

HALO EFFECT OF NORWEGIAN SALMON PROMOTION ON EU SALMON DEMAND

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ABSTRACT

The Differential Almost Ideal Demand System (AIDS) is estimated to exam the direct and spillover responses for salmon promotion conducted by the Norwegian Seafood Export Council in EU Atlantic salmon market. The model allows the advertising effect on demand curve to shift and rotate simultaneously. EU demand is segmented by country of origin, namely Norway, Chile, United Kingdom, Canada, and Rest of World. Results suggest that Norwegian advertising shifted its own demand curve rightward and curve of Rest of World leftward and counterclockwise rotated the curve of UK. The advertising-induced demand curve rotation is found to be important for marginal benefit-cost ratio and producer surplus measurement. A tiny change of price elasticity causes a substantial change of marginal benefit-cost ratio and a not tiny change of producer surplus.

Keywords: advertising, demand curve rotation, spillover, salmon, EU demand

INTRODUCTION

Norwegian salmon industry has operated a mandatory check-off program through a levy on salmon exports since 1979 aimed at increasing salmon consumption both domestically and abroad. Because more than 97% of Norwegian salmons are exported, the majority of fund is allocated to export promotion, largely to EU market, which accounts for two-thirds of Norwegian export.

In 1997, in response to a dumping complaint filed by United Kingdom producers, the Norwegian government agreed to increase its export tax on Norwegian salmon entering the European Union from 0.75% to 3.00% (Bull & Brittan, 1997) [6]. The higher fee generated was used to promote fresh Atlantic salmon as a generic product in the European Union. Salmon agreement lapsed in 2002 and the fee reverted to 0.75 percent. The advertising and promotion program managed by Norwegian Seafood Council (NSEC) has funded annual budget of \$9 million in EU during our sample period of January 1998 to July 2007.

Traditionally, advertising is viewed as either persuasive or information (Bagwell, 2005) [3], and most empirical studies in the literature estimates the effect of the advertising expenditure as a simple shift in the demand curve. However, as noted by Quilkey (1986, P.51) [25], advertising can rotate the demand curve in a counterclockwise direction by stressing a product's "substitutability for other products in its end uses," and in a clockwise direction by emphasizing product uniqueness (Zheng and Kinnucan, 2008) [26]. This study focused on the effects of Norwegian advertising in the salmon demand of EU market allowing the demand curves to shift and rotate simultaneously.

Previous research on salmon export promotion has identified optimal spending levels (Kinnucan and Myrland, 2000) [15], producer welfare impacts (Kinnucan and Myrland, 2002) [18], and free-rider effects (Kinnucan and Myrland, 2003) [14], the advertising elasticities in these studies are either assumed or best guessed. The responsiveness of specific markets including France, Italy, Norwegian domestic market to the promotion have been estimated (Bjørndal et al., 1992, 1994; Dong et al., 2007; Myrland and Kinnucan, 2000; Myrland et al., 2004, 2007) [4, 5, 11, 20, 21, 22], while all of these previous researches follow the traditional way of estimating the effect of the advertising expenditure as a simple shift in the

demand curves. No research to our knowledge has been done to test whether advertising rotates market demand curves. The issue of curve rotation or more specifically advertising's effect on the market demand elasticity is important for measurement of optimal advertising intensity, and welfare effects of advertising (Kinnucan and Zheng, 2004) [16].

The purpose of this research is first to determine the effects of increased promotion expenditures on the EU demand for Atlantic salmon by either shifting or rotating the demand curves or both. The second purpose is to compare the differences of the optimal spending level and producer surplus with the advertising effect of demand rotation considered and without. Because the promotion includes both generic (eat more salmon) and brand (eat more Norwegian salmon) appeals, special attention is paid to spillover effects on the demand for non-Norwegian sources.

MODEL SPECIFICATION

The first difference AIDS model (Deaton and Muellbauer, 1980) [9] was selected for estimation because it is consistent with demand theory and proved to be better than its main competitor Rotterdam in world salmon demand analysis. Given the focus on spillover effects, the EU demand for salmon is therefore segmented by supply sources, namely Norway, United Kingdom, Chile, Canada and Rest of World. Over our sample period 1998.1-2007.7, they accounted for 71%, 13%, 6%, 0.06% and 10%, respectively, of the salmon consumption in EU on a value basis. The salmon products are assumed to be weakly separable from all other goods and two-stage budgeting is invoked to justify the conditional demand specification.

The prices of salmon in our study are assumed to be predetermined as more than two-thirds of world supply is farmed salmon (Knapp, 2007) [19]. An important advantage of fish farming over capture fisheries is the greater in harvesting (Eagle et al., 2004) and the supply is elastic [13]. At the import/export level, supply is more elastic than at the farm level because the exporter has alternative sources of supply (DeVoretz and Salvanes, 1993) [10].

The differential AIDS model augmented with advertising as a shift variable is given by Duffy (2001, equations (35)) [12] as

$$dw_i = a_i + b_i d \ln Q + \sum_{j=1}^n \gamma_{ij} d \ln p_j + \sum_{j=1}^n \varphi_{ij} d \ln A_j \quad (\text{Eq. 1})$$

Where i indexes the number of equations in the system; $d \ln Q = \sum_{i=1}^n w_i d \ln q_i = (d \ln y - d \ln P)$ is the

Divisa quantity index for the change in real expenditure; $d \ln P = \sum_{i=1}^n w_i d \ln p_i$ is the Stone price index in change form; and y is group expenditure.

In the present study there are five products, only one of which is advertised. Interest centers on whether the advertising affects the own-price elasticity for the advertised product, but also for the other four products in the system. To determine that, let product 1 be the advertised good and, following Chang and Kinnucan (1991) [7], specify the own-price coefficients in equation (3) to be linear functions of changes in the advertising expenditure:

$$\gamma_{ii} = c_i + r_i d \ln A_1 \quad (\text{Eq. 2})$$

Substituting Eq. 2 into Eq. 1 yields:

$$dw_i = a_i + b_i d \ln Q + c_i d \ln p_i + \sum_{\substack{j=1 \\ i \neq j}}^5 \gamma_{ij} d \ln p_j + \varphi_{i1} d \ln A_1 \quad (\text{Eq. 3})$$

$$+ r_i (d \ln p_i \cdot d \ln A_1) \quad i = 1, \dots, 5$$

Then the formula for the own-price elasticity is:

$$\eta_{ii} = \left(-1 + \frac{c_i}{w_i} - b_i \right) + \frac{r_i d \ln A_1}{w_i} \quad (\text{Own-price elasticity}) \quad (\text{Eq. 4a})$$

Since the advertising is assumed to have no effect on cross price and expenditure elasticities, the formulas for the cross-price elasticities and expenditure elasticities are the same as for the original AIDS, namely:

$$\eta_{ij} = \frac{\gamma_{ij} - b_i w_j}{w_i} \quad i \neq j \quad (\text{Cross-price elasticity}) \quad (\text{Eq. 4b})$$

$$e_i = \frac{b_i}{w_i} + 1 \quad (\text{Expenditure elasticity}) \quad (\text{Eq. 5})$$

The advertising elasticities, derived using the formula $\alpha_{i1} = \left(\frac{\partial w_i}{\partial \ln A_1} \right) \frac{1}{w_i} = \frac{\partial \ln q_i}{\partial \ln A_1}$, are as follows:

$$\alpha_{i1} = \left(\frac{\varphi_{i1}}{w_i} \right) + \frac{r_i d \ln p_i}{w_i} \quad i = 1, \dots, 5 \quad (\text{Eq. 6})$$

Comparing equations (4a) and (6), if advertising affects own price-elasticities it must also affect advertising elasticities. In particular, with the maintained hypothesis that $\varphi_{11} > 0$, the largest own advertising effect obtains when the advertising makes demand less price elastic and price is rising ($r_1 > 0$ and $d \ln p_1 > 0$) or when advertising makes demand more price elastic and price is falling ($r_1 < 0$ and $d \ln p_1 < 0$).

Incorporating the seasonal dummy variables to the equation (3) yields the final estimated equation:

$$dw_i = a_i + b_i d \ln Q + c_i d \ln p_i + \sum_{\substack{j=1 \\ i \neq j}}^5 \gamma_{ij} d \ln p_j + \varphi_{i1} d \ln A_1 \quad (\text{Eq. 7})$$

$$+ r_i (d \ln p_i \cdot d \ln A_1) + \sum_{k=1}^3 d_{ik} D_k + \varepsilon_i \quad i = 1, \dots, 5$$

It is well accepted that the effects of advertising linger beyond the period of initial exposure, and each new expenditure builds on the residual contribution of past outlays (Chang and Kinnucan, 1991; Nerlove and Arrow, 1962) [7, 23]. The advertising in equation (7) therefore specified as a stock variable (versus flow). For nonlinear rate assumption, the more complicated lag distribution technique should be considered and some arbitrary restrictions normally are imposed to force a particular form of the lag on the data. Integrating the complex nature of the formulation of the lag distribution with price and advertising interact was infeasible for estimation. Based on the above consideration, decay rate was assumed to be constant and goodwill variable was generated as the average expenditures at current and

past 5 terms by Norwegian Seafood Export Council ($A_t = (\sum_{l=0}^5 ADEXP_{t-l}) / 6$).^a A lag length of five is also consistent with Clarke's observation that 90 percent of the cumulative effect of advertising on sales of mature, frequently purchased, low-priced products occurs within 3 to 9 months of the advertisement (Clarke, 1976) [8].

The advertising effects on demand elasticity and curve rotation are computed using the following formulas.^b

$$\frac{\partial |\eta_{ii}|}{\partial \ln A_1} = -(r_i - \alpha_{i1}(c_{ii} + r_i d \ln A_1)) / w_i \quad (\text{Eq. 8a})$$

$$\partial \ln \Delta_i / \partial \ln A_1 = \frac{r_i - \alpha_{i1}(c_{ii} + r_i d \ln A_1)}{(c_{ii} + r_i d \ln A_1) - bw_i - w_i} + \alpha_{i1} \quad (\text{Eq. 8b})$$

Equation (8a) measures the absolute change of price elasticity respected to percentage change of advertising expenditure. Equation (8b) is to test the advertising-induced rotation in the demand curves.

CURVE ROTATION AND PRICE ELASTICITY CHANGE

Kinnucan and Zheng (2004) [16] show that advertising can affect the demand elasticity in two ways: by changing the demand curve's slope or by changing the P^0 / q^0 , which can be presented by Equation (9).^c

$$\partial \ln \eta / \partial \ln A = \partial \ln \Delta / \partial \ln A - \alpha \quad (\text{Eq. 9})$$

where $\alpha = \partial \ln q / \partial \ln A$ is the advertising elasticity, $\Delta = -(\partial q / \partial p)$ is the demand curve's slope in absolute value, $\eta = \Delta(p^0 / q^0)$ is the absolute value of the price elasticity. p^0 and q^0 are price and quantity respectively. From equation (9), advertising effect on the price elasticity can be decomposed to a rotation effect, represented by $\partial \ln \Delta / \partial \ln A$ and a shift effect, represented by α when price is fixed. $\partial \ln \Delta / \partial \ln A$ is negative when own advertising stress unique product attributes or positive when it stress substitutability in end uses (Quilkey, 1986) [25].

The implication following the above analysis is that curve rotation is neither necessary nor sufficient for advertising to change the own-price elasticity. Kinnucan and Zheng (2004) [16] show that the elasticity change induced by the curve shift in most cases will be negligible, which on the other hand indicates that although the curve rotation does not necessarily mean the demand elasticity change, it is the main contributor to the change if there is any.

DATA AND ESTIMATION PROCEDURE

The data set consists of export data from the Norwegian Seafood Export Council. The set contains monthly data on quantity, FOB price and Norwegian promotion expenditures for the period 1998.1-2007.7. All prices and advertising expenditure are in local currencies except for Chile and ROW, which are in US dollars. The prices of Norway, UK and Canada and advertising expenditure were converted to US dollars using the appropriate exchange rate. The exchange rate was obtained from website of Pacific exchange rate service (<http://fx.sauder.ubc.ca/>) [24]. The first 6 observation were lost in the computation of the advertising variable specified as a goodwill stock.

The differential AIDS given in equation (3) was estimated using the LIMDEP program using Seemingly Unrelated Regressions (SUR). The system was estimated with the equation for the ROW deleted to avoid singularity in the variance-covariance matrix. The coefficients from the omitted equation were recovered by rerunning the model with equation for Canada deleted. Homogeneity and symmetry restriction implied by demand theory are rejected by Wald test. When price and advertising interacts are incorporated to the model, the classical equation for theory restrictions test are questionable. Based on the above consideration, the model was estimated without homogeneity or symmetry restrictions.

ESTIMATION RESULTS

The estimation results for the empirical model are given in Table I. The R^2 's range from 0.14 to 0.24. The estimated intercept, which indicates trend effect, is negative and significant in the UK equation. This suggests that EU consumer prefer to buy less salmon from UK. Two of the three seasonal dummy variables are significant in both Norway and UK equations. Considering the occupying market share taken by salmon from these two countries, this underscores the importance of seasonality in EU salmon market demand. The coefficients of the seasonal variables in two equations are opposite in signs. This indicates Norwegian salmon and UK salmon fill different market niches.

Table I. SUR estimates of parameters for salmon demand in EU

Independent variable	Norway	Chile	UK	Canada	ROW
Price					
Norway	-0.007 (-0.110)	0.026 (0.647)	0.004 (0.064)	-0.003 (-1.548)	-0.017 (-0.406)
Chile	-0.026 (-0.645)	-0.023 (-0.896)	0.046 (1.324)	-0.001 (-1.010)	0.008 (0.314)
UK	-0.044* (-1.905)	-0.020 (-1.355)	0.081** (3.961)	0.001 (1.424)	-0.022 (-1.363)
Canada	-0.003 (-0.692)	-0.008** (-2.464)	0.001 (0.139)	-0.0002 (-1.588)	0.011** (3.460)
ROW	0.060** (2.161)	-0.023 (-1.305)	-0.038 (-1.567)	-0.001 (-1.054)	0.003 (0.140)
Advertising*price	-0.058 (-0.484)	-0.004 (-0.039)	-0.153** (-2.125)	0.001 (1.449)	0.0005 (0.104)
Advertising	0.033* (1.857)	-0.004 (-0.326)	0.013 (0.862)	-0.0003 (-0.673)	-0.037** (-3.150)
Total expenditure	0.034** (2.016)	-0.032** (-2.924)	-0.012 (-0.816)	-0.001* (-1.820)	0.009 (0.808)
Summer	-0.001 (-0.134)	-0.002 (-0.465)	0.010 (1.521)	0.00000 (-0.022)	-0.007 (-1.386)
Fall	-0.022** (-2.615)	0.002 (0.408)	0.020** (2.648)	0.0001 (0.420)	-0.001 (-0.125)
Winter	-0.016* (-1.814)	0.003 (0.470)	0.015** (2.014)	0.00002 (0.083)	-0.001 (-0.153)
Intercept	0.010 (1.741)	0.0004 (0.121)	-0.012** (-2.426)	-0.00002 (-0.116)	0.002 (0.458)
R^2	0.18	0.23	0.24	0.14	0.21
DW	2.68	2.92	2.72	2.73	2.65

a Numbers in parentheses are t-ratios, **=significant at 5% level; * = significant at 10%.

Price elasticities

Given the parameters in AIDS model have little economic significance, the regression results of table I are more usefully evaluated in terms of elasticities. All the own Marshallian price elasticities are negative

and significant at the five percent level. Demands vary from inelastic for the UK salmon (-0.367) to elastic for the Chile salmon (-1.367). The demand for Norwegian salmon is -1.049. To gain insight into the relative substitution relationships, we computed compensated elasticities using Slutsky equation and reported in table II. Estimated cross-price effects between Norway and UK are significant and positive in signs. It is 0.067 for e_{13} and 0.746 for e_{31} . This indicates a reduction in the Norwegian price drags down the UK demand more so than vice versa. This is to be expected, as Norway's market share is 71% against just 6% for the UK. In UK equation, the magnitude of cross elasticities of e_{31} is three times and that of e_{32} is twice of own elasticity e_{33} . This shows that UK demand is more affected by Norwegian and Chilean salmon prices than its own price. It may explain the complaints from UK salmon producers.

Expenditure Elasticities

The conditional expenditure elasticities are all positive and significant except for that of Canada salmon, which only occupies 0.06% of EU market. The expenditure elasticities are barely elastic or inelastic for Norway, UK and ROW. As most of salmon from these countries are fresh, it indicates that fresh salmon are almost unit income elasticity and have a trend to become not luxury goods with large supply of farmed salmon. The elasticity for Chilean salmon is 0.481. Although it is relatively larger than that reported by Asche (1996) for frozen salmon in EU (0.158), it confirms Asche's conclusion that the fresh salmon is more income elasticity than frozen salmon in EU market [1].

Table II. Estimated Hicks Price Elasticities and Expenditure Elasticities

Equation	ei1	ei2	ei3	ei4	ei5	Expenditure
Norway	-0.305** (-3.441)	0.020 (0.348)	0.067** (2.056)	-0.004 (-0.592)	0.182** (4.693)	1.047** (44.798)
Chile	1.119 (1.668)	-1.338** (-3.135)	-0.207 (-0.835)	-0.125** (-2.456)	-0.284 (-0.969)	0.481** (2.710)
UK	0.746* (1.764)	0.421 (1.566)	-0.249 (-1.585)	0.005 (0.166)	-0.191 (-1.034)	0.908** (8.138)
Canada	-3.334 (-1.276)	-1.608 (-0.974)	1.487 (1.559)	-1.322** (-6.527)	-1.091 (-0.967)	-0.239 (-0.351)
ROW	0.566 (1.296)	0.176 (0.634)	-0.089 (-0.549)	0.115** (3.498)	-0.876** (-4.593)	1.092** (9.473)

a Numbers in parentheses are t-ratios, **=significant at 5% level; * = significant at 10%

Advertising Effect

Shift

The advertising shift variables in table I are positive and significant at 10 percent critical level in Norway equation, negative and significant at 5 percent level in ROW equation. It suggests that the Norwegian salmon benefits from its own promotion program at the cost of the ROW.

Elasticities evaluated at the sample mean are 0.046 for Norway and -0.385 for the ROW (table III), which indicates the spillover effect is much larger than the direct effect. This is to be expected, as Norway's market share is 71 percent against just 10 percent for the ROW. Although the advertising shifts are not significant for Chile and UK, their signs make sense. The negative spillover for Chile is expected, as the promotion stressed fresh salmon and almost all the Chilean salmon in EU is frozen. Recalling that the initial intention of Norway-EU agreement is to get win-win for both Norwegian and EU salmon producers by generic advertising (eat more fresh Atlantic salmon). The only positive signs of Norway and UK in table III show likely that the agreement has got the intended effects.

Rotation

As what we pointed out in section 2, curve rotation and parallel shift simultaneously change the demand elasticity. However the elasticity change of demand curve shift is proved to be negligible in most case by Kinnucan and Zheng (2004) [16]. We therefore take estimated parameter of price-advertising interact, which is to measure the demand elasticity change as the indicator of advertising-induced curve rotation.

In table I, only price-advertising parameter in UK equation is found significant at 5 percent level, which suggests that Norwegian promotion program rotates the demand curve of UK salmon not itself. Based on the estimation in table I, we computed the advertising rotation effect according to formula (8) and reported in table III.^d The calculated curve rotation effect for UK is 0.189, indicating a 1% increase in the Norwegian advertising would increase the slope of UK salmon demand by 18.9%. It suggests that Norwegian advertising weaken the products attributes of UK salmon in EU market. The result means the generic advertising works, for the purpose of generic advertising is to advertise the fresh Atlantic salmon as a whole. A 1% increasing of Norwegian advertising would increase its own slope by 14.2%, but it is statistically insignificant.

Table III. Estimated Advertising effects

Equation	Advertising elasticity	Slope change
Norway	0.046** (1.881)	0.142
Chile	-0.058 (-0.310)	0.030
UK	0.103 (0.867)	0.189
Canada	-0.483 (-0.668)	-1.330
ROW	-0.385* (-3.190)	-0.400

a Numbers in parentheses are t-ratios, **=significant at 5% level; * = significant at 10%.

The effect of advertising-induced rotation on the producer surplus is illustrated in Figure 1. Suppose prior to the advertising program the EU demand for Norwegian salmon (Excess demand) and Norwegian supply to EU market (Excess supply) schedules as the curved labeled D1 and S. Now suppose increasing the level of advertising, without consideration of demand curve rotation, D1 parallel shifts to D1'. The producer surplus resulting from the demand shift is presented as the shaded area *abcd*. However if the advertising rotates the demand curve in a counterclockwise, with the same amount of shift, we get curve D2' and new equilibrium point of f. Produce surplus is then presented by the area *acef*. It is quite obvious that *acef* is smaller than *abcd*, which suggest with the same magnitude of the demand shift, a counterclockwise of demand rotation will make the producer surplus shrink, vice versa. The exact effect of curve rotation on producer surplus depends on how demand elasticity responds to the advertising expenditure, the elasticity of excess supply curve and the total export value. For example, the producer surplus change will be mild if the advertising-induced change of elasticity is tiny, the excess supply is more elastic and the export value is relatively small.

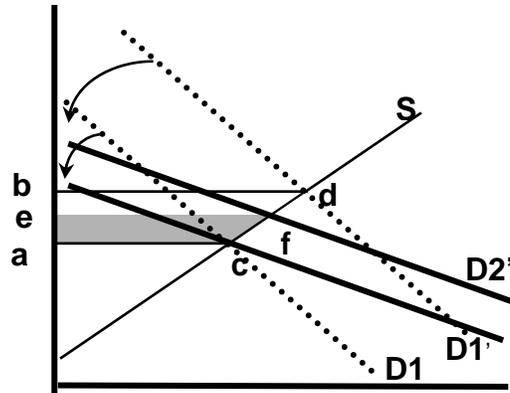


Figure 1. Effects of advertising on producer surplus

SIMULATION

Marginal cost-benefit ratio

Between years 1998 to 2006, the average yearly increase rate of Norwegian advertising expenditure is 38%. Using formula 8(a) in section 2, the yearly absolute change of own demand elasticity is 0.038 for Norway and 0.047 for UK, which indicates that the advertising makes both Norwegian and UK salmon more price elastic. We calculate the marginal return of advertising ($MBCR^e$) with the demand elasticity of Norway before and after more advertising expenditure. $MBCR$ changes from 5.93 to 6.19. This suggests an increase of 0.24 dollar return for one more dollar of advertising expenditure. The result is consistent with the classical rule that it is always less profitable to shift a more elastic demand curve.

Producer surplus

In order to examine the effect of advertising-induced shift and rotation on the change of producer surplus, we simulated the producer surplus of two scenarios presented in figure 1 under the framework of Equilibrium Displacement Model and with the formula ($\Delta PS = P^* P^0 Q^0 (1 + \frac{1}{2} Q^*)$), where asterisked variables indicate relative changes (e.g. $P^* = dP/P$). Scenario (1) the producer surplus change by advertising-induced shift without considering advertising-induced rotation or equivalent with constant elasticity and (2) the producer surplus change by the same magnitude of shift with the consideration of advertising-induced rotates.

The estimated absolute value of Marshallian elasticity (η) for Norwegian salmon is 1.046. Excess supply elasticity of Norwegian salmon in EU market (ε) is assumed to be 1.65.^f The estimated advertising elasticity (α) is 0.046 (table III). Average increase of Norwegian advertising expenditure per year between 1998 to 2006 is 38%. The base year of the price, quantity and advertising expenditure is 1998. We get producer surplus change of scenario (1) 7.56 million US dollars per year. It indicates Norwegian producer get 5.08 million more returns by increasing salmon advertising expenditure 2.48 US dollar per year.

Considering the advertising makes Norwegian salmon more elastic by absolute value of 0.038, calculating the producer surplus of scenario (2) with $\eta=1.011$, we get 7.67 million US dollar. The difference between two scenarios is 109,963 US dollars per year. The result suggests a tiny change in elasticity will affect the producer surplus not so tiny.

CONCLUDING COMMENTS

The estimated compensated cross price elasticities of Chile (marginal significant) and Norway are larger than UK own price elasticity, which means both Norwegian and Chilean salmon are strong substitutes to UK salmon in EU market and a reduction in either Norwegian or Chilean salmon drags down the demand for UK salmon more than the same reduction in its own price. This result indicates major suppliers like Norway and Chile are in a position to exercise market power in the EU market.

Results suggest that advertising can either shift or rotate demand curves. The promotion program conducted by the Norwegian Seafood Export Council shifted demand curve of Norwegian salmon rightward and that of ROW leftward. The advertising induced the demand curve of UK to rotate counterclockwise. Based on these results, we get the conclusion that spillover effect is important in our study. The positive signs of advertising parameters in Norway and UK equations and negative sign in Chile equation suggest that the Norway-EU salmon agreement has got the intended effects. The counterclockwise rotation of demand curves of UK indicates advertising weakened the uniqueness of UK salmon resulted by generic advertising.

Our study suggests that the long-ignored advertising rotation effect is important for market strategy. A tiny change of demand elasticity will substantially change the marginal cost-benefit ratio. Although producer surplus change is mainly induced by the demand shift, a tiny change of demand elasticity will generate a not so tiny change of producer surplus. The exact magnitude of advertising-induced producer surplus change is a complex issue. It depends on the extent of curve rotate and shift, advertising expenditure change, excess supply elasticity and total export value.

REFERENCES

- Asche, F. (1996). A system approach to the demand for salmon in the European Union. *Applied Economics* 28: 97–101.
- Asche, F, Bjørndal, T. and Sissener, E. H. (2003). Relative productivity development in salmon aquaculture. *Marine Resource Economics* 28: 205-210.
- Bagwell, K. (2005). The economic analysis of advertising, <http://www.columbia.edu/~kwb8/papers.html>, accessed 10 March, 2008.
- Bjørndal, T., Salvanes, K. G. and Andreassen, J. H. (1992). The demand for salmon in France: The effects of marketing and structural change. *Applied Economics* 24: 1027–34.
- Bjørndal, T., Gordon D. V. and Salvanes. K.G. (1994). Elasticity estimates of farmed salmon demand in Spain and Italy. *Empirical Economics* 4: 419–28.
- Bull, E. M. and Brittan, L (1997). Agreement on a Solution to ‘The Salmon Case’. Agreement between the Government of Norway and European Commission signed at Brussels, 2 June.
- Chang, H.-S. and H. Kinnucan(1991):. "Advertising, Information, and Product Quality: The Case of Butter." *American Journal of Agricultural Economics*. 73:1195-1203.
- Clarke, D.G. (1976). Econometric Measurement of the Duration of the Advertising Effect on Sales. *Journal of Marketing Research* 13: 345-357.

- Deaton, A. and Muellbauer, J. (1980). *Economics and Consumer Behavior*. Cambridge, MA: *Cambridge University Press*.
- DeVoretz, D. J. and Salvanes, K. G.(1993). Market structure for farmed salmon. *American Journal of Agricultural Economics* 75: 227–33.
- Dong, D., Kaiser, H. M. and Myrland, Ø. (2007). Quantity and quality effects of advertising: a demand system approach. *Agricultural Economics* 36: 313-324.
- Duffy, M. 2001. Advertising in Consumer Allocation Models: Choice of Functional Form.” *Applied Economics*. 33: 437-56.
- Eagle, J., Naylor, R. and Smith, W.(2004). Why farm salmon outcompete fishery salmon. *Marine Policy* 28: 259-70.
- Kinnucan, H. W. and Myrland, Ø. (2003). Free-rider effects of generic advertising: The case of salmon. *Agribusiness* 19: 315-24.
- Kinnucan, H. W. and Myrland, Ø. (2000). Optimal advertising levies with application to the Norway-EU salmon agreement. *European Review of Agricultural Economics* 27: 39–57.
- Kinnucan, H.W. and Zheng, Y. (2004) Advertising’s effect on the market demand elasticity: a note. *Agribusiness* 20: 181-88.
- Kinnucan, H.W. and Zheng, Y. (2005) National benefit-cost estimates for the dairy, beef, pork, and cotton promotion programs, in Kaiser, H. M., Alston, J. M., Crespi, J. M., and Sexton, R. J. (2005) *The Economics of Commodity Promotion Programs: Lessons from California*, Peter Lang, New York, pp. 255-86.
- Kinnucan, H. W. and Myrland, Ø. (2002). The relative impact of the Norway–EU salmon agreement: A midterm assessment. *Journal of Agricultural Economics* 53: 195–219.
- Knapp, G. P. (2007). Implications of aquaculture for wild fisheries: the case of Alaska wild salmon. Powerpoint presentation, Institute for Social and Economic Research, University of Alaska, Anchorage.
- Myrland, Ø., and Kinnucan, H.W. (2000). Measuring the effects of the 1998/99 Pan-European salmon marketing campaign in Germany and France. *Proceedings in the International Institute of Fishery Economics and Trade*.
- Myrland, Ø., Emaus, P.A, Roheim, C., and Kinnucan. H. W. (2004). Promotion and Consumer Choices: Analysis of Advertising Effects on the Japanese Market for Norwegian Salmon. *Aquaculture Economics and Management* 8:1-18.
- Myrland, Ø., Dong, D. and Kaiser, H. M.(2007). Quality versus quantity effects of generic advertising: The case of Norwegian salmon. *Agribusiness* 23:85-100.
- Nerlove, M. and Arrow, K. J. (1962). Optimal advertising policy under dynamic conditions. *Economica* 114: 129-42.

Pacific exchange rate service, The University of British Columbia, Sauder School of Business.
<http://fx.sauder.ubc.ca/> Accessed 6, February, 2008.

Quilkey, J. J. (1986) Promotion of primary products - a view from the cloister, *Australian Journal of Agricultural Economics* 30: 38-52.

Zheng, Y and Kinnucan, H.W. (2008) Measuring and testing advertising-induced rotation in the demand curve. *Applied Economics*: forthcoming.

ENDNOTES

^a A Pascal distribution lag is also considered with the weights given by $w_i = (1 - \lambda)^2 (1 + i)\lambda^i$. Value of λ was assumed to build up a smooth geometric decay or a hump-shaped lag structure. Advertising effects estimated performed statistically poorer.

^b The derivation of the formula could be provided if asked for.

^c For more detail of the derivation of the equation, see Kinnucan and Zheng (2004).

^d The estimated value was used, ignoring the significance issue. The market share and advertising took their mean values when they are needed.

^e $MBCR = \frac{\alpha / \eta}{\theta}$ given by Kinnucan and Zheng (2005), Where α is the advertising elasticity, η is the absolute value of the demand elasticity and $\theta = A / pq$ is the promotion intensity defined as advertising expenditure divided by product value. In our sample period, $\theta = 0.0074$.

^f The supply elasticity value is calculated with the equation $\varepsilon_x = \frac{\varepsilon_d + K_d \eta_d}{K_x}$, where Norway domestic supply

ε_d is estimated to be 1.571 by Ashce, F. et al (2003); $k_d = 0.027$ is mean of Norwegian domestic market share at our sample period; $k_x = 0.975$ is export share of Norwegian salmon $\eta_d = 1.35$ is given by Kinnucan and Oystein (2000). We assume excess supply elasticity of Norwegian salmon in EU is the same to that in the world market.