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CURRENCY INVOICING IN NORWEGIAN SALMON EXPORT

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Abstract: The purpose of this paper is to examine the choice of currency for Norwegian salmon exporters. The choice of invoicing currency will affect prices in different markets as well as risk, factors that are becoming increasingly important as the supply chain for salmon is becoming more sophisticated, and more transactions mechanisms introduced. The results indicate that destination specific market characteristics have impacts as to the choice of invoicing strategy. Norwegian salmon exporters primarily invoice in the export market currency (47% of the exported quantity), but also use a vehicle currency and producer pricing (19%) in a significant number of transactions. Euro is the preferred vehicle currency (18%), closely followed by USD (16%). USD is the dominating invoicing currency for exports beyond Europe.

JEL codes: F14, Q22

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1. Introduction

Choice of invoicing currency is a topic that has gained much attention in the theoretical literature in international trade for several decades. If one assumes that an exporter is free to determine the invoicing currency, three different strategies are available: An exporter who is concerned about exchange rate risk would set the prices in the domestic currency. This is known as "producer currency pricing" (PCP). The prices can also be set in the importers currency, a "local currency pricing" strategy (LCP). This will for instance be the case for an exporter who can exercise market power or conduct so-called "pricing-to-market" (Krugman, 1987), but can also be due to other factors that do not imply oligopolistic behavior such as currencies convertibility. Finally, the exporter could set the price in a major "world" currency, a "vehicle currency pricing" strategy (VCP), which typically will be the US dollar, Euros or Japanese Yen. McKinnon (1979) argues that trade in homogenous primary goods should be conducted in a single vehicle currency as market efficiency increase if the prices were expressed in the same currency.[2]

The theoretical literature holds a number of insights with respect to the choice of invoicing currency that depends on market and product characteristics. As more detailed data on the transaction level has become available for some countries/industries, empirical testing of the different predictions has become possible. Goldberg and Tille (2009) study invoicing strategies for Canadian imports. They argue that when the traded goods have close substitutes the trades are rarely invoiced in the exporters' currency with the exception of exporters from the US[3], and that exporter with a volatile exchange rate makes little use of their own currency. Goldberg and Tille (2009) also establish a relationship between the transaction size and choice of invoicing currency where large volumes are generally invoiced in the importers currency. This finding may indicate that the bargaining power between the exporter and importer matter for the choice of invoicing currency, and that the relevant bargaining tool for the importer is transaction size.

In recent years, there have been dramatic changes in the supply chains for many seafood products. The market has become global for a number of species (Asche et al., 2012; Tveteras et al., 2012), and the growth of the large retail chains have led to increased concentration downstream (Murray and Fofana, 2002; Guillotreau, Le Grel and Simioni, 2005; Guillotreau and Jiménez-Toribio, 2011; Asche et al., 2011ab). With their focus on efficient logistics the retail chains have also led to increased coordination upstream (Kvaløy and Tveteras, 2008; Olsson and Criddel, 2008) as well as the creation

[2] McKinnon (1979) also argue that highly differentiated products should be invoiced in the home currency.
[3] It is argued that this could be due to industry "herding" behavior in a common invoicing currency.

of very large production companies (Asche et al, 2013).[4] Salmon is among the most successful aquaculture species in terms of increased production growth. This is largely due to a substantial productivity growth through the supply chain from suppliers (Tveteras and Heshmati, 2002), at the farms (Nilsen, 2010; Vassdal and Holst, 2011; Roll, 2013; Asche and Roll, 2013, Asche, Guttormsen and Nielsen, 2013) and in the supply chain (Asche, Roll and Tveteras, 2007). Increasingly, more sophisticated transaction methods are being used like contracts (Larsen and Asche, 2011) and futures contracts (Sollibakke, 2012; Oglend, 2013), as well as integration through mergers (Asche et al, 2013).[5] This has made salmon the species with one of the most varied transaction modes in the seafood market. This also means that the strategy with respect to invoicing currency can be an important factor for a producer's competitiveness.

This paper analyzes different determinants of currency invoicing in the export of fresh and frozen salmon from Norway, the leading salmon producing country.[6] There are two main topics in the paper; first a descriptive analysis will be provided for the invoicing pattern from Norwegian exporters to different destination regions to shed light on issues such as the importance of vehicle currencies in different regions. Second, a more stringent empirical analysis where more factors can be controlled for will be conducted using a multinomial logit model. This is a widely used approach to empirical analysis of invoicing currency (Donnenfeld and Haug, 2003; Wilander, 2006). In this analysis, the effect of factor such as firm size, transaction size, distance, import market size, wealth, exchange rate volatility, trading frequency and competitive pressure in the destination market will be investigated.

The rest of the paper is organized as follows. Section 2 offers a brief discussion on some relevant literature; the data and econometric method are described in section 3. In section 4 the invoicing structure revealed in the data are discussed. Section 5 presents the empirical results and some concluding remarks sum up the study in section 6.

[4] The increased coordination in the supply chain has also led to more focus on different product attributes that also have value (Roheim, Asche and Insignaris, 2011; Sogn-Gruntvåg, Larsen and Young, 2013).

[5] These tools are also used to address risk as production risk (Asche and Tveteras, 1999; Tveteras, 2000; Tveteras and Battese, 2006) and price risk (Guttormsen, 1999; Oglend and Sikveland, 2008) is prevalent. Industry structure can also be used to address risks (Oglend and Tveteras, 2009; Herrmansen and Heen, 2012). More inelastic demand and suppy has also contributed to increased price risk (Asche, 1996; Andersen, Roll and Tveteras, 2008; Aasheim et al., 2011).

[6] There has been little focus on the impact of exchange rate movements in the seafood literature in general. Tveteras and Asche (2008) show that exchange rates does not impede market efficiency for salmon and fishmeal, while Larsen and Kinnucan (2009) show efficient price transmission for salmon. Xie, Kinnucan and Myrland (2009) show that exchange rate movements are split according to the slopes of the demand and supply schedules. As demand for salmon is becoming more inelastic (Asche, 1996), this implies that the consumers take a large share of the burden.

2. Literature review

There exists a rich theoretical literature on the choice of currency in international trade.[7]
Some highlighted findings from the theoretical studies is that if the firm's choice of invoicing currency depends on the choice of its competitors it is optimal to "herd" in the same currency, that currencies from countries with monetary stability is most likely to be chosen as invoicing currencies and that the elasticity of demand and exchange rate volatility are important factors behind currency choice (Kamps, 2006).

Grassman (1973) provides the first empirical analysis of choice of invoicing currency. He finds that when there is trade between an industrialized country and a developing country, the trade are mainly invoiced in the currency of the industrialized country or in a third currency, and that invoicing patterns differ by type of products. McKinnon (1979) suggests that trade in homogeneous products, such as oil and primary commodities, will mainly be invoiced in USD or another vehicle currency with low transaction costs, while in trades of differentiated products invoicing in the exporters currency is preferred. Page (1977) shows that a high share of international trade flows are invoiced in major currencies, some of them used as vehicle currencies. This first strain of empirical studies, which are at an aggregated level and descriptive in nature, argues that the use of a vehicle currency will be most important for trades between advanced economies and developing countries. Trades between advanced economies are mainly invoiced in the currency of the exporter.

More recently, better quality of data combined with improved econometric techniques have increased the number of empirical studies investigating the choice of invoicing currency. The impact on the currency choice from different explanatory variables is not straightforward. In many cases the econometric results seems to depend heavily on the aggregation level, the direction of trade (import or export) and whether the partner country for the trade is known or not. Donnenfeld and Haug (2003) is the first econometric study on the choice of invoicing currency. They investigate Canadian import data for 12 different industries at the 6-digit HS-level for the period 1989Q1-1994Q4[8]. They establish a positive relationship between exchange rate risk and the use of LCP in some of their estimations, but they are not able to establish such a relation as an overall finding for all the industries. They also argue that a large GDP in the exporting country relative to the importers GDP favors producer currency pricing (PCP).

[7] A non-exhaustive list of important studies is Baron (1976), Giovannia (1988), Donnenfeld and Zilcha (1991), Johnson and Pick (1997), Friberg (1998), Deveroux et.al. (2004), Bacchetta and van Wincoop (2005), Engel (2005), Floden and Wilander (2006) and Witte (2010).
[8] They do not investigate differences between the industries.

Kamps (2006) explores the use of euro as invoicing currency and offers a comparison of the use of the euro and USD as world vehicle currencies. Not surprisingly the euro has become more important both as a vehicle currency, as well as for local- and producer currency pricing over the last decade. However, Kamps (2006) argues that relative to the USD, the role of the euro as a vehicle currency is limited. If a country exhibits high exchange rate volatility with respect to the euro, the probability for the use of euro as a vehicle currency increases. Kamps (2006, pp 6) states that *"this is particularly true for the countries with the prospect of adopting the euro at some point in the future"*. Goldberg and Tille (2008) also document an increasing importance of the euro as invoicing currency for the EU and accession countries. Ito et al. (2010) discusses the limited use of the yen in trade invoicing for Japanese exporters. They find that the Japanese exporters commonly use local currency pricing in the export to advanced economies, and USD in exports to East-Asia. One possible reason for regional invoicing differences in the case of salmon can be that the exporters make use of historically dominant vehicle currencies in specific markets. Another possible reason for regional invoicing differences is that firms seek to set prices not to deviate from the price of their competitors (Fukuda and Ono (2006)). Hence, if an exporter invoices in a vehicle currency on a regular basis, the probability for other exporters to also invoice in the third currency increases.

Wilander (2006) studies the choice of invoicing currency in Swedish exports at the industry level for the period 1999-2002. In his study exchange rate risk are measured as exchange rate volatility, and he finds a negative relationship between exchange rate volatility and the use of local currency pricing. Wilander (2006) also argues that low inflation will favor local currency pricing, and that increased efficiency in the financial markets in the importing country decrease the probability for producer currency pricing. In the case of the Swedish export industries it is found that about 25 % of the trades in paper and pulp are invoiced in Swedish krona (SEK), while about 60 % of the trades in motor vehicles are invoiced in SEK. This finding may indicate that there is a lower probability for using producer currency pricing for less differentiated products. Friberg and Wilander (2008) survey the currency choice of Swedish exporters. Two interesting findings in this study are first that negotiations between the parts in the transaction are important for both choice of currency and price. Secondly the firms also report that in nearly all cases the settlement currency is equal to the invoicing currency. Ito et al. (2010) investigate the choice of invoicing currency for 23 Japanese exporters in 4 different industries and find that Japanese firms tend to favor LCP when the destination country is an advanced economy. They argue that USD is the most common currency for trades in the Asian markets, with exporters of highly differentiated products who tend to invoice in Yen as the main exception. Ligthart and Werner (2012) analyze the effect of the introduction of the euro on the pattern of currency invoicing by investigating import to Norway from different OECD-

countries in the period 1996Q1-2006Q4. Their results indicate that the euro has overtaken the role of USD as the main vehicle currency, and an increase in the use of producer currency pricing in the export from Eurozone countries. The main cause of the increased use of euro is explained by lower inflation volatility. They observe a decline in the share of producer currency pricing in the Non-Eurozone countries.

3. Data and model specification

The data used is transaction data on all Norwegian exports of fresh and frozen salmon, and is provided by Statistics Norway. The data is recorded from the custom declaration for each individual export transaction for fresh and frozen salmon in the period 2003-2009. The total number of reported trades of fresh salmon during these years is 519,149, while it is 21,251 for frozen salmon. In each observation it is possible to identify both the exporting firm and the destination country for the shipment. There are 343 different exporters represented in the data, who supply a total of 113 different destination markets[9]. Other important variables are the date of the transaction, quantity in kilos, transaction value (in NOK) and invoicing currency.[10]

The choice of invoicing currency is assessed with a multinomial logit model (Greene, 2008). In this paper, this implies that the choice of currency made by the firm for each transaction must be made from one of four options: PCP, LCP, euro as a vehicle currency or USD as vehicle currency. Giving a dependent variable coded with the values 1, 2, 3 or 4, respectively. Formally, the model takes the following form:

(1) $$\Pr(Y_{i,t} = k) = \frac{e^{\beta_j x_{i,t}}}{\sum_{j=1}^{4} e^{\beta_j x_{i,t}}}$$, *where k=1,2,3,4*

$Y_{i,t}$ represent the chosen currency for trade between a given firm and a given destination in year *t*. The model is normalized by setting invoicing in NOK (PCP) as the base category. The independent variables is included in the vector x. The reported coefficients will be the marginal effects of the individual specific characteristics on the choice probability. The size of the marginal effects in a multinomial logit model can be somewhat difficult to interpret, so in the result section the focus will be on the estimated sign and significance levels.

[9] Both firms and destinations may in some cases contain only one observation

[10] Given the result of the investigation of settlement currency vs. invoicing currency in Friberg and Wilander (2008), it will be assumed that the currency reported as the invoicing currency is also the currency used in the actual settlement of the transaction.

As independent variables total yearly import volume in the destination market is included as a measure of the importance of the market. The number of trades is included as a measure of trade regularity, and is expected to work in disfavor of the use of a vehicle currency. The variance in the exchange rate is calculated as the variance of the difference in the log-monthly exchange rates. This variable is included to capture the potential effect of exchange rate variation on choice of currency. The real exchange rate is measured as the real value of the Norwegian currency, i.e. an increase in the real exchange rate means a real depreciation of the Norwegian krone. A real depreciation of NOK may make it more favorable for the importer to use PCP when the NOK becomes cheaper relatively to the local currency. To control for the size of the destination market we include GDP and GDP per capita is included as a control for consumer wealth. Two dummy-variables are included. One is included to control for the EU-countries who have not adopted the euro as their local currency, as these countries are expected to to have a stronger preference for EUR as a vehicle currency. A second dummy is included to control for the trades of frozen salmon, which because of its storability may differ from fresh salmon. The inflation rate difference between Norway and the destination country is included as a measure for monetary stability. One would expect that high inflation in the destination country will make it less favorable for the importer to use LCP. Data for exchange rates, inflation, GDP and GDP per capita is taken from IMF and the World Bank[11]. Geographical distance is included as the literature indicates that this is often an important variable. Data for geographical distance is obtained from CEPII.[12] Most of the explanatory variables are standard in the literature. However, the fact that firm data us used allows some additional factors to be investigated. The firm-specific factors included as independent variables are firm size (total export), firm to destination specific export, the number of Norwegian competitors in the destination market and trade frequency. The number of exporters to a given destination market is included to control for competitive pressure in the destination market. To measure trade frequency, the firm's total number of trades to destination is included.

Finally a set of regional control dummies are included. The region dummies are defined so that they are mutually exclusive. The data is aggregated to yearly observations and sorted by invoicing currency.

[11] More specifically IMF's "International Financial Statistics", and the World Bank's "World Development Indicators".
[12] CEPII's GeoDist databse (http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6)

4. Invoicing structure in Norwegian salmon exports

While Norwegian salmon exports are global with exports to 113 countries, some markets are of course more important, and this will also influence the choice of invoicing currency. About 50 % of total export (volume) of Norwegian seafood products is destined for markets within the EU, with France being the single largest market. In addition, both Russia and the Ukraine are important growth markets in the east, and the Asian market has always been important. In this section an overview with respect to the choice of invoicing currency of Norwegian salmon exports to different destinations as observed in the data is provided. Table 1 summarizes the overall use of different currencies observed in the data[13].

Table 1: Types and shares of currencies and volume by product, 2003-2009

	Fresh Salmon				Frozen salmon			
Currency	*# obs*	*Share, currency*	*tons*	*share tons*	*# obs*	*Share, currency*	*tons*	*share tons*
Euro	249.008	47.96	1689821	56.04	2.390	11.25	20901	6.61
American dollar	108.815	20.96	362086	12.01	12.959	60.98	219581	69.48
Norwegian kr.	78.959	15.21	608145	20.17	4.871	22.92	59441	18.81
Japanese yen	43.778	8.43	129343	4.29	394	1.85	6684	2.12
Swedish kr.	14.816	2.85	24406	0.81	63	0.30	293	0.09
British pound	12.105	2.33	171502	5.69	509	2.40	8985	2.84
Swiss franc	7.147	1.38	6004	0.20	12	0.06	10	0.00
Singapore dollar	2.372	0.47	3958	0.13	0	0	0	0.00
Danish kr.	2.072	0.40	19694	0.65	28	0.13	0	0.00
Australia dollar	46	0.01	45	0.00	20	0.09	92	0.03
Polish zloty	16	0	201	0.01	0	0	0	0.00
Canadian dollar	10	0	14	0.00	5	0.02	27	0.01
Latvian Lat	2	0	25	0.00	0	0	0	0.00
Estonian Kroon	1	0	20	0.00	0	0	0	0.00
Pakistani Rupi	1	0	2	0.00	0	0	0	0.00
Indian Rupi	1	0	17	0.00	0	0	0	0.00
Total	519.149	100	3015281	100	21.251	100	316014	100

Euro is the dominant invoicing currency for fresh salmon. It is used in 47.96 % of all observed trades, accounting for 56.04 % of the total export volume over the period 2003-2009. USD is second most important (12.01% of the volume), with NOK being the third most favored invoicing currency by the

[13] Table A1 in the appendix summarizes the choice of PCP, LCP and vehicle currencies to the 25 largest destination markets for fresh farmed salmon without head. Specifically, we see that export of salmon from Norway to the largest destinations is predominantly invoiced in the currency of the trading partner (LCP), or USD is being uses as a vehicle currency. Only a little less than 15 % of the trades to the 25 largest destinations are invoiced in Norwegian kroner (PCP). Important destination markets in the EU, such as France, Spain and Germany, almost exclusively denominates the import of salmon in euro (LCP). Another striking feature observed in the data is the use of Japanese Yen in the import to Japan, 95 % of all trades in the period are being denominated in LCP.

sellers (20.17 % of the total export volume). Of the total volume being invoiced in USD only 2.3 % are destined for the US; 97.7 % of the volume invoiced in USD employs USD as a vehicle currency. The situation is remarkably different for export to the EU. The use of euro as vehicle currency applies only to about 22.50 % of the total volume invoiced in euro. The use of SEK and GBP are almost 100 % LCP[14], e.g. the currencies are used almost exclusively for export to Sweden and the UK.

In the case of frozen salmon USD is used in 60.98 % of the trades, accounting for 69.48 % of the volume. Approximately 8 % of the trades invoiced in USD have the US as the destination. USD is frequently used as vehicle currency for trades to Russia, the Ukraine and several Asian markets. For frozen salmon most of the trades invoiced in NOK are destined for Israel, Sweden and Russia. About 8 % of the trades in EUR are trades where EUR is used as a vehicle currency, with Russia being the important destination. Hence, the USD is clearly the most common vehicle currency for Norwegian salmon, and in some areas also the EUR is used as a vehicle currency. However, in total the euro is the most important currency due to LCP pricing. As NOK is the third most common currency, there is also substantial evidence of PCP, indicating that all forms of invoicing strategies are used on a relatively large scale in Norwegian salmon exports.

Overall[15], producer currency pricing is being used for 19 % of the volume (16 % of the transactions) and local currency pricing is used for 47 % of the export volume (55 % of the transactions). For the two types of vehicle currencies, euro is used for 18 % of the volume (10 % of the transactions) and USD for 16 % of the export volume (19 % of the transactions).

The sum of annual averages of export of fresh salmon by destinations is reported in the left panel in figure 1 below, with frozen salmon in the right panel. The single most important destination for fresh salmon in the period is France, followed by Denmark and Poland. Russia clearly dominated the demand for frozen salmon.

[14] As an example, of all shipments of fresh salmon in Swedish kronor (SEK), only 5 are registered with a different destination country.
[15] Including both fresh and frozen salmon

Figure 1: the 25 most important destinations by product (annual averages over the whole period)

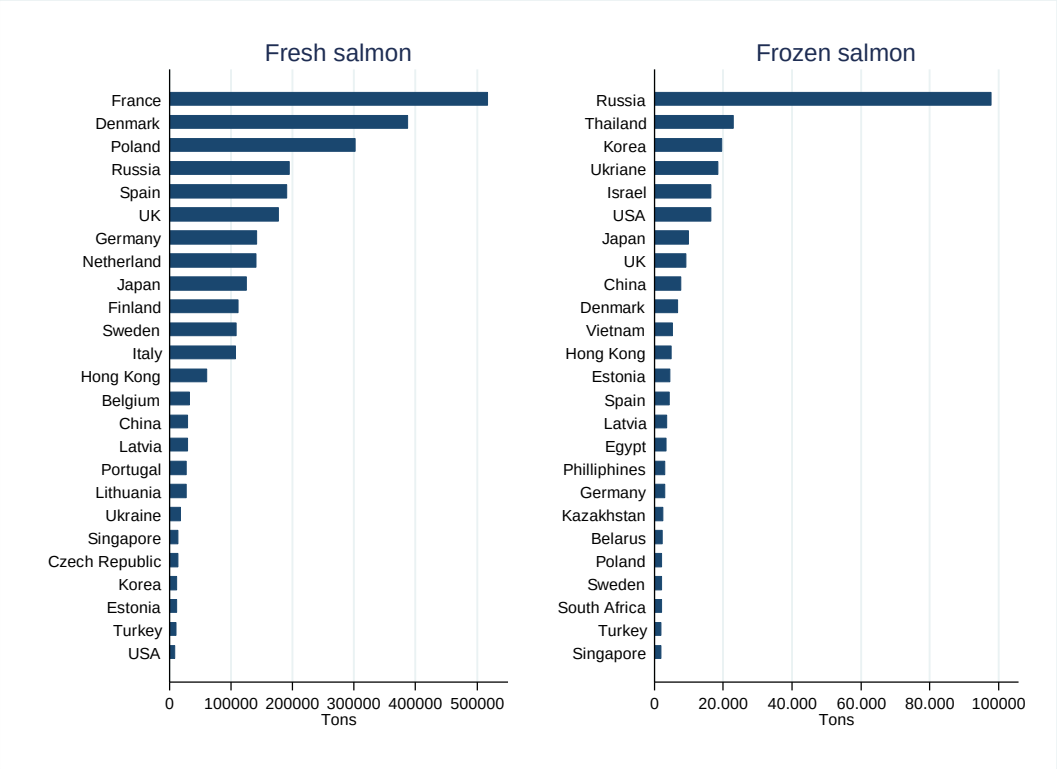
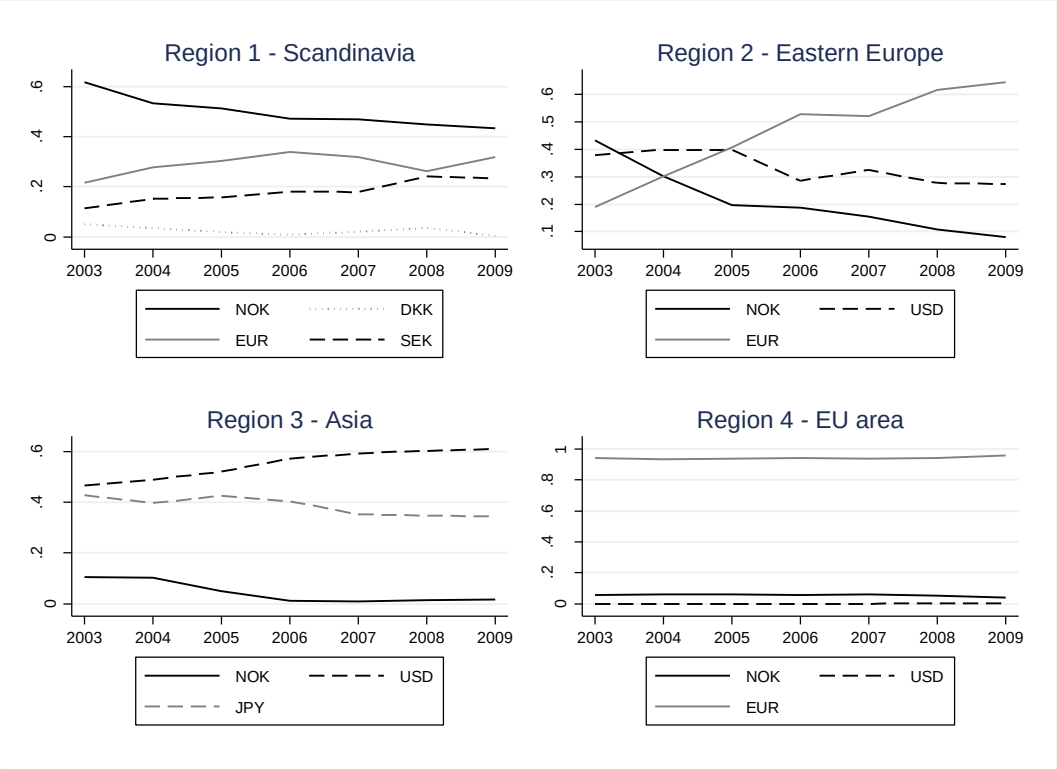


Figure 2 provides a description of the composition of invoicing currencies to different regions for respectively fresh salmon. The figures indicate substantial heterogeneity in the invoicing pattern to different destination markets when focusing on the major currencies in each region.

For fresh salmon most of the export to the Scandinavian countries are invoiced in euro and the Norwegian currency (NOK), but there are also some transactions to Sweden and Denmark where local currency pricing are being used. More local currency pricing are used towards Sweden, than to Denmark. One can also observe a decline in the use of producer currency pricing (NOK) to the Scandinavian countries over time.

Figure 2: Regional invoicing differences, fresh salmon



The euro has overtaken as the dominant invoicing currency for export to Eastern Europe over time, primarily at the expense of NOK, while the use of USD is relatively stable. Thus the latter has a small decline over the period. In the case of Asia the use of American dollar has increased during the period. The use of Japanese yen has declined, and is a reflection of Japans reduced share of the exports rather than a shift in invoicing strategy. In the EU, the euro dominates, although there are also a number of transactions in NOK.

5. Empirical results

The results from the multinomial logit model described in section 3 are reported in table 2, with different columns for respectively the probability of pricing in LCP, euro as vehicle and USD as vehicle relative to PCP in NOK. Hence, a positive effect indicates that it is less likely that the invoicing is in NOK. As one can see, most estimated parameters are statistically significant, and all explanatory variables have a statistically significant impact for at least one of the choices.

Table 2. ***Average marginal effects, choice of invoicing currency***

	PCP vs. LCP	*PCP vs. Vehicle (EUR)*	*PCP vs. Vehicle (USD)*
ln Geographical Distance	*-0.028*	*-0.111*	*0.089*
	*(0.015)**	*(0.013)****	*(0.013)****
ln GDP	*0.061*	*-0.014*	*-0.025*
	*(0.006)****	*(0.005)****	*(0.005)****
ln GDP per capita	*0.115*	*-0.033*	*-0.013*
	*(0.016)****	*(0.009)****	*(0.007)***
Exchange rate variation	*-0.009*	*-0.016*	*0.027*
	*(0.005)**	*(0.005)****	*(0.006)****
Inflation difference	*0.005*	*-0.000*	*0.006*
	*(0.003)**	*(0.002)*	*(0.001)****
ln-diff. Real Exchange Rate	*-0.249*	*0.296*	*-0.192*
	*(0.041)****	*(0.047)****	*(0.055)****
ln Total import in destination country	*0.016*	*-0.009*	*-0.017*
	*(0.006)****	*(0.005)**	*(0.007)****
ln total export firm	*0.012*	*0.007*	*0.013*
	*(0.003)****	*(0.003)***	*(0.003)****
ln firm-to-destination volume	*-0.034*	*0.013*	*-0.025*
	*(0.005)****	*(0.004)****	*(0.006)****
ln # trades to destination by firm	*0.021*	*-0.006*	*0.003*
	*(0.003)****	*(0.003)**	*(0.003)*
ln # competitors in destination market	*-0.038*	*-0.023*	*0.047*
	*(0.012)****	*(0.009)****	*(0.012)****
EU-member, no euro	*-0.151*	*0.093*	*-0.011*
	*(0.022)****	*(0.013)****	*(0.017)*
Trade of frozen salmon	*-0.015*	*-0.090*	*0.124*
	(0.013)	*(0.010)****	*(0.012)****
East-Europe	*-0.269*	*0.064*	*0.332*
	*(0.038)****	*(0.019)****	*(0.036)****
Asia	*-0.263*	*0.120*	*0.258*
	*(0.036)****	*(0.048)***	*(0.051)****
EU	*0.057*	*-0.060*	*-0.065*
	*(0.032)**	*(0.017)****	*(0.032)***
Other regions	*-0.104*	*0.130*	*0.066*
	*(0.032)****	*(0.023)****	*(0.035)**
Obs.	*7425*		

*Note: clustered standard errors in parentheses (exp.firm, destination country). Year dummies included. ***, **, * denotes significance at the 1 %, 5% and 10% respectively.*

In table 2 the independent variables are grouped in three groups. In the first group, the estimates from standard explanatory variables used in the literature are reported. The second group reports the average marginal effects on the choice of invoicing currency from firm-specific variables. Finally, the effects from a set of dummies are reported in the third group.

Geographical distance between the exporter and the destination market is used as a proxy for transportation costs. The probability for invoicing in the local currency decreases with distance. Increased distance also decreases the probability for the use of euro as a vehicle currency, and

increase the probability for the use of USD as vehicle currency. Higher GDP and GDP per capita increase the probability for invoicing in the importers currency. One possible explanation for this result is offered in Krugman (1984), who argues that firms from small countries may be more experienced in dealing with exchange rates, so when firms from small countries trade with larger countries the probability of using the large country's exchange rate may increase. This finding is in line with the findings of Donnenfeld and Haug (2003). Higher GDP and GDP per capita also decrease the probability for the use of vehicle currencies.

Increased exchange rate variation decreases the probability for the use of LCP and the euro as a vehicle currency, but increase the probability for USD as a vehicle currency relative to the use of NOK (PCP). The latter indicate that if the variation between NOK and the exchange rate of the importer increases and the firm's substitutes towards a vehicle currency, the dollar will be the preferred choice. This result is in line with the findings in Wilander (2006), but the opposite of the effect found in Donnenfeld and Haug (2003)[16]. Kamps (2006, pp.16) also discusses the link between exchange rate variation and the use of LCP and argues that "*high exchange rate risk only leads to LCP if the products are not highly differentiated*". This may also be interpreted as a preference for hard currencies, which may be particularly prevalent in the trade with seafood where the EU, Japan and the USA makes up about three quarters of all seafood imports (Smith et al, 2010; Tveteras et al, 2012).

The inflation measure is significant, with a positive sign for invoicing in the importers currency and the use of USD as a vehicle currency. The finding that increased inflation increases the probability for local currency pricing is the opposite of the finding in Wilander (2006). But one must be aware that while Wilander (2006) includes the inflation in the importing country as his independent variable, it is the inflation difference between Norway and the importing country that is the variable of interest in this study. One explanation for why increased inflation may cause more local currency pricing can be that macroeconomic volatility may shift the firms invoicing strategies towards more stable international fundamentals. The negative sign on the real exchange measure in the first column of table 2 indicates that a real depreciation of the Norwegian currency makes it more favorable for invoicing in PCP than LCP. If a vehicle currency is being used a real depreciation of the Norwegian currency decrease the probability for using USD, and increase the probability for using euro, as the vehicle currency. The last independent variable included in the first category in table 2 is the log of the total import of salmon in the destination country. Higher import of salmon in the destination

[16] One should be aware that Donnenfeld and Haug (2003) are only able to establish a significant positive relationship between exchange rate volatility and local currency pricing for 2 out of 24 estimations. This is a fragile result (Kamps, 2006).

country increases the probability for invoicing in the importers currency, and decreases the probability for the use of one of the vehicle currencies, at the expense of pricing in the domestic currency (PCP).

To control for firm size the exporters total yearly export volume to all destination markets, as well as to the specific destination market, is included. The findings reported in the second category in table 2 indicates that increased firm size increase the probability for using LCP or one of the vehicle currencies relative to invoicing in the Norwegian currency. This can be interpreted as an indication that larger firms has greater capacity to engage in specific markets, and fits well with the drivers of horizontal and vertical integration described by Asche, Roll and Tveteras (2007) and Kvaløy and Tveteras (2008), as well as the creation of larger firms due to scale and scope economies at levels in the supply chain downstream from the production (Asche et al, 2013). However, the choice of LCP relative to PCP and export volume can also be due to different factors on the import side of the market. For instance, a shift from many small importers to a handful of large retail chains could result in more use of the importers currency, a development one has observed in many seafood markets (Murray and Fofana, 2002; Guillotreau, Le Grel and Simioni, 2005; Guillotreau and Jiménez-Toribio, 2011; Asche et al, 2011ab). The exporter's yearly number of trades to a destination is included to control for trade frequency. The results indicate that an increase in the firms overall number of trades increase the probability for invoicing in the importers currency, which also fit into this picture. However, when destination specific volume is controlled for, the results indicates that firms that ships large volumes to a given destination prefers PCP at the expense of LCP or USD as vehicle currency. The number of Norwegian exporters to a given destination is included as a measure for market concentration. An increase in the number of exporters to a destination increases the probability for PCP instead of LCP or the use of euro as vehicle currency. This finding is in line with the prediction in the theoretical model of Bacchetta and van Wincoop (2005). A lower probability for invoicing in the importers currency when the number of exporters increase, is also in line with arguments provided by Goldberg and Tille (2009). They argue that higher market shares for an exporting country reduce the use of the importers currency. One would expect that an increased market concentration implies higher market shares. Goldberg and Tille (2009) also argue that a firm may have a motive to invoice in the same currency as its competitors to limit the fluctuations in relative prices; such a motive is strongest when the traded goods are close substitutes.

The estimated average marginal effects related to the dummy variables are reported in the third category in table 2. Export to an EU-country that has not adopted the euro decreases the probability for the use of LCP relatively to PCP. And export to such countries increases the probability for the use

of euro as vehicle currency. It is not surprising that there is no tendency to increased use of USD as vehicle currency for these destination markets. Bacchetta and van Wincoop (2005) argues that if a firm export to a currency union one would expect that that the likelihood of choosing LCP would increase. Export of frozen salmon increase the probability for use of USD as a vehicle currency, and decrease the probability for the use of euro as a vehicle currency. Furthermore, the region specific dummies have significant effect on the firm's choice of invoicing currency. For trades destined for Eastern-European countries the firms prefers PCP relative to LCP, but when the choice is between the use of a vehicle currency or NOK, the firms prefer to use one of the two vehicle currencies. In the case of Asian countries we observe the same pattern as for the Eastern-European region. The pattern is the opposite with respect to the EU. Here firms prefer LCP at the expense of PCP, but would rather make use of NOK than euro or USD when the choice is between NOK and one of the vehicle currencies. The results for the last exhaustive region variable are the same as observed in the case of Eastern-Europe and Asia.

To check the robustness of the coefficients table 2 is re-estimated without the observations from 2008, a year with much turmoil in the exchange rates. This exercise only causes minor changes in the coefficients. In addition a multinomial probit model on the full sample is estimated. This additional estimation is reported in table A.2 the appendix. For most of the independent variables this exercise only causes minor changes in the estimated coefficients[17]. One difference to be noticed is that there is no longer any significant effect from exchange rate variation and the inflation difference for the choice between PCP and LCP in the multinomial probit estimation. In the multinomial logit these two variables are significant, but only at the 10 % level.

[17] A well-known problem associated with the multinomial logit model is the independence of irrelevant alternatives assumption. The multinomial probit reported in the appendix relaxes the IIA-assumption (Cameron and Trivedi, 2007).

6. Conclusion

As salmon production continues to increase the market has become global, and transaction modes are becoming more sophisticated. This paper provides an empirical analysis of one topic that has been shown to be important in the general international trade literature. An overall description of patterns shows that a number of modes are being used, and that a substantial number of transactions are taking place using all the three main invoicing strategies described in the general literature. It is not surprising that Euro is the most commonly used currency, given the importance of the European market. This is evidence of substantial local currency pricing (LCP) in this market. It is somewhat surprising that USD is so frequently used in the export of salmon, indicating a substantial use of USD as a vehicle currency given the moderate exports to the US. With NOK being used for 15 % of all transactions (19 % of volume), also producer currency pricing (PCP) is prevalent.

A number of factors influence the salmon exporter's choice of invoicing currency, and the choice of invoicing currency does not seem to follow any absolute laws. The results indicate that as the export has grown over the last decade and new markets has been established, the invoicing strategies seem to have changed. An important factor for changes in use of different currencies is probably the establishment of the euro. As more countries adopt and incorporate the euro, invoicing in euro also becomes more attractive for Norwegian exporters. Such invoicing strategy lowers the risk regarding price volatility. Specifically, in the case of fresh salmon, the importance of NOK as invoicing currency has largely been overtaken by the euro. In Asia, the role of Japanese Yen has decreased at the expense of more use of USD as a vehicle currency, partially due to the declining importance of the Japanese market. For export of frozen salmon to Asia the use of NOK became more important after 2007, at the expense of USD. The variation in invoicing patterns in different markets and over time, show that this is another dimension that can influence competitiveness through the supply chain, and important factor in the competitiveness of salmon aquaculture (Asche, Roll and Tveteras, 2007). Invoicing strategy is then one element in the transaction strategy of salmon exporters in addition to contracts, vertical integration and futures contracts as investigated by Kvaløy and Tveteras (2008), Larsen and Asche (2011), Solibakke (2012) and Oglend (2013).

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Appendix

Table A 1: share of invoicing currencies used in the 25 largest destination markets. Fresh salmon. (Number of trades in parantheses)

Country	***PCP (=NOK)***	***LCP***	***Vehicle (EUR)***	***Vehicle (USD)***	***(Other currencies, # obs in parantheses)***	***No.obs***
France	*9.36 (6191)*	*90.55% (59888)*	*0*	*0% (2)*	*Swizz Franc (1), British Pound (44), Swedish Kroner (2), Danish kroner (7)*	*66135*
Denmark	*43.90 % (14065)*	*6.34 % (2032)*	*48.74 % (15617)*	*0.11 % (35)*	*Swiss Franc (256)), British Pound (27)), Swedish Kroner (2)), Polish Zloty (1).*	*32035*
Poland	*23.23 % (5600)*	*0.06 % (15)*	*76.63 % (18471)*	*0.08 % (16)*	*British Pound (1), Danish Kroner (1).*	*24104*
Russia	*11.73 % (1568)*	*0*	*6.95 % (929)*	*81.30 % (10863)*	*British Pound (1), Indian Ruupi (1)*	*13362*
Spain	*2.78 % (1093)*	*97.20 % (38168)*	*0*	*0.01 % (4)*	*Swedish Kroner (1)*	*39266*
UK	*7.25 % (961)*	*90.10% (11941)*	*2.02 % (268)*	*0.60% (79)*	*Danish Kroner (4)*	*13253*
Germany	*1.91 % (399)*	*98.06% (20528)*	*0*	*0*	*British Pound (4), Danish kroner (4)*	*20935*
Netherland	*7.27% (1322)*	*90.88% (16527)*	*0*	*0.86% (157)*	*Estonian Kroon (1), British Pound (3), Japanese Yen (172), Swedish Kroner (1)*	*18186*
Japan	*3.67 % (1672)*	*95.36% (43447)*	*0% (1)*	*0.97 % (440)*	*Pakistani Ruupi (1), Singapore Dollar (1)*	*45562*
Finland	*14.21% (1271)*	*85.15% (7618)*	*0*	*0.65% (58)*		*8947*
Sweden	*62.36 % (25794)*	*35.81% (14810)*	*2.59% (658)*	*0.14% (59)*	*Danish Kroner (20), British Pound (7), Japanese Yen (14)*	*41362*
Italy	*7.36 % (2069)*	*92.64% (26051)*	*0*	*0% (1)*	*British Pounds (1)*	*28122*
Hong Kong	*1.72% (544)*	*0*	*0.12% (39)*	*98.02% (30942)*	*Japanese yen (42)*	*31567*
Belgium	*0.60% (89)*	*99.38% (14672)*	*0*	*0.01% (1)*	*Japanese Yen (1)*	*14763*
China	*0.38% (63)*	*0*	*0.46% (77)*	*98.66% (16434)*	*Japanese Yen (84)*	*16658*
Latvia	*0.31% (14)*	*0.04% (2)*	*65.70% (2948)*	*33.94% (15223)*		*4487*
Portugal	*0.02% (2)*	*99.98% (9212)*	*0*	*0*		*9214*
Lithuania	*0.56% (18)*	*0*	*68.50% (2185)*	*30.94% (987)*		*3190*
Ukraine	*0.53% (11)*	*0*	*0.76% (16)*	*98.71% (2066)*		*2093*
Singapore	*7.85% (675)*	*27.47% (2361)*	*0.01% (1)*	*64.63% (5554)*	*Danish Kroner (1), Japanese Yen (2)*	*8594*
Czech Republic	*1.50% (44)*	*0*	*98.39% (2879)*	*0.07% (2)*	*Swiss Franc (1)*	*2926*
Korea	*21.07% (1581)*	*0*	*0.15% (11)*	*78.76% (5910)*	*Japanese Yen (2)*	*7504*
Estonia	*69.19% (1534)*	*0*	*13.08% (290)*	*17.73% (393)*		*2217*
Turkey	*95.42% (1854)*	*0*	*4.27 (83)*	*0.31% (6)*		*1943*
USA	*39.53% (1532)*	*60.37% (2340)*	*0.08% (3)*	*0*	*Japanese Yen (1)*	*3876*
Total (25 largest)	*14.76% (69966)*	*56.88% (269612)*	*9.38% (44476)*	*18.82% (89232)*	*0.15% (712)*	*473998*

Table A.2. ***Average marginal effects, choice of invoicing currency***

	PCP vs. LCP	*PCP vs. Vehicle (EUR)*	*PCP vs. Vehicle (USD)*
ln Geographical Distance	*-0.028*	*-0.106*	*0.090*
	*(0.014)***	*(0.012)****	*(0.013)****
ln GDP	*0.062*	*-0.015*	*-0.026*
	*(0.006)****	*(0.005)****	*(0.005)****
ln GDP per capita	*0.112*	*-0.030*	*-0.018*
	*(0.015)****	*(0.008)****	*(0.007)***
Exchange rate variation	*-0.007*	*-0.014*	*0.026*
	(0.005)	*(0.005)****	*(0.006)****
Inflation difference	*0.003*	*-0.000*	*0.006*
	(0.003)	*(0.001)*	*(0.002)****
ln-diff. Real Exchange Rate	*-0.230*	*0.270*	*-0.198*
	*(0.041)****	*(0.044)****	*(0.055)****
ln Total import in destination country	*0.013*	*-0.008*	*-0.013*
	*(0.006)***	*(0.005)*	*(0.006)****
ln total export firm	*0.012*	*0.006*	*0.014*
	*(0.003)****	*(0.003)***	*(0.003)****
ln firm-to-destination volume	*-0.033*	*0.012*	*-0.020*
	*(0.005)****	*(0.004)****	*(0.005)****
# trades to destination by firm	*0.021*	*-0.005*	*-0.000*
	*(0.003)****	*(0.003)**	*(0.003)*
# competitors in destination market	*-0.033*	*-0.020*	*0.040*
	*(0.011)****	*(0.009)***	*(0.012)****
EU-member, no euro	*-0.141*	*0.092*	*-0.011*
	*(0.021)****	*(0.013)****	*(0.017)*
Trade of frozen salmon	*-0.018*	*-0.085*	*0.123*
	(0.012)	*(0.010)****	*(0.012)****
East-Europe	*-0.156*	*0.065*	*0.261*
	*(0.056)****	*(0.017)****	*(0.037)****
Asia	*-0.237*	*0.149*	*0.232*
	*(0.033)****	*(0.040)****	*(0.048)****
EU	*0.077*	*-0.046*	*-0.051*
	*(0.031)***	*(0.016)****	*(0.029)**
Other regions	*-0.095*	*0.140*	*0.054*
	*(0.029)****	*(0.023)****	*(0.032)**
Obs.	*7425*		

*Note: clustered standard errors in parentheses (exp.firm, destination country). Year dummies included. ***, **, * denotes significance at the 1 %, 5% and 10% respectively.*

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