Pricing to market in Norwegian seafood exports

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1 Introduction

During the last decade and particularly the last few years, the number of anti-dumping cases related to seafood has increased substantially. Most of these cases are in the world's two main markets for seafood, USA and EU. Initially, most complaints were directed toward the two most successful species in modern aquaculture, salmon and shrimp, but recently complaints have been targeted at a number of species. The surge in anti-dumping complaints seems to have two possible explanations. Either they are protectionist measures since anti-dumping duties are among the few legal ways to impose protection from trade or there are a number of cases where agents in the seafood markets are able to exploit market power.

In this paper we will investigate whether Norwegian exporters seem to exploit market power. Norway is of interest as the second largest exporter of seafood in the world, and the exports are mostly a relatively small number of species (salmon, cod and the pelagic species herring and mackerel). These species are sold in several product forms, but with the exception of fresh salmon, there are relatively few importers for most of the products. Hence, if any nation is able to exercise market power in the seafood market, Norway should be a clear candidate. Norway has also been involved in several trade conflicts in relation to seafood, and both with USA and EU.

However, there are also arguments against Norwegian exporters being able to exercise market power. Although the seafood market is segmented, there seems to exist highly integrated and often global markets for each (group of) species. This is the case for cod and other whitefish, salmon and tuna. Moreover, the markets for these different (groups of) species do not

seem to be integrated. Hence, although the seafood market seems segmented, there are also large global markets including supplies from several countries, eroding the possibility to exploit market power. Moreover, there are few if any countries where the industry is concentrated or operates like a unit. The rule rather seems to be a number of small firms.

A necessary prerequisite for market power to take place is the possibility to segment markets. Different regulations will to some extent create segmented markets for a company selling to different countries. Given the volatility of exchange rates, a natural hypothesis to examine is whether sellers find it optimal to offset the effects of exchange rates changes in order to keep local prices stable. We will use Knetter [3] to examine this hypothesis. Empirically, investigations of whether a firm or industry has market power will concentrate on the relationship between price and marginal cost. The competitive price taker is forced to adjust his price to changes in marginal cost, whereas the seller with market power has more leeway in this respect. While prices are normally readily available, information on marginal costs are notoriously difficult to obtain. Thus, a direct approach that relies on a measure of marginal cost is inconvenient. Indirect approaches are more common where one tries to induce information on marginal costs from observed behavior. Of interest in this respect are data that potentially can be used to uncover the responsiveness of prices to marginal cost. It turns out that data on export prices are in particular useful because of the variation that currency changes induce on variables. In the next section we describe the theoretical foundation of the hypothesis we want to test. We then introduce the empirical specification of our data analysis. A few remarks on the mar-

ket and some summary statistics of the data are given before we present our results. Finally, we offer some concluding remarks.

2 Literature review

The literature on exchange rates and pricing in international markets can be listed under three headings; (1) the law of one price, (2) exchange rate pass-through and (3) pricing-to-market (Goldberg and Knetter [1]). The different strands of literature are listed sequentially as they appeared in time. Research focusing on the law of one price tries to determine whether markets are integrated. Identical (common currency) prices for a good follows from the hypothesis of absolute purchasing power parity. Exactly identical prices are however a somewhat strict hypothesis, but accounting for costs associated with trade one can assume that a stable price differential prevails between two markets. This is the hypothesis called the relative purchasing power parity. Testing this theory has proved difficult since it assumes that identical goods are compared.

The elasticity of exchange rate pass-through measures the percentage change in local currency import prices when the exchange rate changes by one percent. If this elasticity is one, we have complete exchange rate pass-through, while an elasticity less than one indicates incomplete pass-through. A common empirical specification is to have price in the importers currency as dependent variable and the exchange rate as explanatory variable.

Pricing to market is the notion of Krugman [5] describing price discrimination across markets in international trade. Price discrimination is a concept

somewhat difficult to define to cover all cases. The usual definition is that price discrimination involves selling the same commodity at different prices to different consumers. The *same commodity* is the term that restricts how useful the definition is. As we know from Debreu, goods in different locations and/or different time periods are different goods. For example, conditions for selling to different markets vary due to regulations. A definition that takes into account that *varieties* of a commodity rather than identical goods are sold to different markets, is better. Moreover, it is appropriate to compare prices that correct for the different costs that such product differentiation involves. Let us denote these prices *net* prices. We thus arrive at the definition of Phlips [7]: Price discrimination take place when varieties of a commodity are sold by the same seller to different buyers at different net prices.

Now, price discrimination can take place over time and across locations. In this paper we study spatial pricing practises, i.e. whether destination (import country) is an explanatory variable in determining export prices. Pricing to market can occur for other reasons than traditional price discrimination by a seller with market power. In particular, given the frequency that changes in the currency markets occur with, *costs of adjustment* might explain some pricing to market behavior in the short run. In order to examine this hypothesis of short run adjustment costs, it is necessary to use a dynamic model like the one used by Kasa [2].

So what are the a priori expectations with respect to the effect of the exchange rates to export prices? On the one hand, price discrimination across markets relies on weak arbitrage opportunities. A characteristic of seafood markets is that many products are sold fresh and quickly deterio-

rates in quality, thus reselling is no option. Transportation costs relative to price are significant and this work in the same direction; it is hard to sustain a profitable resale when one has to cover extra transportation costs. Thus a necessary condition for commanding market power is present. On the other hand, the broad view is that competitive forces give few opportunities for exercising market power for mass market agricultural and seafood products. Small niche products might obviously enjoy market power over devote consumers, but with respect to economic importance and potential welfare considerations the question of market power is not that interesting for these products. Focusing on the mass market, the diversity and variety of products ensure that competition from substitutes severely restricts the market power possibilities.

3 Model

We use the empirical specification of Knetter [3] which is a system of equations on reduced form where export prices are determined by time and destination and possibly by changes in the exchange rate. For a given product the export price to destination i is written:

$$P_{it} = (1 + a_i) \prod_{t=1}^{T} (1 + b_t)^{D_t} X_{it}^{\gamma_i} e^{\epsilon_{it}} \tag{1}$$

$$i = 1, \ldots, N \text{ and } t = 1, \ldots, T$$

P_{it} is the free on board (fob) price to destination i denoted in the exporter's currency. X_{it} is the exchange rate between the exporting and destination market's currency expressed as the number of units of exporters

currency needed to buy one unit of the destination market's currency. The factor involving the $1+T$ parameters a_i and b_t is a measure of marginal cost and a possible markup. The idea is that markups are partly explained by common factors that affect all destinations and partly by destination specific effects. For estimation one time effects are dropped in order to avoid singularity. The constant a_i is interpreted as the base level of marginal cost and markup to market i while the time dummies, D_t, is introduced in order to capture the *relative common movements* in markups. The parameter γ_i measures the effect of the exchange rate on the export price. To be sure, other destination specific explanatory variables may explain prices, but compared to the exchange rate, these variables are likely to be of lesser importance in magnitude. Finally, ϵ_{it} is a white noise disturbance term.

Short of estimating structural equations with all relevant and precise information – a task close to impossible in economics – we find this empirical framework appealing. Instead of relying on instrument variables like export country's wage level as a measure of movements in marginal costs, the time effects capture all systematic variation in prices except for the exchange rate. The specification requires panel data, i.e. equations of time series to several destinations have to be estimated simultaneously in order to estimate the time effects. The drawback is that a full set of time effects reduce the number of degrees of freedom. On the other hand, it also reduces the possible bias of omitted variables in this fairly simple model specification.

For estimation purposes it is convenient to transform (1) to a linear form:

$$\ln P_{it} = \alpha_i + \sum_{t=1}^{T} \beta_t D_t + \gamma_i \ln X_{it} + \epsilon_{it} \tag{2}$$

where $\alpha_i = \ln(1 + a_i)$ and $\beta_t = \ln(1 + b_t)$. The T time effects are now represented by α_t and β_i are the N country specific effects.

The empirical framework described by (2) is capable of distinguishing between two hypotheses about market structure. The null hypothesis is a competitive world market for the relevant product, while the alternative hypothesis allows for price discrimination across markets.

To alleviate the interpretation of this framework, let us shortly discuss two important dimensions that markets are characterized along. Markets might be segmented or integrated, and they might be perfectly or imperfectly competitive. In integrated markets the terms of trade are not affected by the location of the buyer, and transportation costs do not rule out the possibility of resale and exploitation of arbitrage opportunities. Segmented markets on the other hand, have different regulations, customs duties and other taxes - or may be so geographically apart - that resale across markets are prohibitively costly. We are now interested in what combinations of these two dimensions that characterize our seafood markets. If markets are competitive, they have to be integrated, and if markets are segmented, imperfect competition prevails. The difficult case is when all we know is that markets are integrated; in that case the market may or may not be perfectly competitive. The latter case exists if the seller is able to charge a price above marginal cost but unable to price discriminate different groups of buyers.

If markets are competitive and integrated, prices will equal marginal cost and price variability due to exchange rate changes is not present. Moreover, country specific effects are not prevalent in this case. Consequently, the hypothesis of competitive markets for the seafood products under study here

implies that the constant coefficients α_i are equal across destinations and that the exchange rate coefficients γ_i are zero, while the movements of marginal costs over time are captured by the β_t's. If the estimated coefficients are to measure marginal costs exactly, we have to assume rather strictly that exact aggregation of export firms hold. But as long as costs move together, the coefficients provide an approximate measure of markups. A related point concerns the possibility that the exported product to destination A is not totally homogenous to the product being shipped to destination B. The model is based on the assumption of homogenous goods ensuring that cost shifts lead to the same effect in all destinations. But it is possible that the interpretation of products being imperfect substitutes is more reasonable. In that case, our interpretation of results should take account of this.

If markets are imperfectly competitive and integrated, then prices equal marginal cost plus a markup and $\alpha_i + \beta_t$ will measure this sum while γ_i are zero. Integrated markets imply that markups are common, and thus country effects are equal, but the estimated α_i and β_t's will not tell whether markets are competitive or not since the estimated coefficients fits the above mentioned case of competition as well. So long as price variability due to exchange rates is not present, the empirical predictions are indistinguishable.

Segmented markets, on the other hand, can be identified by different country specific effects α_i. The relevant procedure to decide whether markets for a specific product are integrated or segmented is thus to test whether estimated α_i's can be regarded as equal. But notice that if exports to different destinations are not homogenous, we will also end up with different estimated country effects. Thus our specification relies on homogenous products in

order to identify segmented markets.

The strongest support for a price discriminating exporter is however if the exchange rate coefficient γ_i is substantially different from zero. Marston [6] among others show that the response of export prices to exchange rate changes is a function of how the demand elasticities changes with price level, or put more technically; how convex demand schedules are. If the demand elasticity becomes less elastic when the import price increases, then the optimal response of the exporter is to increase his markup. And conversely, a demand elasticity that gets more elastic with a price increase, leads to reduced markups. Economists will consider the latter case most plausible where price increases due to exchange rate changes are offset by reduced markups in order to stabilize local prices.

4 Markets and data

Norwegian seafood exports consist of more than 100 products and roughly 150 export markets.[1] When deciding on products and markets to include in the study, two considerations were involved. First, from an economic and statistical point of view it is desirable to include large markets. Obviously, an economic analysis should concentrate on the important products with the largest welfare implications. The statistical point concerns the quality of data. Export statistics are aggregated numbers of total quantity and value. Unit values (i.e. total value divided by total quantity) is used as price. Depending on the price elasticity, unit values can be interpreted as quantity

[1] Source: Monthly statistics, December 1999, Norwegian Seafood Export Council

Table 1: Unit values, nominal, NOK

Product	**Destination**	**Mean**	**St.dev.**	**Min**	**Max**
Fresh salmon	FR	31.95	4.53	26.11	43.27
	DK	31.33	5.05	25.07	42.69
	JP	36.62	6.85	28.12	50.75
Klipfish	PT	36.48	8.29	29.04	53.17
	BR	48.54	6.29	42.33	62.42
	FR	38.07	7.57	30.97	53.06
Salted cod	PT	25.61	5.85	19.27	36.94
	ES	26.35	4.93	20.19	33.89
	GR	26.98	5.21	20.73	36.23
Frozen shrimps	GB	47.75	5.57	39.78	58.40
	SE	47.38	6.02	38.78	57.85
	FI	44.10	6.04	37.03	56.52

or value weighted average prices. Now, the larger the quantity and value figures are, the less likely is it that errors or delayed reporting in one or the other variable results in a seriously biased unit value whereas this problem is imminent in small markets. Second, products that are quite different from each other and that are included. Even though we analyze relatively few products, we include products that are representative for whole classes of products. A class of products will include varieties with more or less similar marketing characteristics, but which the official statistics treat as separate products. Thus, we cover a lot of the relevant exports of Norwegian seafood products.

The most important product is fresh farmed salmon where Norway has a market share of 70 %. The large market share in combination with the fact that the production process of farmed fish and the structure on the supply side is distinctively different from the traditional harvesting fisheries, can potentially give opportunities for price discrimination. Fresh salmon is the product that is sold to most destinations. We include the three largest markets; France, Denmark and Japan. This is an interesting mix of destinations, France is the largest market, Denmark is a typical pass-through market where most of the imports are reexported after value added production, and Japan is considered to be generally less price sensitive to this kind of products.

Klipfish, or "Bacalao de Noruega" as it is known in main markets, is salted and dried cod. . The two producers of this product are Norway and Portugal. However, since Portugal are consuming all its production, this leaves Norway with a market share close to 100 % in international markets. Like the case of fresh salmon, a large market share makes the hypothesis of

Table 2: Exchange rates, NOK needed to buy 1 or 100 units of foreign currency

Currency	**Mean**	**St.dev.**	**Min**	**Max**
FRF	120.82	7.01	108.31	128.18
DKK	106.35	6.27	94.52	113.08
JPY	5.92	1.09	4.33	8.17
PTE	4.30	0.18	4.04	4.60
USD	6.97	0.74	6.21	8.81
ESP	5.44	0.50	4.83	6.24
GRD	3.17	0.72	2.41	4.60
GBP	11.38	0.97	10.00	13.31
SEK	98.40	7.10	88.95	107.21
FIM	144.49	11.90	124.26	163.45

pricing to market interesting to examine. A distinct feature of dried salted cod compared with the other products in this study is the large degree of value added in production. The major markets include Portugal, Brazil and France. Brazil is a special case since most trades are paid in US dollars and not the local currency Real, consequently we use US dollars as explanatory variable in this case.

Wet salted cod have some common markets with klipfish. In this study we include Portugal, Spain and Greece. Norway is the leading provider together with Iceland. Value added is less than for klipfish, but it is common wisdom that wet salted cod for direct consumption demands higher quality fish than salted and dried cod. The last product in our analysis is frozen shrimps where we analyze the British, Swedish and Finnish markets. This might be regarded as our "control" product. The market share is moderate and the competitiveness in this trade is generally high, thus the traditional conditions for price discrimination is not present.

We use yearly data from 1988–2000. [2]A table of summary statistics of unit values are given in tables 1 and 2.

5 Results

Four systems containing three equations each are estimated. Each system consist of the equations for a given product - fresh salmon, klipfish, salted cod and frozen shrimps - and each equation within a system corresponds to

[2]Obviously, extending the analysis beyond 2001 will neccesiatate a completely different mix of products and currencies since the Euro, the common European currency, came into full effect from 2002.

Table 3: Null hypothesis: Country specific effects are equal

Product	**Test statistic,** $F_{2,21}$	**P-value**
Fresh salmon	7.2308	0.004
Klipfish	1.2113	0.318
Salted cod	3.3189	0.056
Frozen shrimps	0.9671	0.396

a destination. The time effects are restricted to be equal across equations. The number of restrictions make it is necessary to pool the equations and estimate the coefficients by use of appropriate dummies; otherwise we run out of degrees of freedom. Consequently we have to assume that the error term of each equation is uncorrelated. Table 4 reports the results for the country specific coefficients α and the exchange related coefficients γ.

With the exception of salmon, the country specific effects are significant at the 5 % level. This in itself is not all that interesting since α represents the constant term in period one. More interesting is whether the country terms differ from each other. The F-tests in table 3 show that this is the case for fresh salmon. Thus the results rule out the integrated competitive market model for a homogenous good. As alluded to earlier there are two explanations for this result. Either the markets are segmented or there is some degree of product differentiation, i.e. the commodities shipped to each destination are not completely identical. We find both explanations plausible, and even more plausible is it that a combination of the two effects takes place. With respect to the possibility of product varieties across destinations, consider the case of fresh salmon to France and Japan. The estimates of α differ substan-

tially for these two destinations, in fact it is the largest difference observed between any two destinations in our analysis[3]. First, even though prices are stated free on board, air born shipping to Japan necessitates other and more expensive package and preparation than shipping to France. This in itself creates a product variety with higher costs and prices. A further effect that is a direct consequence of higher costs is that to the extent there are quality differences in the commodity defined by the trade statistics, the higher quality products tend to go to the high cost destinations. This is a universal phenomenon of all seafood products and agricultural produce. Thus cost and quality differences work in the same direction, and the high coefficient of Japan relative to the French is to be expected. The other products show less substantial differences although the test statistic for salted cod indicates segmented markets at a significance level slightly below 95 percent.

The more interesting estimates are the exchange rate coefficients. To start with frozen shrimps, as expected the analysis shows that the responsiveness of prices to exchange rates is close to zero, and there is no evidence of pricing to market behavior. For salted cod and klipfish we see a similar pattern with two notable and somewhat surprising exceptions. In the case of klipfish the prices (in US dollars) to Brazil responds negatively to changes in the exchange rate. And an even stronger negative price response is taking place in the salted cod trade to Portugal. By the way we define currencies, price policies aiming at local currency price stabilization will give positive γ's. But

[3]The fact that the estimate of the coefficent for France is not statistically significant does not alter the argument. Even if the French alfa is zero, rather than -0.9, the difference between the two values are still large.

these estimates suggest that if the exchange rate makes the import price 1 percent cheaper, the exporters will respond by lowering prices with 0.62 and 1.1 percent respectively for klipfish and salted cod. Thus, the price response amplifies the exchange rate effect. As explained before, an exporter facing a demand curve exceeding unit elasticity will follow such a pricing policy.

Finally, the product that have been analyzed most closely with respect to possible price discrimination, fresh salmon, reveal pricing to market behavior in the two European markets, France and Denmark. Most notable is this policy in the case of France where exporters fully compensate exchange rate changes and thus ensuring local price stability. In the case of Denmark our estimate indicates that 50 % of exchange rate effects on import prices are offset by pricing to market behavior of exporters. Most likely, the main explanation for this result is the Salmon Agreement between Norway and the European Union which has a minimum import price among its measures.[4]

6 Conclusion

We have analyzed to what extent exporters practice pricing to market in Norwegian seafood exports. Using panel data on export prices and exchange rates we were able to investigate whether exporters command market power for specific products. Eligible products were those that are economically important and that can produce data series of high quality. Our null hypothesis of no pricing to market is rejected for the case of fresh salmon. Our data reveal a systematic pattern whereby exports to France is characterized

[4]See Kinnucan and Myrland (2002) for further information on the Salmon Agreement.

Table 4: Estimation results

Product	**Coeff.**	**Destination**	**Estimate**	**St.err.**	**P-value**
Fresh	α	France	-0.987	1.416	0.493
salmon		Denmark	1.558	1.354	0.263
		Japan	3.937	0.145	0.000
	β	France	1.005	0.299	0.003
		Denmark	0.482	0.294	0.116
		Japan	0.012	0.091	0.898
Klipfish	α	Portugal	3.555	0.700	0.000
		Brazil	4.931	0.359	0.000
		France	5.120	1.542	0.003
	β	Portugal	-0.090	0.470	0.850
		Brazil	-0.624	0.190	0.004
		France	-0.344	0.325	0.302
Salted	α	Portugal	4.647	0.963	0.000
cod		Spain	2.976	0.528	0.000
		Greece	3.070	0.171	0.000
	β	Portugal	-1.095	0.643	0.103
		Spain	0.064	0.298	0.832
		Greece	0.033	0.125	0.791
Frozen	α	Great Britain	3.711	0.316	0.000
shrimps		Sweden	4.780	0.758	0.000
		Finland	4.430	0.719	0.000
	β	Great Britain	0.146	0.129	0.271
		Sweden	-0.158	0.164	0.347
		Finland	-0.090	0.144	0.539

by efforts to keep local currency prices stable whereas salmon destined to Denmark show a pricing regime where 50 percent of the effect of currency changes are offset by reduced markups. The other product prices seem to be more insensitive to exchange rate changes, although a couple of product-destination pairs reveal a pricing policy that might be explained by price setting exporters facing a demand schedule less convex than unit elasticity.

References

[1] Goldberg, Pinelopi K. & Michael M. Knetter. 1997. Goods Prices and Exchange Rates: What Have We Learned? *Journal of Economic Literature* 35: 1243-1272.

[2] Kasa, Kenneth A. 1992. Adjustment Costs and Pricing-to-Market: Theory and Evidence. *Journal of International Economics* 32: 1-30.

[3] Knetter, Michael M. 1989. Price Discrimination by U.S. and German Exporters. *American Economic Review* 79(1): 198-210.

[4] Knetter, Michael M. 1993. International Comparisons of Pricing-To-Market Behavior. *American Economic Review* 83(3): 473-486.

[5] Krugman, Paul. 1987. Pricing to Market When the Exchange Rate Changes. In S. W. Arndt and J.D. Richardson, eds. *Real-Financial Linkages among Open Economies*, Cambridge: MIT Press.

[6] Marston, Richard. 1990. Pricing to Market in Japanese Manufacturing. *Journal of International Economics* 29(3,4): 217-36.

[7] Phlips, Louis. 1983. *The Economics of Price Discrimination*. Cambridge University Press, Cambridge UK.