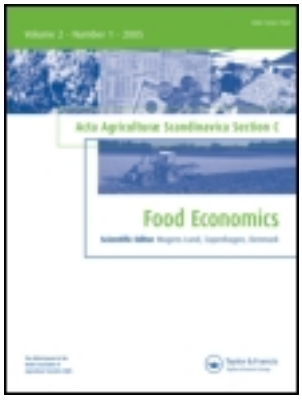

Food Economics - Acta Agriculturae Scandinavica, Section C

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/sagc20

Food consumption changes in Russia: An analysis of regional demand for herring products

Sigbjørn Tveterås [a], Ragnar Tveterås [b] & Kristin Lien [c]

[a] CENTRUM Católica, Pontifica Universidad Católica del Perú, Lima, Peru

[b] University of Stavanger, Stavanger, Norway

[c] Norwegian Seafood Export Council, Tromsø, Norway

Available online: 17 May 2012

To cite this article: Sigbjørn Tveterås, Ragnar Tveterås & Kristin Lien (2011): Food consumption changes in Russia: An analysis of regional demand for herring products, Food Economics - Acta Agriculturae Scandinavica, Section C, 8:4, 222-232

To link to this article: http://dx.doi.org/10.1080/16507541.2012.678580

Food Economics – Acta Agricult Scand, Section C, December 2011; 8: 222–232

RESEARCH ARTICLE

Food consumption changes in Russia: An analysis of regional demand for herring products

SIGBJØRN TVETERÅS[1], RAGNAR TVETERÅS[2] & KRISTIN LIEN[3]

[1]*CENTRUM Católica, Pontifica Universidad Católica del Perú, Lima, Peru,* [2]*University of Stavanger, Stavanger, Norway, and* [3]*Norwegian Seafood Export Council, Tromsø, Norway*

Abstract
In this paper, we study the effects of large income changes on the consumption of herring products in Russia. Herring consumption has shifted rapidly from low-value whole herring (WH) to high-value herring fillet products. We estimate regional herring demand using a panel data of household survey data from the seven Russian federal districts. The results show that WH is an inferior good while herring fillet products are normal goods, which implies that continued economic growth will lead to further shift towards value-added products. Furthermore, the most important factor to explain the large regional differences in herring consumption is real income disparities.

Keywords: *Panel data model, structural changes, transition economy, heterogeneous consumers, regional data, herring.*

1. Introduction

Liberalization of the Russian economy and the subsequent income growth has led to large changes in Russian consumer habits during the last decade, not least in food consumption. Food retail chains currently offer a wide variety of food products targeting different income groups and tastes. The wide array of products currently on display in supermarkets' shelves bears little resemblance to the communist era. This transformation is part of the broader changes in the Russian economy as summarized by Shleifer and Treisman (2005):

> Russia's economy is no longer the shortage-ridden, militarized, collapsing bureaucracy of 1990. It has metamorphosed into a marketplace of mostly private firms, producing goods and services to please consumers instead of planners.

Herring, the most important fish in Russians' diet, has also undergone changes in presentation to satisfy widening consumer tastes. Low price and wide availability have made herring popular in the Russian household. According to a survey, 30–40% of all households consume herring once or more a week (NSEC, 2005). However, traditionally the small pelagic fish has been marketed cured as whole salted in open markets, representing an inexpensive meal for poor Russians. Now an increasing share is marketed as much more expensive value-added products in supermarket shelves (Nilssen, 2005). The more expensive herring products provide both convenience and taste variations to Russians that have become both richer and busier.

To understand the role of economic growth and changing preferences in promoting these new trends in herring consumption, we estimate demand for herring products at the region level. Access to region-specific data allows us to take into account the diversity of the Russian population. Russia has different ethnic groups, religions and traditions. Moreover, studies show that the regional divide, in economic terms, has been widening in favor of those regions with large cities and export-oriented industries (Fedorov, 2002; Gerry et al., 2008). As a result, purchasing power in Moscow and St Petersburg along with the oil-and-gas-rich Ural Federal District is much higher than in other parts of the country.

Correspondence: Sigbjorn Tveteras, Professor, CENTRUM Católica, Pontificia Universidad Católica del Perú, Jr. Daniel Alomía Robles 125. Urb. Los Álamos de Monterrico, 33 Lima, Peru. Tel.: +511 3133400/7287. E-mail: stveteras@pucp.pe

(Received 27 September 2011; accepted 13 March 2012)

ISSN 1650-7541 print/ISSN 1651-288X online
http://dx.doi.org/10.1080/16507541.2012.678580

For these reasons, we can expect there to be large regional differences in the demand of herring products.

While the main focus of this study is on the demand side, increased marketing of value-added herring products must also be linked to changes on the supply side. Three types of structural supply-side changes are important to point out. First, during the 1990s and 2000s Russian imports of Norwegian herring increased. The recovery of the North Sea hearing stocks and the subsequent increase in catches from the 1980s and onwards made Norway the largest supplier of herring, accounting for roughly one-third of global herring catches, largely due to a stricter fisheries management regime (Bjørndal et al., 2004; Bjørndal & Lindroos, 2004). The large volumes of herring forced Norwegian fish exporters to look to new markets, also because an increasing share of the catches was targeted for direct human consumption instead of fish meal and fish oil production.[1] Russia and other eastern European markets were the only ones capable of absorbing such large volumes of consumption herring (i.e. at prices higher than those obtained for fish meal and fish oil). In fact, the trade flow to Russia has been so large that it strongly influenced price formation among other important herring producers like Danish fishers (Nielsen, 2004).

Second, the large growth in imports of largely unprocessed consumption herring coincided with the growth of domestic food processing industries in Russia. The financial crisis of 1997/1998 and subsequent devaluation of the ruble spurred a shift from imported to home-produced food products (Serova et al., 1999; Kadochnikov, 2006). This was not only due to decreasing real incomes but also because of improvement in the quality of home-produced output and broadening of its product mix (Kadochnikov, 2006). Furthermore, the devaluation in 1998 gave domestic producers a competitive advantage relative to imported food products. The subsequent restructuring and modernization of the food industry together with the large inflow of unprocessed herring consequently boosted growth in the seafood processing industry that supplied herring products (Nilssen, 2005).[2]

Third, food retail chains that range from small outlets to large supermarkets and hypermarkets increasingly dominated urban areas in Russia. This development followed from the expansion of European food retail chains eastward to Central and Eastern European countries (Dries et al., 2004). As a latecomer, Russia is said to belong to the 'third wave' countries in the supermarket revolution. The late development of the Russian market compared with other Eastern European countries is explained by severe constraints on foreign direct investment in retailing that were progressively relaxed during the 1990s (Reardon & Gulati, 2008). However, the large retail chains have now taken Russia by full force, making modern distribution channels available for most urban Russian consumers.

Herring's versatility as a raw material implies that it can be used to make highly processed and differentiated products. For examples, herring fillets are branded, packaged, and flavored with different marinades and sauces. Russian processors have increasingly provided a wider range and more expensive herring products. In fact, some food retail outlets offer more than 100 different herring products (Tribiloustova & Lien, 2007). This trend of offering more value-added products also implies that elaboration of herring dishes is being outsourced from the household kitchen to the production line.

The main reason why many Russians have been able to indulge their tastes for a wider range of food products is higher incomes. From 1999 to 2008 Russia's GDP experienced annual growth rates of 5–10%. However, income growth has been highly uneven across regions and socioeconomic groups. Differences in income levels among lower, middle, and upper class are larger than most other Western countries. Urban areas have the largest concentration of middle and upper-class consumers. Moscow stands out with especially high-income levels. Gerry et al. (2008) claim that poverty in Russia has become a rural phenomenon. Uneven income distribution suggests that demand analysis of herring should be disaggregated to allow for differences among these distinct consumer segments.

We estimate dynamic demand systems for herring products based on per capita income. There are large differences in per capita income levels among Russia's seven regions. Our econometric estimates indicate significant regional differences in per capita consumption of herring products after controlling for income levels. We find that whole herring (WH) is an inferior good, whereas value-added herring fillet products are normal goods. This suggests that if incomes continue to increase, consumption will shift from unprocessed to value-added herring products. This trend is also observed for other types of seafood in Russia. It is less clear what effect further income growth will have on total demand for herring.

Besides these findings, the main contributions of this paper are twofold. First, this is the only consumer demand study of Russia that uses a household data disaggregated at the region level. Russia is by far the largest country in the world, stretching across two continents. Our hypothesis of large differences in consumption patterns across such a diverse country is supported by the results.

This finding should also have implications for future consumer and marketing studies of Russian markets. Second, we show the rapid changes in herring consumption in Russia from low-value products to diversified high-value products sold in supermarkets. This development is most likely not unique for herring, but reflects an increased demand for quality foods due to higher purchasing power among large consumer segments in Russia. As a result, this study contributes to the literature on changes in transition economies.

The paper is organized as follows: Section 2 provides a short presentation of the data. Section 3 offers a descriptive analysis of patterns of herring consumption. Section 4 presents the econometric models to be estimated. Section 5 discusses the empirical results from the application of those econometric models. Finally, Section 6 provides concluding remarks.

2. The market for herring in Russia

Analysis of herring demand in Russia must take into account the diversity of the country and its population. It is by far the largest country in the world in square kilometer and has a large and diverse population made up of different ethnic groups, social strata, and income levels. Income distribution has become more skewed in recent years (Fedorov, 2002; Gerry et al., 2008). Differences in urban growth are important when studying food consumption in Russia since the urban middle class attracts modern supermarket chains (Reardon & Gulati, 2008). Moscow and St Petersburg tend to lead new trends in food distribution and consumption. It will take time for other cities to catch up with these two metropolises due to lower income levels. More generally, in a country as diverse as Russia large variation in consumption patterns will likely prevail.

Russia is divided into seven federal regions where the more densely populated are west of the Ural Mountains. The Central Federal District is the most populous region with 37.4 million inhabitants. Neighbouring Volga Federal District to the East is the second most populous region with 30.5 million people. The Northwestern and the Southern Federal Districts are also located in Western Russia. They have populations of 13.6 and 22.8 million, respectively. The area to the East of the Ural Mountains is the largest part of Russia in km^2, but thinly populated. A total of 38.4 million people live in this area made up of the Ural Federal District, Siberia and Far Eastern Federal District.

From 2005 to 2007, real per capita incomes grew rapidly across different regions in Russia, increasing income disparities (Table I). The annual growth in real income nationally from 2005 to 2007 was around 13%. The inhabitants of the Ural Federal District had the highest income in 2007 with 17,544 roubles per capita monthly. The prosperity of this region is largely due to the petroleum industry. The Central Federal District (where is Moscow) and the North Western Federal District (where is St Petersburg) have the second and third highest income levels with 14,970 and 14,702 rubles, respectively. The poorest regions are the Volga Federal District with 10,101 roubles and the Southern Federal District with 8880 roubles. The income level in the most affluent region, Ural, is double as high as the poorest region, the Southern Federal District. This income spread has only marginally been reduced from 2005 to 2007. Table I shows that purchasing power in Moscow and St Petersburg is higher than most other places, in particular in the capital with an average real income level of 22,696 roubles. This gives some support to the urban–rural divide hypothesized by Gerry et al. (2008).

Table I. Real monthly income per capita in rubles. Average January–July (2005–2007).

Region	2005	2006	2007	% Change 2005–2007
Central Federal District	11,095	13,093	14,970	35
Moscow	16,189	19,868	22,696	40
North Western Federal District	11,582	12,661	14,702	27
St Petersburg	12,737	13,795	16,450	29
Siberia & Far Eastern Federal District	10,454	11,538	13,150	26
Southern Federal District	6819	7654	8880	30
Ural Federal District	13,597	15,292	17,544	29
Volga Federal District	7682	8596	10,101	31
Russia National	10,041	11,386	12,818	28

Source: GfK/Europanel.

2.1. Food distribution channels

Russia has experienced rapid growth in so-called modern retail distribution channels in recent years. These channels include supermarkets and hypermarkets owned by retail chains. Income growth has paved the way for retail chains that depend on consumers with a high willingness to pay for high-priced quality food. In contrast, the world's poor usually have high-price elasticity for food (Minten, 2008). Thus, while a growing middle and upper class opt for value-added herring products sold in supermarkets, poor Russians will likely continue to buy herring in open market stalls.

The share of total grocery sales that takes place in modern distribution channels has increased from 7% in 1999 to 45% in 2006 (Figure 1). The modern food retailers boast more efficient distribution systems than traditional grocery stores. Some of the domestic food retailers have adopted information and logistical technologies from multinational retail chains, and have greater capacities in transportation and storage of chilled food. This allows the retail chains to supply a greater diversity of products, including more value-added products. The increasing range of products in many food product categories respond to consumers' preferences for quality, variation, convenience ('easy to prepare'), and health benefits. This also seems to be the case for seafood like herring products.

2.2. Herring consumption

With an average fish consumption of 17.4 kg per capita Russians cannot be categorized as fish lovers, since in most developed countries consumption levels are above 20 kg per capita (NMFS, 2009). Honkanen's (2010) study suggests that Russian consumers instead prefer meat. However, herring represents a popular exception (Voldnes & Honkanen, 2007). Russian consumers express that herring products are tasty, healthy, and affordable. Unlike many other types of fish, herring is mainly marketed as salted or conserved in different sauces, making it accessible and more to the palate of Russian consumers. Moreover, the domestic fishing industry has made herring available to Russian consumers over many years increasing their familiarity with the cured pelagic fish.

Russians eat most meals at home and, as such, herring is preferred for starter dishes rather than part of main courses (Voldnes & Honkanen, 2007). Almost 70% of the respondents state that they eat herring in a starter dish once every second month or more frequent. The corresponding figure for use of herring in a main dish is only a little over 20%. In 1998, herring was more frequently used in main dishes, which is probably related to the economic hardship during the 1990s. This shows that the format of herring products that are consumed and how it is used in the meal has changed since 1998.

Furthermore, herring is more frequently consumed by the older consumers, which probably reflect their traditions of eating herring. But compared with the days of communism when herring was an affordable and healthy protein source, herring nowadays has taken the role as a tasty starter dish, among several food choices. As a result, fewer consumers consider herring a traditional food in 2007 compared with 1998 (Voldnes & Honkanen, 2007).

In fact, herring consumption has changed markedly during the last few years. There was a large decline in per capita consumption of WH from 2006 to 2007, from 0.14 to 0.10 kg per month, that is a decline of around 30% (Figure 2). During the same period consumption of fillet herring (FH) in portions increased more than 100%. This represents a shift from unprocessed to more value-added herring products. The decline in WH consumption corresponds to an increasing price from January 2005 to late summer of 2006 (Figure 3). Afterwards the price has been on a declining path. In contrast, the price of FH declined from January 2005 until early 2007, and then the price started to increase. The average price of FH products relative to WH declined significantly from January 2005 until June 2006. This relative price decline in combination with increased promotion activities for FH products may have contributed to increasing the demand for more value-added products.[3] Furthermore, in a period of rapid income growth different income elasticities for fillet and WH products may have contributed further to shifting absolute and relative demand for these two product categories. This will be examined in our econometric analysis.

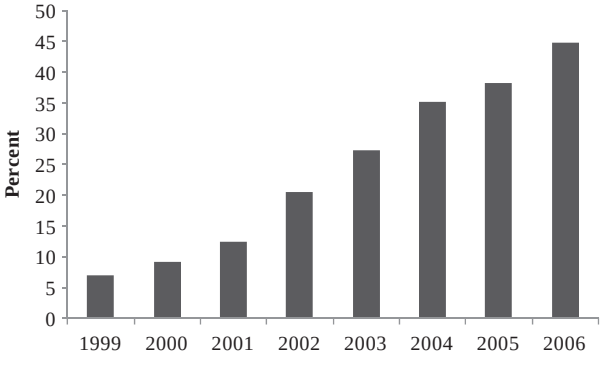

Figure 1. Modern distribution channel grocery sales in percent of total retail sales
(Source: Planet Retail).

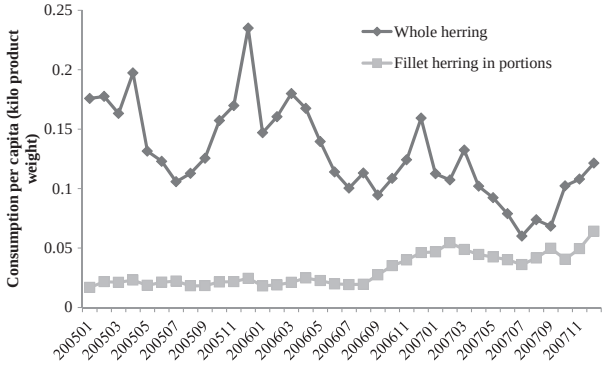

Figure 2. National average herring consumption per capita January 2005 to December 2007.

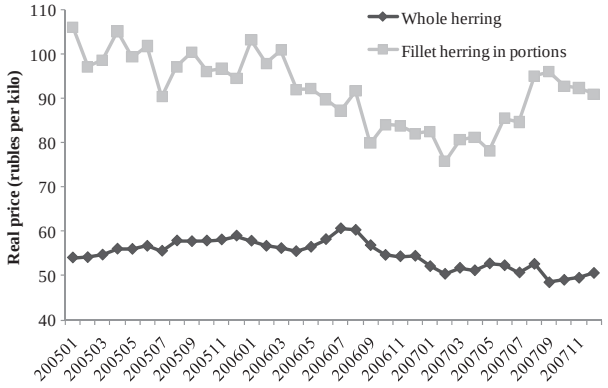

Figure 3. National average real price
(Source: GfK/Europanel).

This shift in consumption also seems to coincide with a shift from traditional grocery outlets, such as open markets and traditional stores to modern distribution channels in the form of supermarkets and hypermarkets. Note that total consumption has only been reduced 5% from 2005 to 2007, from 0.197 to 0.188 kg per month. Hence, total demand for herring remains firm, while the big shift has been in the demand of the herring product mix.[4]

The variation across regions in WH consumption is considerable (Figure 4). The poor Southern Federal District has the highest consumption of WH in all 3 years, according to Figure 4. Volga, another low-income region, also has a comparatively high consumption of WH compared with richer regions. This supports the view that WH is regarded as a cheap protein. There is a significant decline in consumption of WH from 2006 to 2007 for all but one region, and in particular for the Ural Federal District, which in 2007 has the lowest per capita consumption of WH.

The variation in FH consumption across regions presents a different picture (Figure 5). The two poorest regions, Southern Federal District and Volga Federal District, had consumption levels slightly below the national average. However, the Ural Federal District has the highest per capita consumption in all 3 years, and that the consumption increases by a factor of four from 2006 to 2007. For all regions, the consumption of FH in portions increases from 2006 to 2007.

These changes in herring consumption are at the center of this study. Our approach differs from the survey-based studies of Voldnes and Honkanen's (2007) and Honkanen (2010) since our analysis is based on an econometric demand analysis of regional household consumption figures. The data and methodology are described in the next sections.

3. Data

We have access to survey data of approximately 7000 Russian households collected monthly from January 2005 to July 2007 by GfK/Europanel. The households are selected from all Russian regions, and the survey data are used to construct regional aggregates based on the weighted proportion of respondents relative to the total population in the different federal districts, where GfK/Europanel use a weighting scheme based on demographic information. The recruitment criteria for households to make the panel representative relative to official census population profiles include several demographic variables such as household size and housewife age within the region.[5] As a result, the survey data provide estimates on total regional consumption of different herring product categories in volume (metric tonnes net product weight) and value (million rouble). In the data-set, the Far Eastern Federal District and the Siberian Federal District have been merged together as one region. Thus, the survey consists of six regions.

Herring products are classified in product categories by type of processing. There are four product categories: 'FH in Portions', 'Filleted Herring', 'Herring in Rolls', and 'WH'. We will study the two dominant categories, by volume and value, 'FH

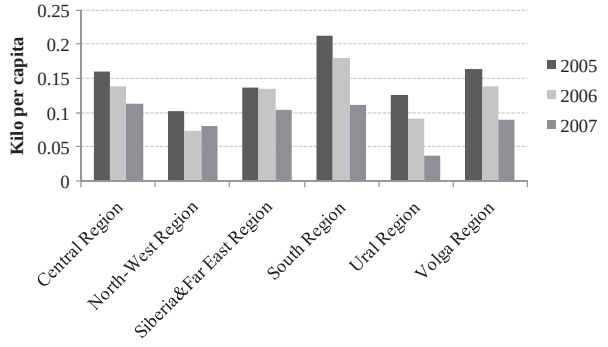

Figure 4. Per capita consumption of WH January–July by region
(Source: GfK/Europanel).

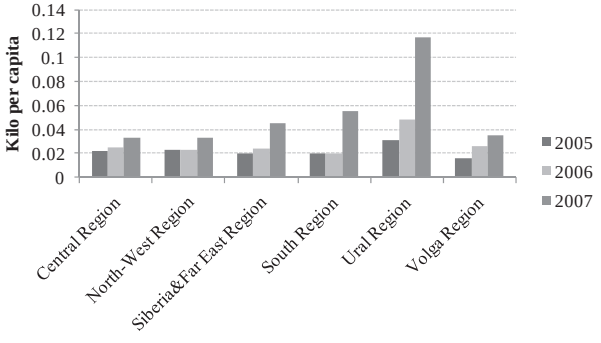

Figure 5. Per capita consumption of FH in portions January–July across regions
(Source: GfK/Europanel).

in portions' and 'WH'. These two product categories account for 97% of total herring consumption in the data period. Changes in consumption of these two categories give a picture of changes in the demand of processed and unprocessed herring products, as WH are used in products with little processing.

From each of the six regions, we have 30 observations, which give us a total of 180 observations. Although the data period is short, the data can give us valuable insights on income effects as there are both large cross-sectional variations in income and there is a rapid change in income during the data period, as shown in Table II earlier.

4. Econometric model specification

We now turn to the econometric model for herring demand in Russia where, as mentioned above, we distinguish between demand for 'FH in portions' and 'WH'. A priori, there are several aspects we must take into account in the econometric model specification. First, it is important that the model of herring demand accounts for structural differences across regions, based on the diversity of the Russian population. Second, the model should allow for differences in short- and long-run demand responses, because it takes time to change consumption pattern. Third, the model should allow for potential correlation between error terms, since consumption of different herring products may be subject to the same exogenous shocks. The model specification we arrive at is influenced both by a literature on econometric demand model estimation on panel data-sets of a similar structure as our data-set (e.g. Maddala, 1991; Pesaran & Smith, 1995; Baltagi & Griffin, 1997; Maddala et al., 1997; Baltagi et al., 2000, 2003; Asche et al., 2008; Tveteras & Tveteras, 2010), and specific considerations related to our research questions and data.

Table II. Estimated short- and long-run elasticities from WH demand and FH in portions equation with region-specific effects.

	Short-run estimates		Long-run estimates	
Elasticity	Whole herring	Fillet herring in portions	Whole herring	Fillet herring in portions
Regional own- and cross-price elasticities				
$e_{P1,Central}$	0.389	−0.951*	0.525	−0.953**
$e_{P1,North}$	−1.132*	−1.716**	−1.694*	−3.221*
Western				
$e_{P1,Sib\&Far}$	−0.029	0.507	−0.037	1.091
Eastern				
$e_{P1,Southern}$	1.155	−1.329	1.693	−3.039
$e_{P1,Ural}$	0.676**	−0.955**	1.408**	−1.116**
$e_{P1,Volga}$	0.353	−0.673	0.431	−0.998
$e_{P2,Central}$	0.325	−1.059***	0.439	−1.061***
$e_{P2,North}$	−1.185*	−1.718**	−1.772	−3.224*
Western				
$e_{P2,Sib\&Far}$	0.455*	−1.651***	0.576*	−3.554***
Eastern				
$e_{P2,Southern}$	0.140	−0.096	0.205	−0.219
$e_{P2,Ural}$	1.241***	−1.837***	2.586***	−2.147***
$e_{P2,Volga}$	−0.239	−1.656***	−0.291	−2.458***
Regional income elasticities				
$e_{I,Central}$	−0.567	0.288	−0.766**	0.288
$e_{I,North}$	−0.814	0.389	−1.217**	0.730
Western				
$e_{I,Sib\&Far}$	−0.797**	0.905*	−1.009**	1.948**
Eastern				
$e_{I,Southern}$	−1.277***	1.063**	−1.871***	2.430**
$e_{I,Ural}$	1.170	0.094	2.439	0.109
$e_{I,Volga}$	−1.782***	0.406	−2.172***	0.603

P1 – own price; P2 – price of other herring product. Significance at *10, **5, and ***1% levels.

Econometric demand studies use several techniques for estimating elasticities of demand from panel data. These estimators vary in their degree of parameter heterogeneity, with pooled estimators at the one extreme and estimators for each individual at the other. There has been a debate on whether to use homogeneous or heterogeneous model parameters over the cross-section (Maddala, 1991; Pesaran & Smith, 1995; Baltagi & Griffin, 1997; Maddala et al., 1997; Baltagi et al., 2000, 2003; Asche et al., 2008; Tveteras & Tveteras, 2010). Intermediate estimators in terms of heterogeneity include standard panel data estimators, that is fixed and random effects estimators, and the more novel iterative empirical Bayes estimator advocated in Maddala (1991), also called the shrinkage estimator. The latter estimator use ordinary least squares estimates as starting values and 'shrink' these estimates towards a common normal distribution through an iterative estimation procedure.

When there is potential parameter heterogeneity between the countries, the fixed effects estimator is likely to impose strong restrictions on the slope parameters. In the case of a dynamic panel data model and coefficients differing between cross-sections, Pesaran and Smith (1995, p. 79) argue that 'pooling and aggregating give inconsistent and potentially highly misleading estimates of the coefficients, though the cross-section can provide consistent estimates of the long-run effects'. The larger the degree of parameter heterogeneity, the greater the bias of the long-run effect provided by the homogeneous estimators. When the number of time observations is small, the bias of the pooled estimator is likely to be a serious problem (Pesaran & Smith, 1995). Hence, the long-run elasticities provided by the fixed effects estimator are likely to be biased if there are structural differences between cross-sections.

We estimate by Zellner's (1962) SURE a two-equation log–log demand system of per capita

herring demand for herring product groups 'FH in Portions' and 'WH' on a panel of Russian regions. The model is specified as:

$$\ln\left(\frac{\text{Demand}_{\text{irt}}}{\text{Capita}_{\text{irt}}}\right) = \alpha_{\text{ir}} + \alpha_{\text{iD}} \ln\left(\frac{\text{Demand}_{\text{irt}-1}}{\text{Capita}_{\text{irt}-1}}\right) + \sum_{i}\sum_{r} \alpha_{\text{Pir}} \ln \text{Price}_{\text{irt}} + \sum_{r}\sum_{Iir} \alpha \ln\left(\frac{\text{Income}_{\text{rt}}}{\text{Capita}_{\text{rt}}}\right) + \sum_{m=1}^{11} \alpha_{\text{Mim}} D_{\text{im}} + u_{\text{irt}}, \quad (1)$$

where subscripts i, m, r and t represent herring products [i = (FH in Portions, WH)], month ($m = 1, 2, \ldots, 11$), region {r = [Central Federal District (incl. Moscow), North Western Federal District (incl. St Petersburg), Siberia & Far Eastern Federal District, Southern Federal District, Ural Federal District, Volga Federal District]}, and time period ($t = 1, 2, \ldots, 30$), respectively.

The dependent variable is per capita demand in kilos per month. Explanatory variables are own price, price of substitute herring product, average per capita monthly income, and monthly dummy variables to capture seasonal shifts. Prices in the model are obtained by calculating the average regional price of the respective herring product groups. Gfk/Europanel data are registered as quantities and value of the groceries that the survey participants purchase, which is why prices must be calculated. This could lead to an endogeneity issue as quantity appears on both sides of the demand equation. However, the calculated prices should be close to actual prices, as they are based on the groceries receipt and as such endogeneity should be a minor issue. We also include lagged regional demand as an explanatory variable. It is fairly common in econometric demand analyses on panel data to specify the dependent demand variable and income variable on per capita form instead of total (regional or national) demand and income (e.g. Maddala et al., 1997). An advantage of the per capita specification is that one can utilize cross-regional variation in per capita demand and income in the estimation. In our case, we have observed that there are substantial cross-regional differences in these variables.

The model is an extension of a standard fixed effects panel data model, which only allows the intercept to vary across units. It is specified such that it allows for heterogeneity across regions in own-price, cross-price, and income elasticities, since a separate parameter is estimated for each region. This allows us to test several hypotheses on regional differences in demand responses.

By including region-specific fixed effects α_{ir} (on the constant term), we allow for structural time-invariant differences in herring demand across regions, which is independent of income levels and prices.

We specify the model as dynamic by including lagged per capita demand as explanatory variables, which is common in econometric demand analyses, see for example Maddala et al. (1997), Baltagi and Griffin (1997), and Baltagi et al. (2000). Our dynamic model allows us to distinguish between short- and long-run demand elasticities, which is useful since economic agents tend to respond less to changes in prices and incomes in the short run than in the long run. The short-run elasticities associated with price and income variables are given directly by the estimated coefficients. The long-run elasticities are obtained by dividing the price and income coefficients by one minus the coefficient associated with the lagged demand variable. Hence, the short-run elasticities of demand with respect to prices and income are given by:

$$e_{\text{Pir}}^{\text{SR}} = \alpha_{\text{Pir}}, \quad e_{\text{Iir}}^{\text{SR}} = \alpha_{\text{Iir}},$$

while the long-run elasticities of demand with respect to prices and income are given by:

$$e_{\text{Pir}}^{\text{LR}} = \frac{\alpha_{\text{Pir}}}{1 - \alpha_{\text{irD}}}, \quad e_{\text{Iir}}^{\text{LR}} = \frac{\alpha_{\text{Iir}}}{1 - \alpha_{\text{irD}}}.$$

When the model is estimated by Zellner's SURE the equations are linked by the fact that their disturbances u_{irt} are allowed to be correlated across equations i, which seem reasonable given that some exogenous shocks probably influence the demand for both products. By taking account of the correlation of the error terms across equations we obtain estimates that are more efficient than the usual least squares statistics, and appropriate test statistics in hypothesis testing.

5. Empirical results

We estimate a two-equation system of demand for WH and FH on regional panel data using Zellner's SURE procedure. The specification includes region-specific effects in both intercept and slope parameters.

Table II presents the corresponding short-run and long-run elasticity estimates derived from the system.[6] The model has no restrictions on symmetry of cross-price elasticities and homogeneity of degree zero in prices and income. A restricted model with symmetry and homogeneity imposed was rejected

with a Chi-square test statistic of 46.63 (18 df, $p = 0.0002$). Also a restricted model with only symmetry imposed was rejected (Chi-square test statistic of 20.78, 6 df, $p = 0.002$). It should be noted, however, that the empirical results on price and income elasticities largely hold also for the restricted models not presented here. Wooldridge's (2002, pp. 282–283) test for autocorrelation for panel data models did not reject the null of no autocorrelation for with test statistic $F(1,5) = 1.680$ and Prob. $> F = 0.252$ for the FH model and $F(1,5) = 0.250$ and Prob. $> F = 0.638$ for the WH model. Consequently, autocorrelation do not seem to be an issue with the estimated models.

The own price elasticities (e_{P1r}) reported in Table II are statistically significant in only two out of six regions at conventional confidence levels. The sign of the own price elasticities also varies across regions; In the North Western Federal District, it is significantly negative, while in the Ural Federal District it is significantly positive. The lack of statistical significance and ambiguity of the sign of the own-price elasticities indicate that price variation has not been a main driver of changes in WH consumption during the data period. The cross-price elasticities (e_{P2r}) with FH products are clearer as WH appear to be a complement. From Figures 2 and 3 we can see that WH prices fell in a period when demand for FH increased, which can explain these results. This result which is counterintuitive could be correlation rather than causation. This is something we will discuss later.

The estimated income elasticities (e_{Ir}) present a more uniform picture across regions for WH. They suggest that WH is an inferior good in all regions but one – the Ural Federal District, where the income elasticity is positive, but not significantly different from zero. Thus, we can infer that the income growth in Russian households is reducing consumption of WH. However, the magnitudes differ with income elasticities of –0.797 in Siberia and Far Eastern Federal District and –1.728 in Volga Federal District. Thus a similar increase in incomes per capita will have a stronger negative effect on WH consumption in Volga compared with the more eastern parts of Russia. In fact, it is in the two poorest regions in terms of real incomes per capita where income growth has a bigger displacement effect on WH consumption.

Heterogeneity in WH consumption across Russia caused by other factors than time dependent variables such as prices and income are captured in region-specific intercepts. In general, a large region-specific intercept indicates that there are strong traditions for consumption of WH in that region. The results show intercepts that vary significantly across regions (see Table AI). After having controlled for income levels, etc., the demand for WH is highest in the North Western Federal District that includes St Petersburg and lowest in the Ural Federal District. One explanation for the large difference between these two specific regions could be proximity to the herring fisheries. Before modern food distribution networks were in place, access to herring products was poorer in regions situated far from the fisheries such as Ural, and thus, traditions for consuming herring were weaker.

Table II also reports the results for demand of FH. Long-run own price elasticities (e_{P1r}) for herring fillet are negative for all regions but one – the Siberian and Far Eastern region – where it is not statistically different from zero. Four of the six negative price elasticities are statistically significant and magnitudes are higher than for WH. This indicates that price has been a more important determinant for herring fillet consumption than for WH during the data period. The cross-price elasticities (e_{P2r}) are not consistent in terms of sign between the WH demand equation and the FH in portions demand equation, as shown in Table II. According to Table II FH in portions is a substitute for WH in the majority of regions, while the two goods tend to be complements for the WH equation. The model with symmetry imposed, which is not presented here, also provided a mixed picture, but only in one region the two products were statistically significant complements.

The estimated income elasticities (e_{Ir}) for FH are positive in most regions, although only statistically significantly different from zero in two regions – the Southern Federal District and Siberia & Far Eastern Federal District. It is interesting to note that the poorest region as measured by per capita income (Southern Federal District) has the highest income elasticity, while the richest region (Ural Federal District) has the lowest income elasticity. The results provide support for positive but declining income elasticity as income increases. Hence further income growth should raise demand for more processed herring, but at a declining rate. This corresponds to a situation where higher income levels reduces herring fillet's share of total household expenditures, and thus demand becomes less income sensitive.

The monthly dummy variables present evidence of significant seasonal variations in demand after having controlled for prices, incomes, etc. (see Table AI). Demand for both whole and FH products are highest in December, and lowest in the summer.

6. Discussion

We have analyzed Russian consumers' demand for herring products during a period characterized by

high-income growth and large changes in consumption patterns. During the relative short period of January 2005 to July 2007 real monthly income of Russian consumers increased 28%. This is an impressive growth considering its large population of 140 million inhabitants. During the same period, herring consumption in all regions has shifted from relatively low-priced unprocessed products to more expensive value-added products. If the trends observed for herring consumption are representative for other food products, the changes are so dramatic that one could make the bold claim that the most recent Russian revolution is a consumer revolution.[7]

There are substantial differences in herring consumption across regions. The poor Southern Federal District's population continues to be the largest consumers of inexpensive whole salted herring, while oil-and-gas-rich Ural's population clearly has the highest consumption levels of value-added herring products. This seems to be in line with observations of a regional divide in Russia. The divide is not so much an East–West division, but driven by economic factors that favors regions with large cities and export-oriented industries (Fedorov, 2002).

This is relevant, as our results show that income is the most important factor in explaining displacement of WH for FH products. In contrast to WH demand, demand of FH products has benefited from both falling prices and rising incomes. There is a chance that the global financial crisis that commenced in late 2008 has halted or even reversed these trends in herring consumption. The world market prices of Russia's biggest source of export revenue, crude oil, plummeted in 2008. Although prices have made some recovery in 2009 and 2010, Russian real incomes have been affected. If our results are relevant beyond the data period, we should expect stagnation in demand of FH and a rebound in WH consumption. However, the valued-added herring products have given Russian consumers new ways to enjoy herring that earlier was not available to them. As a result, it is not obvious that the new consumption patterns of herring products are easily reversible.

Important caveats in relation to the data and modeling effort include the following. First, a longer data period would be desirable as it would allow for more variation in the data. Two and half year of monthly data is relatively short period. Nonetheless, the specific period covered in this study has been a transitional period where large changes have taken place both in relation to marketing and consumption of herring. These rapid changes have produced sufficient variation to estimate demand elasticities. Second, even if we have been able to obtain disaggregate herring data on product format and region, there still remain aggregation issues. Within product formats there can be variation in the quality and presentation of the product and within regions there remain heterogeneity among consumers.

Thus, a topic for future study is to estimate demand at an even more disaggregated level than in this study. To illustrate this point let us take the Central Federal District where Moscow is situated. The average wage level in this region in 2007 was 14,970 roubles. However, in Moscow, where around 10 million of Central Federal District's 37.4 million inhabitants live, the average wage level was 22,696 roubles. A simple calculation then reveals that the average wage level outside of Moscow was 11,784 roubles, almost the half of what they earn in the capital. This underlines the observation of Gerry et al. (2008) that poverty in Russia has become a rural phenomenon. Consequently, the differences in demand are not only across regions but also between large cities and rural areas.

Despite the economic divide in the Russian population, there is no denying that the economic growth has been remarkable from 2000 to 2007, and that it has improved the living standards of many Russians. The selection of food products in Moscow supermarkets, and in other cities, is by no way inferior to what is available in most developed countries. On the contrary, the selection found in their hypermarkets will often exceed that found in many other places. The changes in herring consumption found here give an indication of how Russian consumers' food consumption patterns are rapidly changing with economic growth.

Acknowledgements

We would like to thank two anonymous referees for their helpful comments and suggestions. The usual disclaimer applies.

Notes

1. During the 1980s, 1990s, and 2000s, the share of total catches destined for reduction to fish meal and fish oil were 44, 22, and 7%, respectively (F. Asche, Personal communication, 2011).
2. Tribiloustova (2005) describes in brief some of the restructuring in the seafood processing industry to include, among other things, a redirection towards consumer-oriented product development (pp. 22–23).
3. Increased promotion activities for FH products through TV and other media channels were observed by the Norwegian Seafood Export Council (pers. comm.).
4. Note that if the fillet product weight multiplied by two is approximate the whole weight equivalent. Hence, the actual difference in volume is less when consumption is measured in WH equivalents.
5. More information on the consumer panel methodology is provided in "User Guide: Empowering Users – The Consumer Panel Manual".

6. Table AI in the Appendix contains the parameter estimates of the full system specification of regional demand for WH.
7. Rapid changes in consumption pattern have also been noted indirectly in another study through new mix of seafood products imported to Russia (Berg Andersen et al. 2009).

References

Asche, F., Nilsen, O. B. & Tveterås, R. (2008) Natural gas demand in the European household sector. *Energy Journal*, 29(3), 27–46.

Baltagi, B. H., Bresson, G., Griffin, J. M. & Pirotte, A. (2003) Homogeneous, heterogeneous or shrinkage estimators? Some empirical evidence from French regional gasoline consumption. *Empirical Economics*, 28, 792–811.

Baltagi, B. H. & Griffin, J. M. (1997) Pooled estimators v.s. their heterogeneous counterparts in the context of dynamic demand for gasoline. *Journal of Econometrics*, 77, 303–327.

Baltagi, B. H., Griffin, J. M. & Xiong, W. (2000) To pool or not to pool: Homogeneous versus heterogeneous estimators applied to cigarette demand. *The Review of Economic and Statistics*, 82(1), 117–126.

Berg Andersen, T., Lien, K., Tveterås, R. & Tveterås, S. (2009) The Russian seafood revolution: Shifting consumption towards aquaculture products. *Aquaculture Economics and Management*, 13(3), 191–212.

Bjørndal, T. & Lindroos, M. (2004) International management of north-sea herring. *Environmental and Resource Economics*, 29(1), 83–96.

Bjørndal, T., Ussif, A.-A. & Sumaila, U. R. (2004) A bioeconomic analysis of the Norwegian Spring Spawning Herring (NSSH) stock. *Marine Resource Economics*, 19, 353–365.

Dries, L., Reardon, T. & Swinnen, J. F. M. (2004) The rapid rise of supermarkets in Central and Eastern Europe: Implications for the agrifood sector and rural development. *Development Policy Review*, 22(5), 525–556.

Europanel (2004) *User Guide: Empowering Users – The Consumer Panel Manual*. (London, UK: Europanel).

Fedorov, L. (2002) Regional inequality and regional polarization in Russia, 1990–99. *World Development*, 30(3), 443–456.

Gerry, C. J., Nivorozhkin, E. & Rigg, J. A. (2008) The great divide: 'Ruralisation' of poverty in Russia. *Cambridge Journal of Economics*, 32, 593–607.

Honkanen, P. (2010) Food preference based segments in Russia. *Food Quality and Preference*, 21, 65–74.

Kadochnikov, P. (2006) An analysis of import substitution in Russia after the crisis of 1998. *Problems of Economic Transition*, 49(6), 5–103.

Maddala, G. S. (1991) To pool or not to pool: That is the question. *Journal of Quantitative Economics*, 7(2), 255–263.

Maddala, G. S., Trost, R. P., Li, H. & Joutz, F. (1997) Estimation of short-run and long-run elasticities of energy demand from panel data using shrinkage estimators. *Journal of Business & Economics Statistics*, 15(1), 90–100.

Minten, B. (2008) The food retail revolution in poor countries: Is it coming or is it over? *Economic Development and Cultural Change*, 56(4), 767–789.

Nielsen, M. (2004) International market integration and demand: An analysis of the Norwegian and Danish herring market. *Food Economics*, 1(3), 175–184.

Nilssen, F. (2005) *Produkt- og markedstilpasning av pelagisk fisk i det russiske markedet* (Product and market placement of pelagic fish in the Russian market). Report 7/2005. Tromsø, Norway: Fiskeriforskning.

NMFS (2009) *Fisheries of the United States 2008*. Fisheries Division E.S. Pritchard (ed.) (Silver Spring, MD: National Marine Fisheries Service, Office of Science and Technology), p 76.

NSEC (2005) *Survey herring and mackerel in Russia*. Unpublished Report. Tromsø, Norway: Norwegian Seafood Export Council.

Pesaran, M. H. & Smith, R. (1995) Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68(1), 79–113.

Reardon, T. & Gulati, A. (2008). *The rise of supermarkets and their development implications*. IFPRI Discussion Paper 00752. Washington, DC.

Serova, E., von Braun, J. & Werheim, P. (1999) The impact of financial crisis on Russia's agro-food sector. *European Review of Agricultural Economics*, 26(3), 349–370.

Shleifer, A. & Treisman, D. (2005) A normal country: Russia after communism. *Journal of Economic Perspectives*, 19(1), 151–174.

Tribiloustova, E. (2005). *Fishery Industry Profile – Russia*. FAO/GLOBEFISH Research Programme, Vol. 80. Rome: FAO.

Tribiloustova, E. & Lien, K. (2007). *Herring market in Ekaterinburg (Sverdlovsk Region)*. Report. Tromsø, Norway: Norwegian Seafood Export Council.

Tveteras, S. & Tveteras, R. (2010) The global competition for wild fish resources between livestock and aquaculture. *Journal of Agricultural Economics*, 61(2), 381–397.

Voldnes, G. & Honkanen, P. (2007) Vil russerne spise sild i framtiden? [Will Russians also eat herring in the future?]. *Fisk Industri &Marked*, 8(9), 32–33.

Wooldridge, J. M. (2002) *Econometric Analysis of Cross Section and Panel Data* (Cambridge, MA: MIT Press).

Zellner, A. (1962) An efficient method for estimating seemingly unrelated regressions and tests for aggregation bias. *American Statistical Association Journal*, 58, 348–368.

Appendix

Table AI. Econometric SUR estimates of WH and FH demand equation with region-specific effects.

	Whole herring		Fillet herring	
Parameters	Estimate	*t*-value	Estimate	*t*-value
$\alpha_{D,Central}$	0.259	2.080	0.002	0.037
$\alpha_{D,North\ Western}$	0.331	2.360	0.467	0.018
$\alpha_{D,Sib\&Far\ Eastern}$	0.210	1.470	0.535	0.141
$\alpha_{D,Southern}$	0.318	2.000	0.562	0.046
$\alpha_{D,Ural}$	0.520	4.360	0.144	0.000
$\alpha_{D,Volga}$	0.179	1.450	0.326	0.148
$\alpha_{PW,Central}$	0.389	1.200	−1.059	0.228
$\alpha_{PW,North\ Western}$	−1.132	−1.900	−1.718	0.058
$\alpha_{PW,Sib\&Far\ Eastern}$	−0.029	−0.070	−1.651	0.943
$\alpha_{PW,Southern}$	1.155	1.530	−0.096	0.127
$\alpha_{PW,Ural}$	0.676	2.000	−1.837	0.046
$\alpha_{PW,Volga}$	0.353	0.510	−1.656	0.609
$\alpha_{PF,Central}$	0.325	1.210	−0.951	0.226
$\alpha_{PF,North\ Western}$	−1.185	−1.800	−1.716	0.072
$\alpha_{PF,Sib\&Far\ Eastern}$	0.455	1.800	0.507	0.072
$\alpha_{PF,Southern}$	0.140	0.300	−1.329	0.767
$\alpha_{PF,Ural}$	1.241	3.740	−0.955	0.000
$\alpha_{PF,Volga}$	−0.239	−0.570	−0.673	0.568
$\alpha_{I,Central}$	−0.567	−1.930	0.288	0.053
$\alpha_{I,North\ Western}$	−0.814	−1.970	0.389	0.049
$\alpha_{I,Sib\&Far\ Eastern}$	−0.797	−2.310	0.905	0.021
$\alpha_{I,Southern}$	−1.277	−2.600	1.063	0.009
$\alpha_{I,Ural}$	1.170	1.480	0.094	0.140
$\alpha_{I,Volga}$	−1.782	−4.130	0.406	0.000
α_{M1}	−0.509	−8.020	−0.149	0.000
α_{M2}	−0.365	−6.190	−0.077	0.000
α_{M3}	−0.245	−4.350	−0.135	0.000
α_{M4}	−0.340	−5.970	−0.069	0.000
α_{M5}	−0.510	−9.090	−0.233	0.000
α_{M6}	−0.544	−9.380	−0.220	0.000
α_{M7}	−0.676	−11.240	−0.309	0.000
α_{M8}	−0.538	−7.560	−0.329	0.000
α_{M9}	−0.524	−8.020	−0.190	0.000
α_{M10}	−0.329	−5.170	−0.053	0.000
α_{M11}	−0.276	−4.590	−0.084	0.000
$\alpha_{Central}$	1.088	0.270	2.813	0.787
$\alpha_{North\ Western}$	17.154	2.880	10.365	0.004
$\alpha_{Sib\&Far\ Eastern}$	4.204	0.980	−4.434	0.327
$\alpha_{Southern}$	4.968	0.860	−4.795	0.392
α_{Ural}	−21.054	−2.370	9.693	0.018
α_{Volga}	14.562	2.400	4.546	0.016

Whole herring: $N = 180$, RMSE $= 0.1432$, Pseudo $R^2 = 0.9955$.
Fillet herring: $N = 180$, RMSE $= 0.1847$, Pseudo $R^2 = 0.9975$.

Table AII. Econometric SUR estimates of WH and FH demand equation with urbanization category-specific effects.

Parameters	Estimate	*t*-value	Estimate	*t*-value
$\alpha_{D,0-10}$	0.231	2.280	−0.012	−0.080
$\alpha_{D,10-49}$	0.225	1.990	0.338	3.120
$\alpha_{D,50-499}$	0.181	1.710	0.431	3.520
$\alpha_{D,500-999}$	0.324	3.100	0.274	2.130
$\alpha_{D,1000+}$	0.286	3.130	0.266	1.440
$\alpha_{PW,0-10}$	0.929	1.850	−0.030	−0.070
$\alpha_{PW,10-49}$	0.887	2.550	−1.795	−5.180
$\alpha_{PW,50-499}$	1.369	3.540	−1.219	−3.300
$\alpha_{PW,500-999}$	0.269	0.660	−1.132	−2.800
$\alpha_{PW,1000+}$	1.311	3.550	−0.786	−2.150
$\alpha_{PF,0-10}$	−0.071	−0.250	−2.347	−3.160
$\alpha_{PF,10-49}$	0.617	2.670	−2.039	−3.620
$\alpha_{PF,50-499}$	0.430	1.710	−2.329	−3.650
$\alpha_{PF,500-999}$	0.375	1.400	−1.347	−2.300
$\alpha_{PF,1000+}$	0.017	0.070	−1.767	−2.430
$\alpha_{t,0-10}$	−0.016	−3.660	0.012	2.050
$\alpha_{t,10-49}$	0.003	0.830	0.007	1.230
$\alpha_{t,50-499}$	−0.013	−3.480	0.005	0.990
$\alpha_{t,500-999}$	−0.004	−1.060	0.009	1.880
$\alpha_{t,1000+}$	−0.014	−3.860	0.008	1.590
α_{M1}	−0.429	−7.740	−0.229	−3.140
α_{M2}	−0.254	−5.330	−0.178	−2.530
α_{M3}	−0.185	−3.930	−0.183	−2.720
α_{M4}	−0.267	−5.630	−0.155	−2.290
α_{M5}	−0.469	−10.060	−0.237	−3.510
α_{M6}	−0.571	−11.860	−0.208	−3.140
α_{M7}	−0.713	−13.780	−0.301	−4.400
α_{M8}	−0.554	−9.430	−0.217	−3.140
α_{M9}	−0.548	−10.430	−0.153	−2.150
α_{M10}	−0.283	−5.480	−0.148	−2.130
α_{M11}	−0.240	−4.780	−0.103	−1.440
α_{0-10}	−4.433	−1.800	6.220	1.780
α_{10-49}	−7.765	−3.730	15.069	4.720
α_{50-499}	−9.004	−3.810	13.572	3.790
$\alpha_{500-999}$	−4.053	−1.940	8.564	2.820
α_{1000+}	−7.009	−3.930	9.035	2.960

Whole herring: $N = 165$, RMSE $= 0.1101$, Pseudo $R^2 = 0.9975$.
Fillet herring: $N = 165$, RMSE $= 0.1577$, Pseudo $R^2 = 0.9981$.