indication that there is very little, if any, investment in long lasting relations. While this may not be too surprising for traditional products like dried and dried salted cod, it is more so for a highly perishable product such as fresh cod fillets, where reliable logistics is important for shelf life. All the supply chains for cod seem to carry the characteristics of traditional food supply chains in that it is only the physical product that matters, and there are no quality attributes that are enhanced by building relationships. This does of course go a long way to explain why wild fish like cod do not have any of the product development and demand growth observed in aquaculture species (Asche et al, 2011; Brækkan and Tyholdt, 2014; Bronnmann, Ankamah and Nielsen, 2016), higher price volatility (Dahl and Oglend, 2014;) and vertical coordination (Kvaløy and Tveteras, 2008; Olsson and Criddel, 2008; Larsen and Asche, 2011).

The development towards higher exports of unprocessed cod is a challenge for regional policies in Norway, and similarly for other traditional fishing nations that emphasize local processing to support coastal communities (Standal and Hersoug, 2015; Standal, Sønvigsen and Asche, 2016). In particular, the export share of whole cod, frozen as well as fresh, is rapidly increasing compared to local labor intensive usage of the raw fish. High labor costs in Norway combined with increased demand for fresh products are one main explanation of this development which also increases competition at the Ex.Vessel stage, a feature known to increase the raw fish price to fishermen (Kristofersson and Rickertsen, 2007; Guillotreau and Jiménez-Toribío, 2011).

Appendix:

Table A1: Estimated hazard rates. Left-censored observations excluded.

	Dried salted	Fresh	Frozen	Fresh fillets	Dried	Wet salted
ln Distance	0.901*	1.112**	1.066*	1.081	0.944	0.957
	(0.050)	(0.058)	(0.036)	(0.082)	(0.048)	(0.035)
ln GDP	1.002	0.960	0.938***	1.019	1.021	0.954**
	(0.023)	(0.024)	(0.016)	(0.038)	(0.036)	(0.022)
ln GDP per capita	0.886***	1.009	1.108***	0.899*	0.919*	0.928*
	(0.042)	(0.050)	(0.043)	(0.050)	(0.041)	(0.040)
ln Destination vol.	1.003	0.991	0.995	1.018	0.985	0.982*
	(0.015)	(0.012)	(0.010)	(0.015)	(0.016)	(0.011)
Exporter size	0.971**	0.947***	0.959***	0.964***	0.933***	0.995
	(0.011)	(0.009)	(0.009)	(0.012)	(0.015)	(0.010)
Unit value	0.954	0.794***	0.912**	1.033	0.922	1.008
	(0.059)	(0.056)	(0.035)	(0.069)	(0.097)	(0.064)
# shipments	0.401***	0.608***	0.427***	0.640***	0.340***	0.544***
	(0.051)	(0.027)	(0.039)	(0.037)	(0.059)	(0.044)
Dummy, largest market	1.229	0.917	0.902	0.885	1.120	1.158
	(0.164)	(0.088)	(0.142)	(0.115)	(0.193)	(0.142)
Dummy, multiple spells	1.403*	1.140	1.113	0.970	1.094	0.931
	(0.245)	(0.143)	(0.171)	(0.161)	(0.209)	(0.160)
Dummy, transport mode	0.890	0.823***	0.866	0.966	0.948	0.875
	(0.119)	(0.054)	(0.117)	(0.082)	(0.185)	(0.088)
Observations	1,122	1,598	1,185	735	742	732
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

White-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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