Delivering the Goods:

The determinants of Norwegian Seafood Exports

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Abstract: Seafood is the world's most traded food product. In recent years' aquaculture has become an increasingly important part of seafood production, facilitating increased trade. However, despite evidence that fish farmers have better ability to target markets and ship their seafood through more efficient supply chains due to the higher degree of control with the production process, little attention has been given to the fact that this is likely to also influence trade patterns. This paper investigates if trade margins for aquaculture products differ from trade in wild seafood products along three margins of trade in addition to total export value on export data for Norway, the world's second largest seafood exporting country. The results indicate that aquaculture products in fact are different. In particular, aquaculture products are influenced by more factors than fisheries products such as transportation costs and per-unit shipment costs, highlighting another dimension where the control of the production process can be used to improve competitiveness. Moreover, exports of aquaculture products increase with a country's wealth level, reflecting producers' ability to target higher paying markets.

Keywords: seafood, aquaculture, trade margins, customs data

JEL Classification: F10, F14, Q22, Q27

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1. Introduction

Seafood is the world's most traded food group as more than 36% of production is traded. Consequently, a large share of the seafood production is exposed to international trade (Anderson, 2003; Tveterås et al., 2012; Anderson et al., 2018).[1] In recent decades, global seafood trade has expanded rapidly (Asche et al., 2015), fueled by technological innovations and improved logistics through the supply chain (Anderson et al., 2010) and a substantial growth in aquaculture production (FAO, 2018; Anderson et al., 2018). Since the stagnation of traditional wild fishery production from the late 1980s, aquaculture has been responsible for most of the growth in the world supply of seafood, and it is anticipated that the aquaculture production will continue to grow rapidly (Kobayash et. al., 2015). It is likely that this supply shift has affected trade patterns and trade dynamics for seafood. In addition, the higher degree of control with the production process in aquaculture (Anderson, 2002) also increase efficiency in the supply chain (Asche, Cojocaru and Roth, 2018) and facilitates targeting more valuable product forms and markets (Asche and Smith, 2018).[2] This provides an indication that trade patterns for aquaculture products may differ from wild products, a hypothesis that will be investigated in this paper for seafood exports from Norway, the world´s second largest exporting country of seafood.

The global development in seafood production is largely reflected in Norway's seafood production. The traditional fishery industry has been surpassed (in production value) by a rapidly growing aquaculture industry. Currently, the aquaculture industry accounts for about 40% of the quantity produced and 70% of the production value in Norwegian seafood production (Fiskeridirektoratet, 2019). Aquaculture exports differs from exports of wild fish in several dimensions. For example, there is a higher ratio of value to quantity (i.e., unit price) compared to wild fish reflecting the control of the production process and better timing and targeting towards better paying supply chains (Asche, Roll and Tveteras, 2007; Kvaløy and

[1] Tveteras et al. (2012) estimates that 78% of all seafood is exposed to trade competition. This entails that the product is actually traded, the producer has access to the export market or face import competition. The trade competition is important since it exposes the producer to global competition and they become a part of the global market.

[2] That better control with the production process facilitates targeting more valuable markets and product forms can also be observed as a consequence of improved management in fisheries as exemplified by Pacific halibut (Homans and Wilen, 2005) and Icelandic cod (Knútsson et al, 2016)

Tveterås, 2008: Olsson and Criddle, 2008; Asche and Smith, 2018, Roheim et. al., 2018).[3] Also in other countries aquaculture and wild fisheries often target different value chains (Bjørndal and Guillen, 2018), and typically the small-scale fisheries receives the lowest price (Bjørndal et. al., 2015).

In recent years, empirical analysis of international trade has changed dramatically as data at the firm level has become available (Bernard and Moxnes, 2018). Better data has allowed the investigation of a much more nuanced picture of trade patterns than what was provided using the traditional gravity model with country level data (Tinbergen, 1962; Anderson and van Wincoop, 2003), as it is firms, not countries, that trade. Disaggregated data has also made it possible to investigate the margins of trade in more detail, as well as the factors that may explain the development in these margins (Bernard et al, 2007). The specific definitions of trade margins vary with the aggregation level of the data (Bernard et al, 2007; Mayer and Ottaviano, 2007; Hornok and Koren, 2015). For instance, with product level data export value can be broken down into a price and a quantity component, allowing the Allen-Alchian hypothesis to be investigated in this framework as well as quantity to be disaggregated into shipment size and frequency (Mayer and Ottaviano, 2007). With firm and product level data, there has also been an increased focus on trade costs (Lawless, 2010; Hornok and Koren, 2015). In the traditional gravity model, this is captured by the distance variable. With more disaggregated data, other factors internal to the receiving country as well as shipment specific factors such as handling costs can be accounted for. These are potentially as important as distance, but will not necessarily be correlated with distance.

In this paper, we investigate the main determinants of Norwegian seafood exports using firm level data, with a particular focus on the potential impact of the production technology. We investigate the three margins of trade suggested by Mayer and Ottaviano (2007) in addition to total export value. The three margins are quantity per shipment, number of shipments and unit price. Given that most aquaculture products are exported fresh, a highly perishable product form, while most wild fish is exported in more preserved product forms, the different margins may be quite different for the two production technologies. In particular, one would expect that it is harder exporters of aquaculture products to use economies of scale in transports to

[3] Peculiarities in the production process for aquaculture products (Asche, Oglend and Kleppe, 2017) as well as various market shocks (Smith et al., 2017) also influence these patterns.

mitigate longer distances, and that production technology therefore influence the impact of transport mode. Combined with the control of the production process, this should also make per shipment cost and shipment frequency more important for aquaculture products. Moreover, if aquaculture producers are better able to target higher paying markets, one would also expect wealth level to be more important for aquaculture.

Somewhat surprising, particularly in light of the large number of import demand studies, the literature on trade patterns for seafood is limited[4]. Natale et al. (2015) use a gravity model to investigate determinants for aggregate world seafood exports, compared with meat, in the period 1990-2010. Natale et al. (2015) underlines the importance of growth in aquaculture for expansion of seafood trade. Rabbani et al. (2011) investigated the determinants for import of catfish, basa and tra to the US using an augmented gravity model. There are also some papers investigating the impact of phyto-sanitary measures (Anders and Casewell, 2006; Tran et al., 2011; Chen, Hartarska and Wilson, 2018) and the impact of preferential treatment (Xie and Zhang (2017) using this approach. Straume (2017) and Asche et al. (2018) report significant variation in trade duration for Norwegian salmon exports, and Zhang and Tveteras (2019) and Wang et al. (2019) reports similar results for respectively the EU and ASEAN countries. Few of these papers use firm level data, and there is no focus on potential differences in trade patterns for farmed and wild fish despite the recognition that fish farmers can better target specific market segments due to their control with the production process (Asche and Smith, 2018), and that the control with the production process also allow for more efficient supply chains (Asche, Roll and Tveteras, 2007).

We proceed as follows. In section 2 we outline the empirical approach. Section 3 provides a discussion of the data and relevant descriptive statistics, while the results are presented in section 4. We conclude in section 5.

[4] Some recent examples of import demand studies for seafood are Muhammad and Jones (2011), Asche and Zhang (2013), Xie and Zhang (2014), Sha et al., (2015), Dey et al. (2017) and Brækkan et al. (2018).

2. Empirical approach

Fundamental drivers of trade can be investigated using a gravity type model adapted to the firm level (Mayer and Ottaviano, 2007), and is given in equation (1).[5] The dependent variable ($X_{j,t}$) is exported value to destination market *j* in period *t*. The standard gravity variables are geographical distance ($dist_j$) to the market and the size of the economy ($GDP_{j,t}$), i.e.;

(1) $$\ln X_{j,t} = \alpha_1 + \alpha_2 lndist_j + \alpha_3 lnGDP_{j,t} + u_{j,t} ,$$

The dependent variable can be decomposed into different margins of trade. The common starting point in the literature is to distinguish between an extensive margin (e.g., the number of exporting firms) and an intensive margin (e.g., the average export value per exporting firm). Access to firm-level transaction data, enables further disaggregation (Mayer and Ottaviano, 2007; Bernard et al., 2007; Lawless, 2010; Hornok and Koren, 2015). Following Mayer and Ottaviano (2007), we investigate exports from a given firm (*i*), of a given product (*k*), to destination (*j*), using a specified mode of transportation (*m*) in a given year (*t*). Furthermore, we decompose export value (*X*) into exported quantity per shipment (*Q*), unit price (*P*), and number of shipments (*N*):

(2) $$X_{i,k,j,m,t} = N_{i,k,j,m,t} \cdot P_{i,k,j,m,t} \cdot Q_{i,k,j,m,t},$$

While some studies only investigate specific margins, as e.g. Manova and Zhang (2012) and Görg et.al. (2017) who focus on the unit price, most studies investigate all margins. The multiplicative form of equation (2) implies that the effect of any explanatory variable on export value will be equal to the sum of the effect on the three margins. In log-linear models, this implies that the parameters for any explanatory variable for the three margins will sum to parameter in the export value equation. This means that if, for instance, distance has a stronger impact on e.g. price than for export value, it must have a smaller impact on one of the other margins (quantity per shipment or number of shipments).

[5] The traditional gravity model used to investigate multilateral trade (Tinbergen, 1962; Anderson and van Wincoop, 2003, 2004) motivates this model, but there are some important differences. Chaney (2008), Arkolakis et al. (2008) and Bernard et al. (2011) provide the theoretical foundation for using a gravity type of equation to investigate exports from or imports to, or a set of trade margins from/to a specific country.

On the right-hand-side of the equation, we follow the general literature and augment the standard gravity variables with several explanatory factors that has been introduced in recent years. The wealth of the destination market is captured with GDP per capita (Manova and Zhang, 2012), internal trade cost by country size (*size*) and urbanization (*urban)* (Lawless, 2010) and additional transportation costs by per shipment cost (*shippingcost)* (Hornok and Koren, 2015)). Finally, we include a variable for firm *i*'s value market share of Norwegian export of product *k* in market *j* using transportation mode *m* in period *t* (*exportshare*) in the equations for the various margins.[6] Manova and Zhang (2012) use a market share variable as a proxy for market power. However, market share can also signal quality. Feenstra and Romalis (2014) show that high quality producers will have a higher market share and charge the highest price. More generally, Bernard et al. (2007) note that large firms are more productive and make up a disproportionally large share of trade. However, Chaney (2014) shows that this is patchy, as firms tend to cluster their exports to similar regions as this reduce trade costs.

Several dummies are also included. The first dummy distinguishes between fresh and conserved products (*conserved*), the second captures the effect of transportation mode (*mode*). In addition, firm-product and time fixed effects are included in the model to account for unobserved heterogeneity, including that not all markets are served (Hornok and Koren, 2015; Görg et. al., 2017).

The empirical model to be estimated is then given as:

$$(3) \qquad lnX_{i,k,j,m,t} = \alpha_1 + \alpha_2 lndistance_j + \alpha_3 lnGDP_{j,t} + \alpha_4 ln(GDP/capita_{j,t}) + \alpha_5 lnshippingcost_{j,t} + \alpha_6 lnsize_{j,t} + \alpha_7 lnurban_{j,t} + \alpha_8 lnexportshare_{i,k,j,m,t} + \alpha_9 Dconserved + \alpha_{10} Dmode + \gamma_{i,k,t} + u_{i,j,k,m,t}$$

Separate regressions are estimated for the total export values and the three different margins outlined in equation (2).

[6] Manova and Zhang (2012) defines the market share variable as firm i's total export of a given product to a given destination divided by the total export from China in the given product to the given destination. This share is multiplied by the share of Chinese exports in total consumption of the given product in the destination market. Our market share variable follows the first part of the definition in Manova and Zhang (2012), though on a more disaggregated level.

3. Data and descriptive statistics

A large number of exporting firms exports seafood from Norway to 145 different markets. Figure 1 shows two important patterns that are present for both wild and farmed fish. Firstly, the export value has increased substantially in both sectors during the period 2004-2014, although the trend breaks for wild fish in 2011. Secondly, the number of exporting firms in both the aquaculture and the fishing sector has had a steady decline.[7] Hence, given that export value has increased fewer firms handle substantially more trade relations and/or export a significant larger value to each export market.

Insert figure 1 here

The empirical analysis is based on firm level data on exports of seafood from the exporters' custom declarations for the period 2004-2014, provided by Statistics Norway. For each transaction, the data set identifies the exporting firm and destination country, the weight in kilos, the export value in Norwegian kroner (NOK), the mode of transportation, and the shipment date. In total, the dataset contains 1,452,261 unique transactions from 710 Norwegian exporters, serving 145 different destination markets. Data for distance are taken from the CEPII-database[8], while data for other gravity variables are taken from the World Bank Development Indicators[9] (WDI).

The analysis is limited to the 22 most valuable seafood products for the period 2004-2014 to avoid very small product categories. These products cover over 90 % of the total export value of seafood from Norway.

Table 1 ranks the products according to total export value over the period. The table also reports the number of Norwegian exporters of a given product and the number of destination. The final column indicates the production technology for the product (aquaculture versus wild) and whether the product is exported as fresh or conserved. Approximately 1/3 of the

[7] While innovation is the key driving factor for the production increase in aquaculture (Bergesen and Tveteras, 2019; Rocha-Aponte and Tveterås, 2019), quota development is the most important factor influencing production in the wild fisheries (Cojocaru et al., 2019). That the export sector is being consolidated may not be to surprising given that both the aquaculture sector and the harvesting sector has consolidated significantly at the production level as well as the harvesting/landing level (Asche et al, 2013; Cojocaru et al, 2019).

[8] The CEPII-database is found at http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp.

[9] The WDI-database is found at http://data.worldbank.org/data-catalog/world-development-indicators.

products belongs to aquaculture, and these account for 2/3 of the production value, reflecting the few species and products from aquaculture.[10]

Insert table 1 here

Over the period the export value totals 417.5 billion NOK or on average NOK 37.95 billion per year. Fresh farmed salmon is by far the most important product with an average annual export value share of 40%. By value, the second largest product is fresh fillets of salmon, with a trade value of about 13 % of the trade value of fresh farmed salmon. By total export value the aquaculture products dominate the wild fish products, and also makes fresh product more important than conserved products in aggregate despite a limited contribution from wild fish to this category. Still, wild seafood is important for the coastal regions of Norway with respect to jobs and economic activity, and there are a number of policies designed to support them (Standal and Asche, 2018).[11]

There are large variations in the number of firms and destination markets for the various product categories. While close to three hundred different firms export fresh salmon in at least one of the years in the period, less than half this number export fresh trout. There are more firms exporting frozen fillets than fresh fillets of salmon, indicating that the logistics for the fresh fish may be somewhat specialized. For wild fish the product with the highest number of exporting firms are frozen cod. The lowest number of exporting firms is the seventy firms exporting frozen capelin. Fresh salmon is also the product that is exported to most destination markets, while fresh cod is exported to the fewest. The large number of export destinations for fresh salmon indicates the globalized nature of the supply chains of the salmon industry. Fresh cod, on the other hand is primarily exported to countries with a close geographical proximity to Norway, reflecting less developed supply chains (Asche, Roll and Tveteras, 2007).

[10] All aquaculture products are based on two species, salmon and salmon trout. These two species make up more than 99% of aquaculture production in Norway, and there are no reported commercial landings of these two species in 2017 (Fiskeridirektoratet, 2019). Of the species classified as wild, there was a limited production of farmed cod in the latter part of the data set (1685 tons where harvested in 2005, increasing to a peak of 20,612 tons in 2010, before rapidly declining to 1,213 tons in 2014 (Fiskeridirektoratet, 2019)). There is no way to distinguish farmed from wild cod in the trade statistics, but since the quantities are relatively minor even in 2010 the source of error is small.

[11] And Norway was the world´s 9th largest fisheries nation in 2015 (FAO, 2017).

From table 1 it is evident that there is a mix of fresh and conserved (frozen, dried, salted etc.) products in Norwegian seafood exports. In table 2 and 3 we report how total exports as well as the three margins vary for fresh and conserved products and for the two production technologies and by transportation mode.

Insert tables 2 and 3 here

When it comes to the overall export value, the composition differs significantly for the two production technologies. For aquaculture, fresh products heavily dominated the preserved products, while it is opposite for wild fish. The majority of the exports by value of fresh aquaculture products are transported by truck, while it is the second most important transportation form for wild fresh at almost the same value as by boat. Boat is the most used transport form for conserved products for both production technologies. This is as expected for the conserved products, as boat facilitates economies of scale in transports and are therefore generally the preferred transport mode for exports over longer distances (Behar and Venables, 2011). The importance of truck for fresh product indicate that these product deviate significantly from the general transportation patterns, which is not too surprising given the perishability of the products. Consequently, firms ship fresh products more frequently than conserved products with smaller shipment size, while the economies of scale in transports leads to fewer larger shipments for conserved products.

It is also of interest to note that for fresh aquaculture products, air is the second most important transport form, while this transportation form is unimportant for fresh wild products. This does not need to be so as exemplified by the importance of air transport for Icelandic cod (Knútsson et al, 2016), but is most likely a function of the organization of the Norwegian supply chains (Asche et al, 2007). The importance of boat transport for fresh wild fish largely reflects direct landings in Denmark and the UK by a fishing vessel rather than a supply chain for such product after they are landed in Norway.

4. Empirical results

Table 4 presents the empirical results from the estimation of equation (4) with firm, product and annual fixed effects and robust standard errors clustered on destination country. Separate equations are estimated for aquaculture and wild fish products and for the different margins explained in section 2 in addition to the total export value. Please note that the parameters for the three margins add up to the parameter for total export value.[12]

Insert table 4 here

The results indicate several interesting differences in the export patterns for farmed and wild fish. Starting with the export value equation, the estimated parameters generally have the expected sign. Most parameter estimates are significant for aquaculture, but there are several insignificant parameters for wild fish, including the two traditional gravity variables. In particular, while there is a negative effect from distance on aquaculture products, in line with the findings in Natale et al. (2015) as well as the general literature, there is no significant effect of distance on wild fish products. This result may be explained by the somewhat odd structure of the export patterns for many wild products due to specific preferences in individual markets. For instance, Brazil and Portugal are the two main markets for dried salted cod, and Nigeria and Egypt among the most important markets for frozen herring. It is interesting that the size of the economy in the destination market does not matter at all. Export value of aquaculture products increase with the wealth level in the destination country, which may not be too surprising given the farmers´ ability to target markets. However, there exists no such effect for wild fish, which are most likely explained by the diversity in the range of species, as well as the markets that are being served, including significant exports of low-value fish like herring to poor countries. The additional trade cost variables have the expected signs, but are more important for aquaculture products. Per-unit shipment costs are negatively associated with export value of aquaculture products in line with the findings in Hornok and Koren (2015), and thereby augment the trade costs associated with distance. Geographical size of the importing country does not matter, but the degree of urbanization is highly positive for both types of product as it reduces trade costs (Lawless, 2010). In line with Bernard et al. (2007) and Feenstra and Romalis (2014), large firms trade more to all markets. Fresh products are more valuable than conserved products in aquaculture, most likely an effect of quality. The effect is opposite for products of wild fish, which is likely due to the input factor use in processing. Transport by truck has a lower export value than transport by boat for wild fish

[12] A structural break test was conducted to investigate if the exports of farmed and wild product could be aggregated into total seafood exports. This hypothesis was rejected with a *p*-value<0.001.

products, indicating that economies of scale are more important for wild fish, which is not too surprising given the much higher share of conserved products, while this variable does not matter for aquaculture.[13] Export value by air is lower than transport by boat for both categories.

When it comes to the first trade margin, the number of shipments, also here there is a clear difference between aquaculture and wild fish products when it comes to distance, per-shipment costs, product form and transportation mode. Here the distance effect is significant for wild fish, while it is not for farmed fish. This is not surprising given the much higher share of fresh fish for aquaculture, where increased exports have to happen with more shipments, as slower bulk transport is not an option due to the perishability of the products. This is amplified by the high per-unit shipment costs, while conserved aquaculture products have fewer shipments as they have the opportunity to ship bulk. For wild fish, where a much larger share of the exports can be shipped bulk by boat, the distance effect is significant. Not surprisingly, firms with a high market share in the destination markets ships their products more frequently both when it comes to aquaculture and wild fish products. These findings fit well with the findings of Hornok and Koren (2015) who argues that the number of shipments of US exporters decreases with per-unit shipment costs. Our results indicate that transport by air of aquaculture products are positively related to increased number of shipments, while the opposite is true for wild fish. Again, the likely explanation is that firms exporting valuable fresh aquaculture products ships more frequently to ensure the quality of the products. Conserved fish products can be shipped in bulks by boat without loss of quality.

The second margin is unit value. This is increasing in distance in accordance with the Alchien-Allen (1964) effect in that higher transportation costs make quality relatively cheaper, as also found in most general studies (e.g. Görg et al. 2017; Manova and Zhang, 2012). This effect is amplified with other trade costs such as per-unit shipment costs. There is no statistically significant effect of market size or wealth level. This is not surprising since markets reported to be well integrated in a number of market integration studies (Tveteras et al. 2012; Anderson et al. 2018; Landazuri-Tveteras et al. 2018). High markets share for a company in a market leads to higher unit values as predicted by Feenstra and Romalis (2014).

[13] Behar and Venables (2010) note that economies of scale is the most important way of overcoming the high transportation costs associated with long distances.

Again the results indicate that transportation mode matters. For wild fish products shipping with both truck and air are associated with higher unit values. For aquaculture products air transport has higher unit values than transport by boat.

The final margin to be investigated based on equation (2) is export quantity per shipment. The results are largely the same as for export value. As transportation costs increases, volume of aquaculture products decreases. The largest volumes of the aquaculture products are not destined for the largest economies, but large volumes of aquaculture products are shipped to wealthy countries. Large volumes are positively associated with additional trade costs such as urban population. Firms with a large market share export the highest quantities of both aquaculture- and wild fish products. We find a diverse effect from the dummy for fresh vs conserved products for aquaculture and wild fish. The largest quantities of aquaculture products are related to fresh product forms, while conserved product forms dominate the exported quantities for wild fish products. The transport mode that are associated with the largest quantities are boat for both aquaculture- and for wild fish products.

5. Concluding remarks

Trade with seafood has expanded rapidly in recent decades, at least partly fueled by the growth in aquaculture production.[14] It is well known that the control with the production process in aquaculture has been instrumental in facilitating the innovations that has led to productivity growth and increased competitiveness (Anderson, 2002; Asche, 2008; Kumar and Engle, 2016). This control with the production process also facilitates productivity growth in the supply chain beyond production, and targeting of the most valuable markets (Kvaløy and Tveteras, 2008; Asche and Smith, 2018; Brækkan et al. 2018). As a consequence, one will expect that the trade patterns for aquaculture products differ from wild fish. This hypothesis is investigated at the export firm level for total export value of a product to an export market, as well as for the three margins number of shipments, unit price and shipment size.

[14] Belton et al. (2018) show that far from all aquaculture production in developing countries is export oriented, as significant quantities are produced targeting the domestic market in all the largest aquaculture producing countries. In particular, this is true for the largest species by quantity produced, carp.

Trade patterns were investigated for Norway, the world´s second largest seafood exporter. In many ways, the trends in Norway´s seafood production mirror global patterns. In 1970, fisheries dominated the seafood sector. Since then, aquaculture production has increased rapidly, while fisheries landings stabilized in the early 1990s. The briefest inspection also suggests important differences in the export patterns. Aquaculture focuses on fewer species than wild fisheries, the unit value is much higher and a larger proportion is exported as fresh. The observation of Roheim et al. (2007), that more processing/conservation destroys value rather than creating is vindicated in that most of the aquaculture exports are less processed or conserved than wild fish.[15]

The results indicate that aquaculture products do have different trade patterns from wild fish, and also that these patterns are to a larger extent influenced by the same factors as is present for more aggregated data on manufacturing exports. Among the most important differences is that export value is (more) responsive to distance and other shipping cost than wild fish. It is also interesting to note that the wealth level in the import country is important for aquaculture products, but not for wild fish, supporting the notion that aquaculture producers exercises their control with the production process to provide products for better paying markets. On the other hand, most transports of wild fish is conducted by boat, and the number of shipments responds to distance indicating that for these mostly storable products economies of scale is used to limit the effect of distance. The negative effect from distance for the number of shipments is offset by larger unit values, so the total effect from distance on export value of wild fish is not significant. The Alchien-Allen effect, that is that quality becomes relatively cheaper with increased trade cost, is present for both types of product. Somewhat surprisingly, the size of an economy does not impact trade patterns significantly. While this is a significant deviation from the general trade literature, it is likely a reflection of the fact that cultural and other idiosyncratic factors are highly important in the demand patterns for seafood. This is underlined by fact such as Poland being the largest market for fresh salmon and Portugal for cod in 2015. Indirectly, the results also support the high degree of market integration found in most seafood markets, as neither economy size nor wealth level influence unit price.

[15] As an anecdote, it of interest to note that the leading fisheries economist Rögnvaldur Hannesson likes to say that so-called value adding of seafood in reality is controlled spoilage.

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Table 1. Descriptive statistics by product, 2004-2014

	Product	Annual average export value (bill. NOK)	Share of total export value, 2004-2014	# exporters	# destinations	Type of product
1	Salmon, fresh	18.60	49 %	284	102	Aquaculture, fresh
2	Salmon, fresh fillets	2.49	6.6 %	221	84	Aquaculture, fresh
3	Mackerel, frozen (<600g)	2.22	5.8 %	108	80	Wild fish, conserved
4	Dried salted cod	1.82	4.8 %	175	64	Wild fish, conserved
5	Spring spawning herring, frozen	1.81	4.8 %	113	76	Wild fish, conserved
6	Salmon, frozen fillets	1.76	4.6 %	238	87	Aquaculture, conserved
7	Herring frozen fillets	1.15	3.0 %	85	51	Wild fish, conserved
8	Salmon, frozen	1.09	2.9 %	234	95	Aquaculture, conserved
9	Dried salted saithe	0.97	2.6 %	102	67	Wild fish, conserved
10	Trout, fresh	0.91	2.4 %	130	58	Aquaculture, fresh
11	Cod, wet salted	0.84	2.2 %	173	40	Wild fish, conserved
12	Cod, frozen	0.70	1.8 %	216	51	Wild fish, conserved
13	Haddock, frozen	0.62	1.6 %	142	40	Wild fish, conserved
14	Cod, frozen fillets	0.48	1.3 %	164	58	Wild fish, conserved
15	Dried cod (stockfish)	0.46	1.2 %	135	66	Wild fish, conserved
16	Trout, frozen	0.43	1.1 %	116	48	Aquaculture, conserved
17	Cod, fresh fillets	0.34	0.9 %	154	39	Wild fish, fresh
18	Saithe, frozen	0.33	0.9 %	178	59	Wild fish, conserved
19	Greenland halibut, frozen	0.28	0.7 %	188	52	Wild fish, conserved
20	Capelin, frozen	0.26	0.7 %	70	48	Wild fish, conserved
21	Mackerel, frozen (>600g)	0.23	0.6 %	78	47	Wild fish, conserved
22	Trout, frozen	0.17	0.4 %	122	53	Aquaculture, conserved

Table 2. Descriptive statistics, aquaculture by transport mode. Fresh and conserved product forms. 2014 [a]. Firm means

	Aquaculture fresh			
	Overall	Boat	Truck	Air
Export value	385	3.04	386.3	105
# shipments	1317	4	1060	868
Unit value	42.72	50	41.98	48.67
Export volume per shipment	6.84	15.04	8.68	2.48

	Aquaculture conserved			
	Overall	Boat	Truck	Air
Export value, firm	59.40	51.5	27.47	0.42
# shipments	73	50	45	3
Unit value	60.63	59.52	62.61	56.61
Export volume per shipment	13.42	17.32	9.75	2.45

[a] Export value in million NOK. Weight in tons. Unit value in NOK/kg.

Table 3. Descriptive statistics wild fish by transport mode. Fresh and conserved product forms. 2014 [a]. Firm means

	Wild fish fresh			
	Overall	Boat	Truck	Air
Export value	9.67	7.90	7.40	0.14
# shipments	66	12	82	4
Unit value	41.41	32.74	52.80	78.65
Export volume per shipment	3.54	20.15	1.71	0.47

	Wild fish conserved			
	Overall	Boat	Truck	Air
Export value	71.01	91.90	17.18	0.076
# shipments	88	96	35	4
Unit value	15	13.33	31.47	82.71
Export volume per shipment	53.80	71.82	15.60	0.23

[a] Export value in millions. Weight in tons. Unit value in NOK/kg.

Table 4. Parameter estimates

	Aquaculture	Wild	Aquaculture	Wild	Aquaculture	Wild	Aquaculture	Wild
	Export value		# Shipments		Unit value		Export volume per shipment	
Distance	-0.208*	-0.037	-0.141	-0.159**	0.038***	0.042***	-0.104**	0.080
	(0.124)	(0.146)	(0.102)	(0.080)	(0.009)	(0.011)	(0.051)	(0.082)
GDP	-0.362	-0.240	-0.075	-0.114	0.026*	0.044**	-0.312**	-0.169
	(0.281)	(0.307)	(0.192)	(0.172)	(0.015)	(0.021)	(0.130)	(0.170)
GDP/cap	0.825**	0.035	0.407	0.041	-0.001	0.048	0.419**	-0.053
	(0.376)	(0.418)	(0.249)	(0.219)	(0.017)	(0.030)	(0.162)	(0.256)
Shipping cost	-0.397*	0.122	-0.323**	-0.004	0.040***	0.040**	-0.114	0.086
	(0.231)	(0.174)	(0.153)	(0.092)	(0.013)	(0.019)	(0.126)	(0.108)
Size	-0.018	-0.047	-0.046	-0.028	-0.001	-0.006	0.029	-0.013
	(0.059)	(0.075)	(0.042)	(0.039)	(0.004)	(0.006)	(0.033)	(0.045)
Urban pop.	0.817***	0.645*	0.381*	0.321*	-0.021	-0.029	0.456***	0.353*
	(0.295)	(0.334)	(0.201)	(0.175)	(0.018)	(0.024)	(0.146)	(0.194)
Export share	0.489***	0.335***	0.321***	0.161***	0.004***	0.012***	0.165***	0.162***
	(0.030)	(0.036)	(0.020)	(0.015)	(0.001)	(0.002)	(0.016)	(0.028)
Conserved	-2.936***	1.197***	-2.482***	0.644***	-0.037	-0.512***	-0.417***	1.065***
	(0.283)	(0.283)	(0.175)	(0.183)	(0.025)	(0.020)	(0.132)	(0.116)
Truck	0.335	-0.949***	0.924***	-0.247*	0.010	0.058***	-0.599***	-0.759***
	(0.382)	(0.210)	(0.282)	(0.133)	(0.010)	(0.015)	(0.129)	(0.108)
Air	-1.845***	-4.338***	0.337*	-1.346***	0.064***	0.240***	-2.246***	-3.232***
	(0.225)	(0.370)	(0.173)	(0.166)	(0.016)	(0.067)	(0.075)	(0.294)
Constant	9.883***	8.831***	-0.120	-0.390	2.301***	1.310***	7.702***	7.911***
	(2.939)	(2.896)	(2.075)	(1.652)	(0.321)	(0.234)	(1.294)	(1.671)
Obs	21,367	21,798	21,367	21,798	21,367	21,798	21,367	21,798
R^2	0.466	0.412	0.434	0.246	0.658	0.886	0.578	0.645
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors clustered on destination country in parentheses
**** p<0.01, ** p<0.05, * p<0.10*

Figure 1: Exporting firms and export value by sector, 2004-2014.