Norwegian export of farmed salmon − trade costs and market concentration

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Abstract

While variation in unit value most commonly has been associated with quality in the trade literature, observed differences in prices between markets might also be explained by variation in market concentration and the degree of competition. Using transaction data on Norwegian exports of salmon, we introduce a Herfindahl index as a measure of competition in a standard gravity model. We find that competition typically is weaker in small and distant markets that due to high trade costs are served by relatively few firms. We argue that the anti-competitive impact of trade costs may explain price differentiation between markets even for homogeneous products.

Keywords: Gravity; Trade costs; Market concentration; Salmon

JEL classification: C13; F14; Q22

1. Introduction

Product quality has received attention in international trade since Alchian and Allen (1964) hypothesized that quality products were shipped longer distances as per unit transportation costs made quality relatively cheaper. Recently, Manova and Zhang (2012) used a gravity model to show that Chinese exporters typically upgrade quality and charge higher prices in richer, larger and more distant markets. Feenstra and Romalis (2014) argue that average quality and price might be lower in large markets since they attract a larger number of and more heterogeneous firms. Auer *et al.* (2018) show that prices depend on wealth level and are higher for high quality products in wealthy markets and higher for low quality products in poor countries.

However, even if differences in unit value most commonly have been associated with quality in the literature, they might also be influenced by variation in market concentration and keenness of competition. The literature on firms in international trade demonstrates that trade costs, *e.g.*, transportation costs and import barriers, contribute to reduce the number of trading firms and as such may weaken the competition in the market (Bernard *et al*., 2007). When firms have different productivity levels, Crozet and Koenig (2010) and Chaney (2008) show that the effect of trade costs on the number of exporters that operate in a market (extensive margin), is larger for heterogeneous than for homogeneous products. Furthermore, Melitz (2003) argues that firms in order to succeed in new markets have to make market specific investments in relations and networks that later are sunk. Hence, in small markets, fixed investment costs may serve as an entry barrier that restricts the number of firms. If the degree of competition varies across markets, firms would have incentives to price differentiate even for homogenous products. This is analogous to the pricing-to-market hypothesis (Knetter, 1993), but where the differentiation is in geographical space rather than product space.

To investigate the importance of market structure on export flows and prices, we estimate a gravity model augmented with variables for market concentration at the destination level using data on Norwegian exports of salmon. While focus on a specific sector limits the generality of the results, it is a good candidate to make the data requirements manageable. Norway is by far the world's largest producer of farmed atlantic salmon with a production share of about 53 % (FAO, 2018). Norwegian exporters have a dominating market share in most markets with the exception of the USA and the UK. Hence, with the exception of these two markets, concentration among Norwegian exporters in a destination makes a good estimate of the overall market concentration.

2. Industry and data

With 95 % of the global production of farmed salmon occurring in the four countries Norway, Chile, Canada and the UK, this industry is largely export driven with a highly perishable product, fresh salmon, as the main product (FAO, 2018). The two largest producing countries, Norway and Chile, export salmon to more than 150 countries, whereof most have no domestic production. There is a global market for salmon (Asche et al, 1999), but there are few substitutes as salmon constitute a separate market segment from other types of seafood (Tveteras et al, 2012; Bronnmann et al, 2016; Landazuri-Tveteras et al, 2018).

The empirical analysis is based on monthly transaction data from the Norwegian salmon exporters' customs declarations for the period 2004-2014, made available by Statistics Norway. The relevant HS-code is 3021411. We use monthly data to take into account that prices and exported quantities of farmed salmon feature considerable seasonal variation due to both supply and demand factors. For each transaction, the data set identifies the exporting firm and importing country, the weight in kilos, the export value in Norwegian kroner (NOK), contract form, the mode of transportation and the shipment date. The data set contains 914,743 unique transactions from 274 Norwegian exporters, serving 102 different destination markets.

[Figure 1 about here]

There is substantial variation in how many destinations each firm is engaged in. As shown in Figure 1, a large share (82 %) of the exporters is active in less than 10 markets, indicating that market specific fixed costs are present in line with Melitz (2003). Whole fresh salmon is a highly perishable product which put emphasis on the logistics, and thereby relation specific investments (Kvaløy and Tveteras, 2008). Only seven firms (2.4 %) are active in more than 50 destinations, and they make up 54 % of the total export value. Such high skewness in the distribution of firms across markets is in accordance with the findings in Eaton *et al.* (2004) for French exporters and Bernard *et al.* (2009) for USA exporters.

Table 1 shows the number of exporters that serve markets in four different distance categories, including firm annual averages for quantity, value and unit value. At distances above 3500 km (outside the European Union), we see a reduction in the number of exporters and each sell a lower volume at a higher price. The association between distance and unit value indicates that the Alchian-Allen "shipping the good apples out" hypothesis applies also for fresh salmon.

However, it is also evident that transportation costs contribute to reduce the number of trading firms and as such may weaken the competition in the market.

[Table 1 about here]

Figure 2 shows the relationship between market concentration (measured by the Herfindahl index computed from all firms' market shares in a destination) and market size (measured by Norwegian export value). A higher Herfindahl index is associated with destinations that import smaller quantities. This finding is in accordance with the assumption in Melitz (2003) that it is harder for firms to recover market specific fixed costs in small markets; *i.e.*, firms are more reluctant to enter small markets that therefore are served by fewer firms. Hence, small markets may be associated with weaker competition, providing an explanation why even a homogeneous product may be sold at a higher price in small markets.

[Figure 2 about here]

3. Model specification

The empirical analysis is conducted at the firm-destination level using a gravity-model approach to estimate the effect of market concentration and market share on export value, unit value and export quantity.

The augmented gravity-model is given as:

$$\ln(S_{i,j,t}) = \beta_0 + \beta_1 \ln(Distance_j) + \beta_2 \ln(GDP_{j,t}) + \beta_3 ln\left(\frac{GDP_{j,t}}{cap_{j,t}}\right) + \beta_4 (MS_{i,j,t}) + \beta_5 (HI_{j,t}) + \beta_6 UK_{i,t} + \beta_6 US_{i,t} + u_{i,j,t}$$

Depending on estimation, $S_{i,j,t}$ is the export value, the unit value or the export quantity, respectively, of fresh salmon from firm *i* to destination *j* in period *t*. $Distance_j$ is the geographical distance between Norway and destination *j* capturing trade costs. $GDP_{j,t}$ is the gross domestic product in real US$-prices in destination market *j* capturing the size of the economy, while $GDP_{j,t}/cap_{j,t}$ is the gross domestic product per capita in real US$-prices in destination market *j* in period *t*, capturing the wealth level in the economy. $MS_{i,j,t}$ is firm *i*'s market share in Norwegian exports to market *j* indicating whether larger firms in a market obtain a higher price. $HI_{j,t}$ is the Herfindahl index in destination *j* in period *t*, defined as:

$$HI_{j,t} = \sum_{i=1}^{n} MS_{i.j,t}^2 \in [0,1]$$

Concentration in a market increases with HI. If there is only one firm in the market (n=1), HI = 1, while HI → 0 as the number of firms becomes large (n → ∞). While HI measures overall concentration in a market, MS measures individual market shares at the firm level. The correlation between $HI_{j,t}$ and $MS_{i,j,t}$ is 0.11. As mentioned in the introduction, our measure of market concentration is based on Norwegian exports which we in most markets, due to Norwegian dominance, assume to be a good approximation of overall market concentration. Using dummies for USA and the UK, we control for the main exceptions.[1]

4. Empirical results

The empirical results are reported in Table 2. They show that Norwegian fresh salmon exports follow a similar pattern to what is found in most empirical studies when it comes to the standard gravity variables. Traded value and quantity is reduced with distance and increase with the size of the economy. Price increases and sold quantity decreases with distance, in accordance with the Alchian and Allen (1964) hypothesis. GDP per capita and GDP have no significant impact on unit price, a result that is not too surprising given that there is a large number of studies showing a highly integrated global market for salmon (Asche and Bjørndal, 2011).

If trade costs or market characteristics weaken competition by reducing the number of firms that operate in a market, this should be captured by the Herfindahl index. The results reported in Table 2 indicate that the degree of market concentration has a positive impact on the export price suggesting that softer competition does increase price. This source of price differentiation between markets could apply even for homogenous products, as it is the trade costs that differentiate the markets. Finally, the results related to the firm specific market share indicate that larger firms in a market obtain a higher price. This supports the hypothesis of Feenstra and Romalis (2014) that larger and more efficient firms in a market provide higher quality and as such achieve a higher price.

[1] Production shares for Atlantic salmon in 2016 (FAO, 2018): Norway (54,8%), Chile (25,6%), UK (7,6%), Canada (6,7%), and others (7,7%). Virtually, all Canadian production and most Chilean production goes to the U.S. Among "others", the largest is the Faroe Islands, who mostly export to the UK, Australia who mainly produces for domestic consumption and has low imports, and U.S. that mainly produces for domestic consumption.

[Table 2 about here]

5. Conclusions

While unit value most commonly has been identified with quality in the literature, observed differences in prices between markets may also be explained by variation in market concentration and keenness of competition, which can be driven by trade costs. This is an argument for introducing measures of market concentration in standard gravity models. In this paper a Herfindahl index is used as a measure of market concentration in a specific market, and individual firms' market shares to each destination is used to capture quality differences between firms. These variables are added to a gravity model and estimated with data on Norwegian exports of salmon. The empirical results indicate that increased concentration in a market does increase unit price. Hence, anti-competitive impact of trade costs may explain price differentiation between markets even for homogeneous products.

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Table 1. Number of exporters distributed on distance and firm annual averages for volume, value and unit value.

Distance (km)	Annual average # exporters	Annual average volume (1000 tons)	Annual average value (billion NOK)	Annual average unit value (NOK per kg)
< 1000	196	31.9	999	31.63
1000 < distance <=3500	204	52.9	1708	32.26
3500 < distance <=9000	112	11.8	418	35.54
> 9000	52	2.5	93	35.88

Table 2. Impacts on unit value, exported quantity and export value of fresh whole salmon from Norway at the firm-destination level

	(1) ln Export value	(2) ln Unit value	(3) ln Exported quantity
ln Distance	-0.923***	0.041***	-0.964***
	(0.180)	(0.006)	(0.184)
ln GDP	0.536***	-0.002	0.537***
	(0.092)	(0.004)	(0.094)
ln GDP/capita	0.039	0.004	0.034
	(0.245)	(0.008)	(0.249)
ln Firm specific market share	0.629***	0.006***	0.622***
	(0.053)	(0.002)	(0.054)
Herfindahl-index	-8.494***	0.318***	-8.811***
	(2.426)	(0.088)	(2.467)
UK	-0.285	-0.008	-0.277
	(0.254)	(0.009)	(0.260)
US	-2.352***	0.029**	-2.382***
	(0.346)	(0.013)	(0.353)
Constant	7.131**	2.799***	4.332
	(3.011)	(0.128)	(3.076)
Observations	54,094	54,094	54,094
Adj. R^2	0.601	0.814	0.589
Firm FE	Yes	Yes	Yes
Month-year FE	Yes	Yes	Yes

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

Figure 1. Distribution of firms over destinations

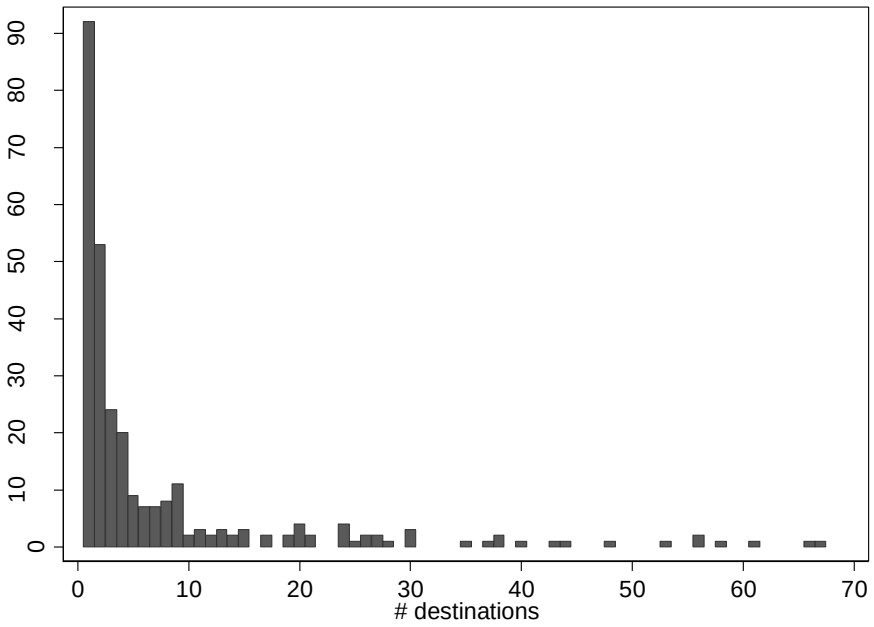

Figure 2. Relationship between market concentration and market size