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Quantitative Analysis of the Impact of Free Trade in the Japanese Salmon Market −A Simultaneous Equation Model−

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【abstract】
Recently, free trade agreements such as the Trans-Pacific Partnership (TPP) have been a subject of much discussion. However, no studies have conducted a quantitative analysis providing concrete simulation results regarding the economic impact that free trade would have on Japanese marine businesses, including fisheries. Salmon is one of the most important fish species produced and consumed in Japan. Therefore, the introduction of free trade into this lucrative market could have wide-ranging impacts. To determine these impacts more precisely, we estimate the Japanese salmon market using a simultaneous equation model and conduct several simulations incorporating free trade scenarios. Our results indicate that free trade will have negative impacts on Japanese salmon production, while positive outcomes can be encouraged through policies ensuring sufficient support to export businesses such as HACCP.

【keywords】
sanitary conditions, simultaneous equation model, economic impacts, salmon market, TPP

1. Introduction

In 2012, Japan entered negotiations over the Trans-Pacific Partnership (TPP), which would bring about full trade liberalization between signatory countries. Although Japan's Ministry of Economy, Trade and Industry posits that joining the TPP would create positive economic effects for Japan, the MAFF estimates the opposite (METI (2010), Suzuki (2010), MAFF (2010)).

This difference in perceptions regarding the effects of free trade is rooted in comparative cost theory. Despite these ideological differences, however, the fact that Japan has participated in TPP negotiations means that accurate predictions of the likely economic impacts, free of theoretical bias, are needed to devise countermeasures to avoid any negative effects (Tsujii (1997)). Consider the case of Japan's fisheries industry, which form an essential regional industry. If one assumes that the fisheries industry's most important function is ensuring regional employment, then a strategy to preserve this industry will be essential in any trade liberalization process, even as liberalization could be considered essential due to its benefits for global businesses undergoing international expansion. Identifying such priorities can help to accurately determine the required policy interventions.

The fisheries industry holds great economic importance, especially for coastal areas. Given their high value and ability to serve as a globally traded commodity, salmon are extremely important to the Japanese fishing industry. The industry is careful to maintain stable salmon stocks by regularly releasing young fish so as to ensure future production. In fact, it is estimated that Japan's salmon exports were worth 30 billion yen in 2010 (Ministry of Agriculture, Forestry and Fisheries, MAFF (1975-2010) Annual Statistics on Fishery and Aquaculture Production). Given the numerous other salmon producers worldwide, such as America (Alaska), Norway, and Chile, as well as other consumers, the effects of liberalization on the current Japanese salmon market needs to be investigated. In particular, as salmon is one of the most important fish species, traded by every global fishing business, the supply and demand predictions in this study clarify the movements of these global businesses.

Therefore, this study uses structural equations to estimate the domestic effects of complete elimination of tariffs on the salmon market.

While an earlier study appears to have focused on a similar topic, its focus and intent were quite different from those of the present one. Ariji (2006) covered the period prior to 2000, when the influence of globalization was weaker, and his study model did not allow simulations to include exports.

2. Materials and methods

2-1. Trends in supply and demand

To determine the market's composition, we used annual statistics on the Japanese salmon market covering the period from 1975 to 2009 to confirm the supply and demand trends. We have, thus, considered the widest possible data range, using currently available statistics to preserve continuity. (Explanations of parameters are described in note of figures.)

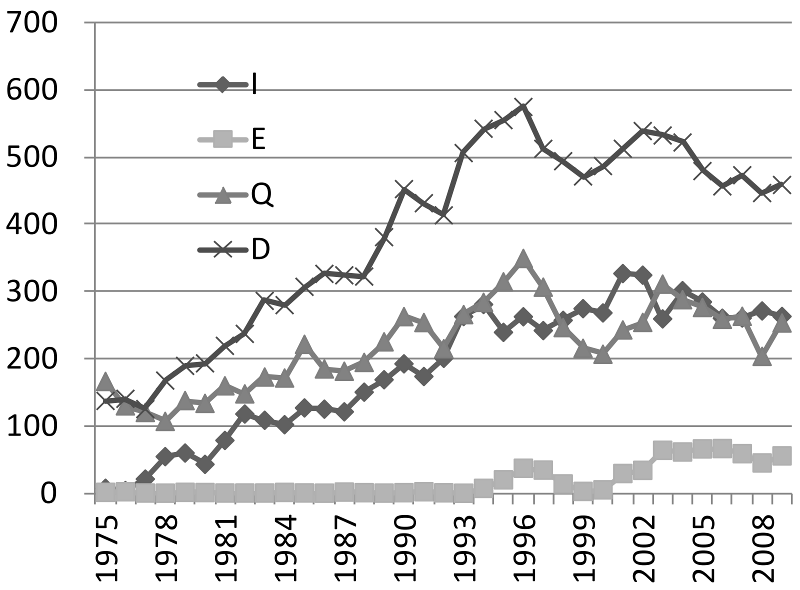

Figure 1 (Yearly changes in) trends in Japanese salmon supply and demand

Notes:

1) Domestic demand (D) (metric tons); domestic production (Q) (metric tons); import (I) (metric tons); and export (E) (metric tons) volumes of salmon on (Data sources: Ministry of Agriculture, Forestry and Fisheries (1975-2010), Annual statistics on fishery and aquaculture production, (MAFF), and Ministry of Finance Japan (1975-2010) Trade statistics, MOF) Y-axis 1000 metric ton.
2) Import and export amounts are converted by the estimated result with original fish weight conversion ratio (0.65), and then weighted by filet and round ratio in trade statistics.

First, we examine the supply and demand trends for Japanese salmon (Fig. 1), based on the calculation of annual statistics from the MAFF (Annual Statistics on Fishery and Aquaculture Production and Annual Statistics on Marketing of Fishery Products) and the Ministry of Finance, MOF (Trade Statistics). Domestic production (Q) increased through the mid-1990s, from approximately 100,000 tons in the latter half of 1970s to over 300,000 tons in 1995. This was followed by a sudden decrease to approximately 200,000 tons in 1999-2000, after which it recovered to level off at approximately 250,000 tons(1).

While import volume (I) increased from the 1990s, it leveled out at about 250,000 tons. Therefore, the market clearly plateaued at the start of the 1990s. In the same

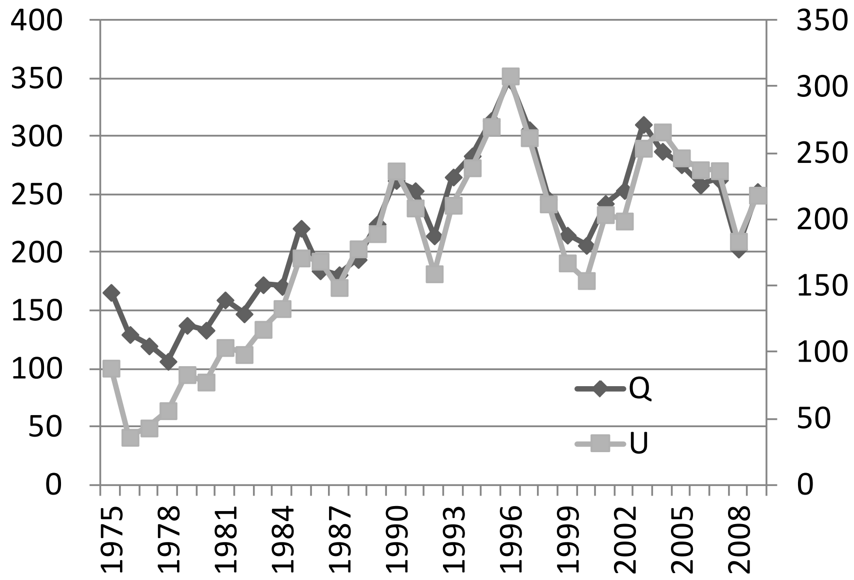

Figure 2 Comparison of domestic salmon production with the amount of returning (salmon)

Note:

Domestic production (Q) (metric tons); the amount of returning salmon (U) (Index 1982 = 100) (Data sources: Ministry of Agriculture, Forestry and Fisheries (1975-2010), Annual statistics on fishery and aquaculture production (MAFF) and The Fisheries Agency (2011)). Y-axis 1000 metric tons.

period, salmon's export volume (E) began to increase and it currently hovers around 60,000 tons. Indeed, these figures make salmon Japan's highest volume marine product export. Demand (D), calculated by subtracting amount exported and concurrent ending inventory from total supply (sum of ending inventory from the prior period, or the opening inventory, added to the combined total of domestic production imports), consistently increased through the first half of the 1990s. Subsequently, demand showed a moderate decreasing trend. However, while production and import volumes plateaued, export volumes increased. From a market equilibrium theory perspective, these current trends could be seen as resulting from demand being predetermined by price and income, given that excess supply is being diverted to inventory and exports (Ito *et al.* (1985)).

Next, in order to examine domestic production trends in detail, we compared these with levels of returning salmon using the Report on the Current Status of International Fishery Resources (Fisheries Agency). The graph clearly indicates that fish catch volumes are essentially determined by the number of returning salmon. This

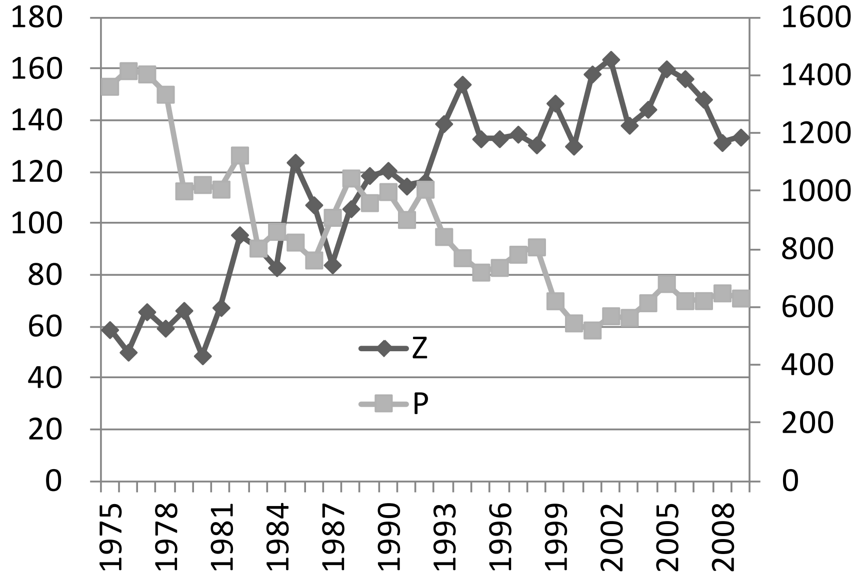

Figure 3 Comparison of price with ending inventory of salmon

Note:

Domestic price (P) (yen/kg), ending inventory (Z) (metric tons) (Data sources: Ministry of Finance Japan (1975-2010) Trade statistics, MOF). Y-axis 1000 metric tons.

number, in turn, is essentially influenced by increases or decreases in salmon resources. By nature, the salmon return to their birthplace, so released salmon will migrate back to their mother river where they are caught, mainly with fixed nets. (1)

Next, the graph comparing the price to ending inventory (Fig. 3) shows the supply-demand gap. It reveals a strong inverse relationship, with the supply-demand gap determining price. This finding concurs with the Walrasian equilibrium (Ito *et al.* (1985)).

Next, we examine the net import volume (IE = I−E) and its suspected main determining factor, namely changes in the ratio between domestic and foreign prices (P/PI: Ratio of domestic price P (market price in the consuming region, from Annual Statistics on Marketing of Fishery Products) to international price PI (from Trade Statistics), shown in Fig. 4. A nearly positive correlation can be observed. The ratio between foreign and domestic prices results from international prices determined by the international market equilibrium, while domestic prices are determined by the domestic market's equilibrium. For businesses, importing marine goods into the domestic market becomes more profitable as the ratio of domestic to international prices increases, and increasing exports becomes more profitable as the ratio of

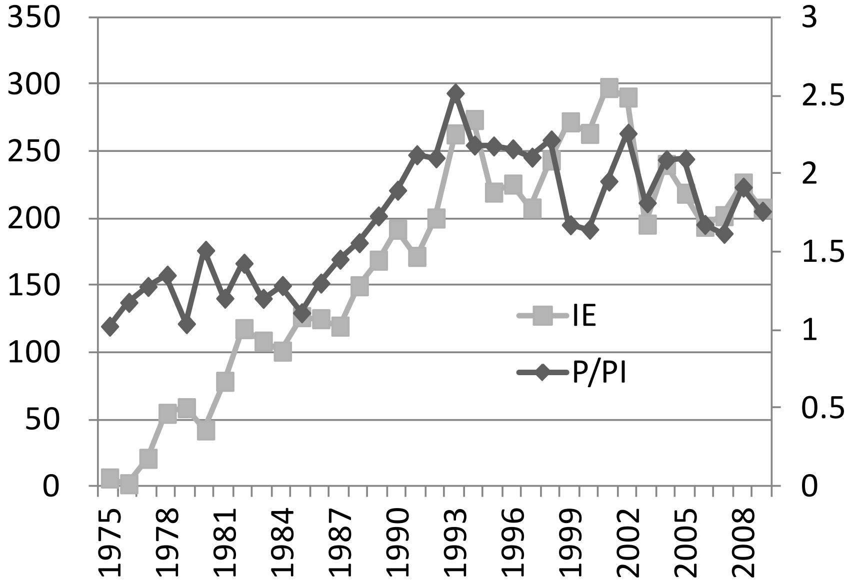

Figure 4 Relation between the net import volume (IE = I－E) and changes in the ratio between domestic and foreign prices

Notes:

The market price in the consuming region (P) and international price in yen (CIF value, yen/kg). (PI) of salmon (Data sources: Ministry of Agriculture, Forestry and Fisheries (1975-2010) Annual Statistics on Marketing of Fishery Products, MAFF and Ministry of Finance Japan (1975-2010) Trade statistics, MOF). P/PI: Ratio of domestic price P (market price in the consuming region, from Annual Statistics on Marketing of Fishery Products) to international price PI (from Trade Statistics).

domestic to international prices falls (Ito *et al.* (1985)). In reality, at the start of the 1990s, the ratio of domestic to international prices as well as net imports simultaneously exhibited a slightly falling trend.

Fig. 5 shows changes in salmon's international price, with PID and PI referring to the international price in dollars and in yen, respectively. We used the CIF price or the price prior to tariffs, from the Trade Statistics. Significant price differences are apparent. By and large, after the PI dropped from 2050 yen/kg in 1975 to 514 yen/kg in 1993, i.e., to approximately one-fourth its original price, the decreasing trend finally slowed, hitting its all-time low in 2002 at 385 yen/kg. Thereafter, it slightly increased to reach its 2009 price of 550 yen/kg. On the other hand, after the PID experienced a steep price rise from 6.6 dollars/kg in 1975 to 8.1 dollars/kg in the latter half of the

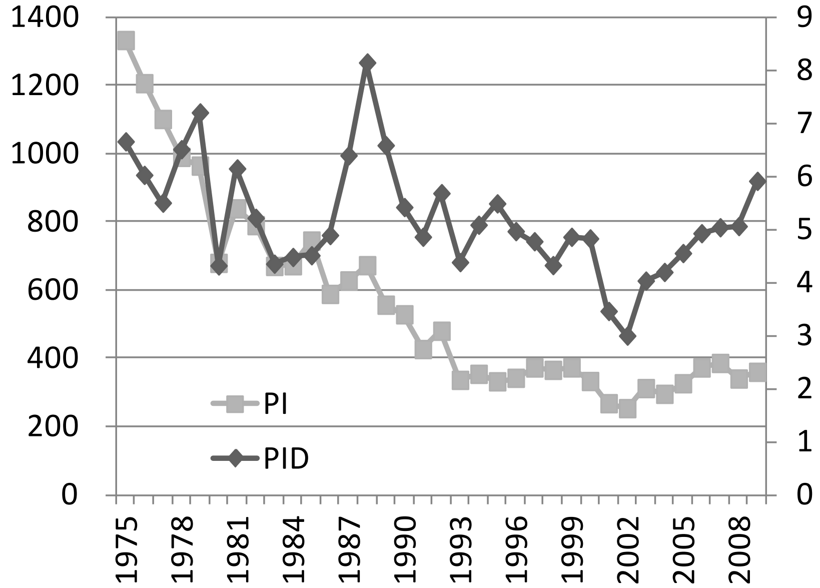

Figure 5 Changes in the international price of salmon, with PID and PI

Note:

Both PI (yen/kg) and PID (dollar/kg) were referred to the international price (CIF value) from Trade Statistics in dollars and in yen, respectively.

1980s, it fell to 3 dollars/kg by 2002 before sharply increasing to 5.9 dollars/kg, or nearly double its earlier price, in 2009. Small variations in the PI compared to those in the PID post the 1990s can be attributed to the yen's constant appreciation. Without this appreciation, salmon's international price would have doubled after 2002—a significant rising trend.

The above trends confirm that the domestic salmon market can be analyzed using the small open economy model (Ariji (2006), Ito *et al.* (1985), Yuize (1978)).

2−2. Analytical Model

To simulate the effects of complete liberalization in the salmon market, we first developed estimates for the structural equations that comprise the simulation model. As a partial equilibrium model is preferable for use with structural equations in a market simulation covering a specific resource, we selected the following model for the structural equations (Ariji (2006), Yuize (1978)):

1) Demand function

$$lnD = \alpha_0 + \alpha_1 lnP + \alpha_2 lnY + \alpha_3 Dummy1 + \alpha_4 Dummy2 \tag{1}$$

The demand function is a common double logarithmic model determined by price and income. D is the level of demand, derived from its definitional identity (as stated above). We used private final consumption expenditures, with P as the market price in the consuming region and Y as the national income variable. The dummy variables (Dummy1, Dummy2) were set as 1 for 1999, and thereafter when the consumption of raw foreign produced salmon in conveyor belt sushi restaurants overtook that of salted salmon (Akiya (2007)). Due to trend changes in the response of the dummy variables, we extended the dummies over two periods, with Dummy1 covering 1999 to 2001, and Dummy2, covering 2002 onwards.

2) Supply function

$$lnQ = \beta_0 + \beta_1 lnP + \beta_2 lnR + \beta_3 lnU + \beta_4 Dummy3 \tag{2}$$

The supply function was derived from the short-term production function. For the long term, marine products typically use a supply function derived from a long-term production function (surplus production model) (Clark (1983)). However, because the amount of returning salmon (U) can be clearly used as a variable for resources, and because salmon mostly caught upon breeding, necessity required we treat the returning amount as an exogenous factor. Therefore, we used a short-term production function as the basis of our function. Additionally, under these circumstances, prices in the fishing industry are known to respond vertically, and so must be treated as a variable. R is the proxy variable for the cost of production materials, using the price of petroleum products.(2) The dummy variable sets the year 2008 as 1, whereby all industries incurred major operational damages due to monetary shocks. In contrast with the supply function provided in the previous paper, we use a double logarithm, as the model estimates were precisely conducted to avoid the negative values predicted in the simulation and estimates (Ariji (2006), Yuize (1978), Ishizaki (1997)).

3) Import function

$$lnIE = \gamma_0 + \gamma_1 \, ln\left(\frac{P}{PI \times \frac{TAX + 100}{100}}\right) \tag{3}$$

The import function is a double logarithmic function using the net import amount as an explained variable. Because net imports are determined in a rational economic manner that uses the ratio of domestic to international prices as pricing information, this formula, therefore, adheres to the economic theory, thus employing the domestic-international price ratio as an explanatory variable. This is the most typical method under the partial equilibrium model(3) (Ariji (2006), Ito *et al.* (1985), Yuize (1978), Mori (1972)).

4) Price function

$$\ln P=\delta_0+\delta_1 \ln Z \quad (4)$$

The price function is a Walrasian equilibrium model with ending inventory —showing the annual supply-demand gap—set as its explanatory variable. Price is determined by the supply-demand gap because marine product producers find it difficult to control production amounts based on pricing information. Therefore, the Walrasian equilibrium model provides an economically appropriate balanced equation because it accounts for the fact that inventory adjustment is performed by freezing the salmon, and that it is difficult for the fishing industry to adjust supply in response to price changes (Ito *et al.* (1985), Nishimura (1990), Ishizaki (1997), Mori (1972)).

5) Definitional equation

$$Z_t = Q_t + IE_t + Z_{t-1} - D_t \quad (5)$$

$$IE = I - E \quad (6)$$

Fig. 6 is a flowchart depicting our formulated structural equations. The flowchart indicates that this formulation is valid because the market is not divergent.

2−3. Estimation Method

The simultaneous inference bias that occurs when using the standard ordinary least squares (OLS) method to derive structural equation estimates renders making accurate estimates impossible. Therefore, we performed a simultaneous estimation. We avoided the identification problem (wherein it becomes impossible to identify what the function is indicating) by choosing an estimation method after investigating degree conditions. In our case, the degree is three as this equals the endogenous variable in the structural equation minus one. The five variables in the demand function, five in the supply function, seven in the import function, and eight in the price function fall under degree conditions not included in the function. Thus, although not unidentifiable, they are subject to over-identification. Therefore, we adopted the 3-stage least squares method (3sls) as the estimation method. This method, the most widely used system estimation method, permits an estimation to be run despite over-identification (Wago and Ban (1988)). We used Newton's method, as this can be solved even if solving for the model is difficult. Similarly, we did not use the standard coefficient of determination to verify our estimation formula's theoretical coherence. Instead, we compared our estimation of the endogenous variables, inserting actual measured values of the exogenous variables into the estimated complete structural equation system, and the

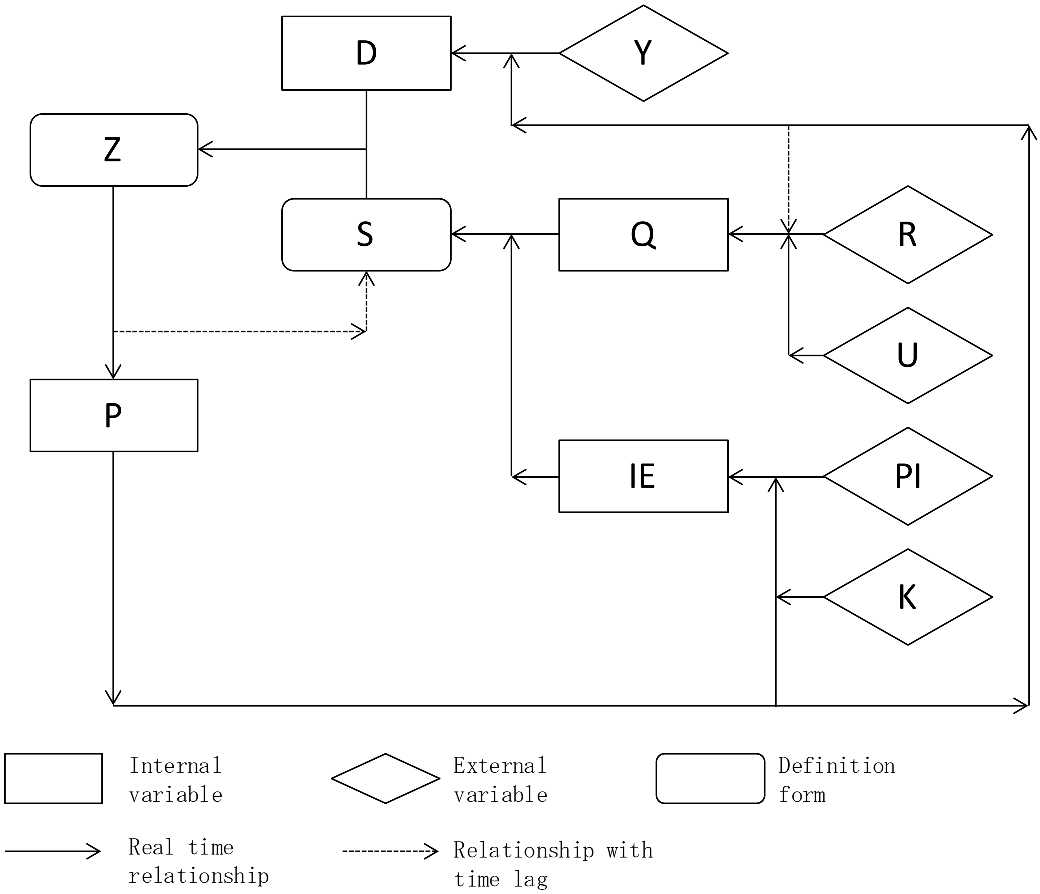

Figure 6 Flowchart representing the formulated structural equations

Note:

Each volume of salmon indicates Domestic demand (D); domestic production (Q); import (I); export (E); the net import (IE = I−E); and returning (U). Proxy variable (R) (Index 1991 = 100) for the cost of production materials, using the price of petroleum products private final consumption expenditures (Y) (billion, yen, and real), yen and dollar exchange rate (K), and ending inventory (Z).(Data sources: METI (2010), Ministry of Agriculture, Forestry and Fisheries (1975-2010) Annual statistics on fishery and aquaculture production, MAFF, Ministry of Agriculture, Forestry and Fisheries (1975-2010) Annual Statistics on Marketing of Fishery Products, MAFF and Ministry of Finance Japan (1975-2010) Trade statistics, MOF). Y-axis 1000 metric tons.

actual measured value of the endogenous variables. This study utilized the final test. Data is the annual time series covering 1978-2009. All measurements were obtained with TSP5.1 (made by TSP International) licensed to the Laboratory of Marine Product Economics of the Department of Fisheries, Faculty of Agriculture, Kinki University.

Table 1 Estimation results

Function	Parameter	Estimate	Standard Error	t-statistic	P-value	DW	R2	Theil's U Inequality coef. 1961
DEMAND	α0	0.73	1.76	0.41	[.681]	1.31	0.96	0.027
	α1	−0.86	0.12	−7.02 ***	[.000]			
	α2	1.45	0.09	16.17 ***	[.000]			
	α3	−0.32	0.04	−7.58 ***	[.000]			
	α4	−0.35	0.06	−6.03 ***	[.000]			
SUPPLY	β0	8.97	0.35	25.92 ***	[.000]	1.76	0.98	0.018
	β1	0.01	0.03	0.19	[.849]			
	β2	−0.03	0.01	−2.42 **	[.015]			
	β3	0.67	0.02	30.36 ***	[.000]			
	β4	−0.13	0.02	−7.64 ***	[.000]			
IMPORT	γ0	11.11	0.13	86.85 ***	[.000]	1.29	0.85	0.070
	γ1	1.83	0.24	7.78 ***	[.000]			
PRICE	δ0	13.96	1.13	12.32 ***	[.000]	0.94	0.85	0.049
	δ1	−0.63	0.10	−6.44 ***	[.000]			

Notes:

1) ***; Significant level at the 1% level, **; Significant level at the 5% level,*; Significant level at the 10% level;

2) Durbin Watson statistic DW; coefficient of determination after corrections to the degrees of freedom based on the final test R2;

3) Theil's U, inequality coefficient of the definition in 1961.

4) Theil's U statistic is a relative accuracy measure that compares the forecasted results with a naive forecast.

5) Number of observation is (32) (1978-2009).

3. Results

The results of the estimation are shown in Table 1[(4)]. All sign conditions are fulfilled, and the coefficients of determination, following corrections to the degrees of freedom based on the final test, are all favorable, with 0.96 for the demand function, 0.98 for the supply function, 0.85 for the import function, and 0.85 for the price function. Theil's inequality coefficient is also favorable. Only the price term in the supply function is not significant. This result is consistent with previous research showing that fisheries find it difficult to respond to price changes in short-term supplies. All other parameters, excluding unimportant constants, are significant (Wago and Ban (1988)). Therefore, we can conclude that these estimate results are reliable.

Since the basic form is double logarithmic, all parameters are elastic. The price

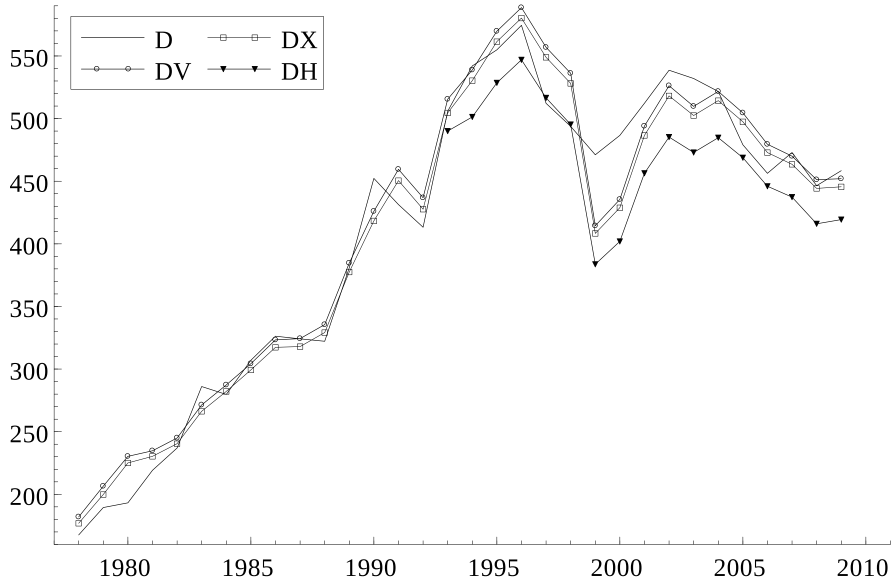

Figure 7 Simulation results of the volume of salmon's domestic demand

Notes:

1) D represents the demand. DX represents the results of the final test using actual measured values.
2) DV and DH represent the results of simulations where tariffs were abolished and international prices increased.
3) 1000 metric tons.
4) We posited two simulation scenarios: (1) the current tariff rate of 3.5% was reduced to 0 (Index V) and (2) the exchange rate remained at current levels (no further yen appreciation), and the international price rose by 20% (Index H). The estimates in Index X are the results of the final test using actual measured values.

elasticity of demand is −0.86. A value under 1 but equal to or exceeding 0.5 shows that it behaves as a necessary good, with a relatively high value among marine products. Salmon's income elasticity is 1.45. As shown in previous studies (Ariji (2006)), a value exceeding 1 indicates that it behaves as a superior good compared to other marine products, and therefore income changes have a major effect (5). The price elasticity of supply is small and insignificant (6) (Ono(2005)). However, elasticity in response to the price of production materials is −0.03, which is significant but yields little effect. In contrast, the largest factor is elasticity of returning salmon amounts. Its value of 0.67 indicates that salmon fishing production levels are largely influenced by numbers of returning salmon. The elasticity of net imports with respect to the domestic-

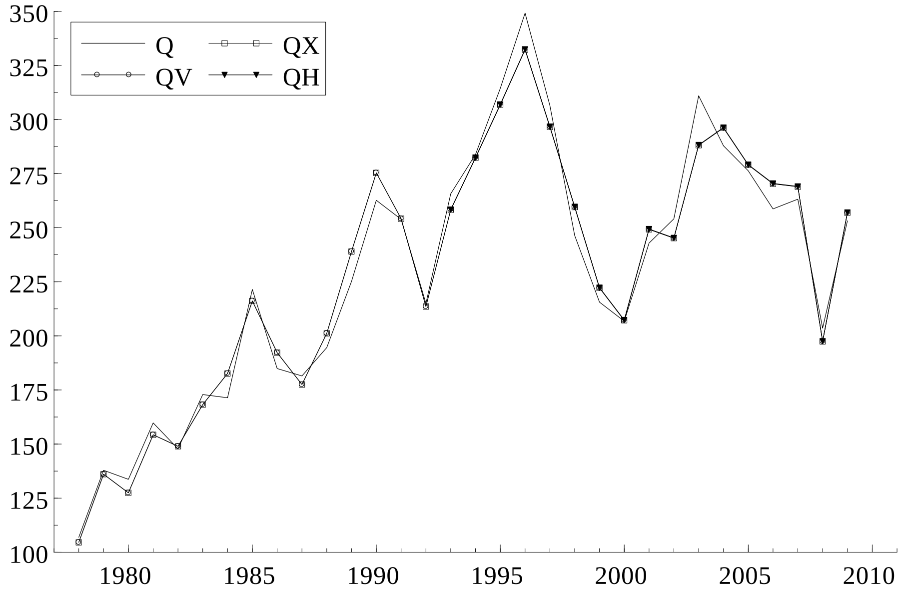

Figure 8 Simulation results of the domestic salmon production

Notes:

1) Q represents the real value of domestic production.

2) QX represents the results of the final test using actual measured values.

3) QV and QH represent the results of simulations where tariffs were abolished and international prices increased.

4) 1000 metric tons.

international price ratio was quite large at 1.83, revealing that salmon has already been acting as a global good. Simultaneously, as its international price rises, a slowdown in yen's appreciation would confer significant advantages to exports.
Regarding the price function, as the elasticity of the demand-supply gap to price was −0.63 (i.e., between −0.5 and −1.0), we can determine that this is a typical value, not a special response (Ono (2005)).

4. Simulation

Based on the abovementioned estimated structural equations, we conducted a simulation for conditions of complete trade liberalization (7). We solved the simulation using a final test based on Newton's method, in the same manner as our verification of theoretical validity. We posited two simulation scenarios: (1) Japan's current import tariff rate of 3.5% was reduced to 0 (Index V) and (2) the exchange rate remained at

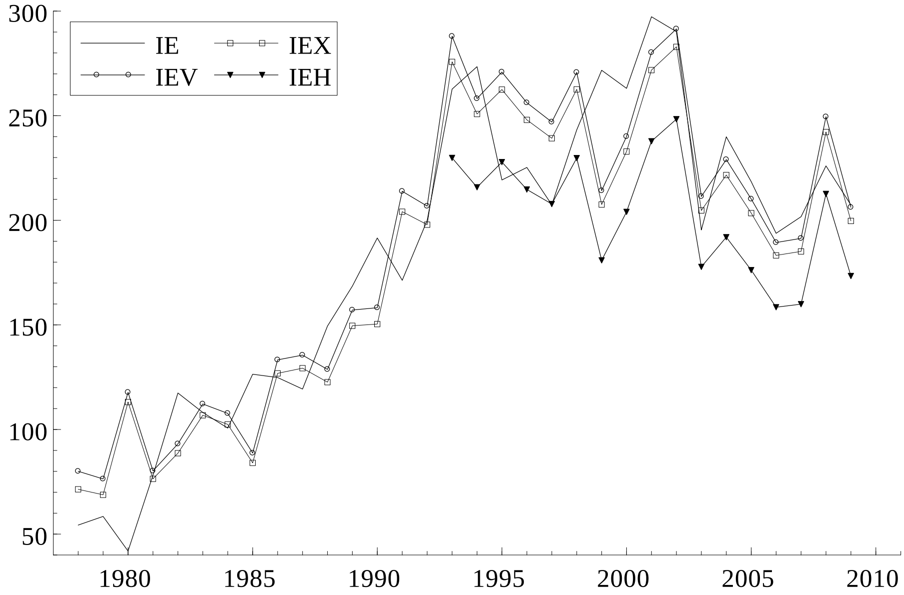

Figure 9 Simulation results of salmon import-export volumes

Notes:

1) IE represents Japan's salmon import-export volumes.

2) IEX represents the results of the final test using actual measured values.

3) IEV and IEH represent the results of simulations where tariffs were abolished, and international prices increased.

4) 1000 metric tons

current levels (no further yen appreciation), while the international price rose by 20% (Index H). The estimates in Index X are the results of the final test using actual measured values.

If trade liberalization occurs with no change in salmon's international price, there would be a 0.011% decrease in domestic catches, a 1.7% decrease in domestic consumer prices, a 3.2% increase in net imports, and domestic fishing would lose an average annual amount of 3.1 billion yen. While production levels would suffer no real impact, prices would be slightly affected, which would coincide with an increase in import volume.

However, given that the international price has shown an increasing trend in recent years, even as the domestic producer price has decreased, the relative domestic price has shown a downward trend compared with the international price. This is one reason behind the increase in exports. On the other hand, the yen's major appreciation has stabilized following the 2008 monetary panic, which means that international prices

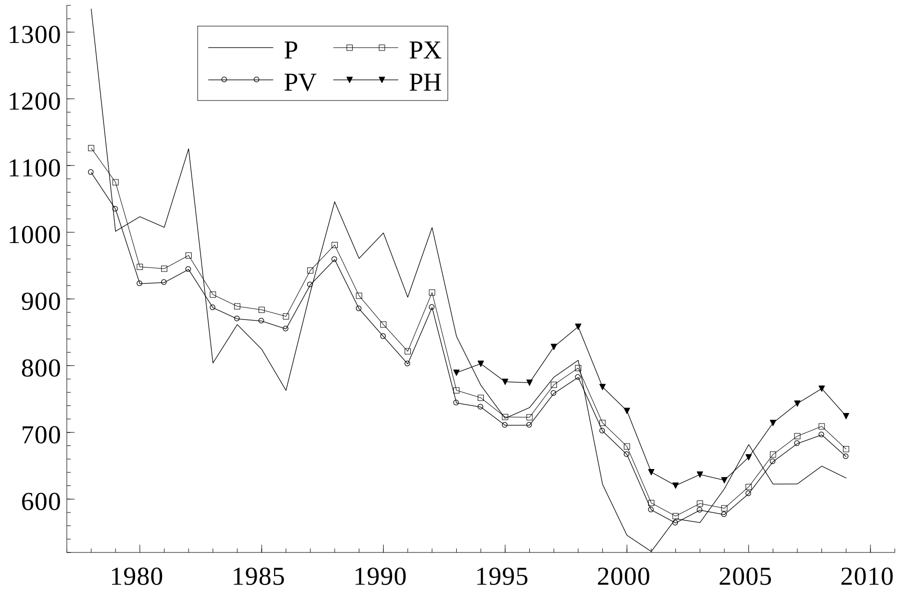

Figure 10 Simulation results of the domestic price of salmon

Notes:

1) P represents the domestic salmon price. PX represents the results of the final test using actual measured values.
2) PV and PH represent the results of simulations where tariffs were abolished, and international prices increased.

should show a comparative decrease (Suzuki (2010)). Thus, an appreciating yen exerts a negative effect on exports. Examining the simulation scenario (2) with this understanding, it can be determined that net imports would decrease if the major yen appreciation ceased, if the yen recovered to about 1 dollar/94 yen (assuming that 2009 levels are more or less maintained), and if the international price (importing price) rose 20%. Assuming imports are static, exports should increase 79% from their average since 2001, increasing export values by a total of 14.1 billion yen (derived from the amount of increase multiplied by the international price). The domestic consumer price would rise 7.4% as supply-demand gap shrank due to increasing exports. While domestic production would only rise 0.05%, its value would nevertheless increase by 12.2 billion yen due to the price increase (8).

5. Discussion and conclusion

The simulations performed in this study demonstrate that under current conditions, the direct effects of complete trade liberalization upon the domestic fishing industry would be limited. This result occurs because the current tariff rate of 3.5% is already quite low. However, this is merely quantitative. Therefore, considering the matter qualitatively, we need to formulate countermeasures for globalization's effects.

For example, there has been a trend (not limited to TPP) toward implementing mandatory safety management systems for global products (such as the mandatory HACCP certification). Japan's implementation has been considerably slower than that of foreign countries. The significance of the TPP may ultimately become less about eliminating tariffs and more about employing favorable market regulations (it will certainly not involve eliminations alone). If safety management becomes mandatory in domestic and international markets, Japan's salmon fishing industry faces a high risk of losing both its domestic and international markets, making rapid responses and support measures essential (Japan Fisheries Association (2011)).

On the other hand, we can see that international demand for salmon is increasing, and that chum salmon, Japan's most plentiful fish species, enjoys higher popularity overseas. Therefore, it is likely that profitable export opportunities will increase in the future. In fact, simulation results show that even if tariffs were abolished, both the export and domestic production values would increase, by 14.1 billion yen and 12.3 billion yen (domestic producer price), respectively, at 94 yen/dollar levels and with a 20% price increase. Thus, we can conclude that the Japanese fishing industry as a whole could increase its profits if tariffs were abolished (9).

Notes

(1) The definition of the data series is decided by the estimated result with the original fish weight conversion ratio (0.65), and that weighted by filet and round ratio in trade statistics.

(2) Because the price index of oil products is almost same as the manufacturing supplies price, the price index of oil products is used to avoid a data deficit. In addition, we use the oil price index as the weight of the cost of fishing tools (the net or FRP ship) and energy oil are the largest. The labor wedge is considered part of the factor price but it is not significant in the estimation. This is an important issue to resolve; however, it would require analysis of fishery households and management. This topic will, therefore, be the subject of our future research. Furthermore, fisheries do not calculate the ratio of returning salmon; rather it is determined by an independent method.

(3) The model import function is a small country open economy type in which relative

price is the explanatory variable. For more details, refer to Tsujii (1997), Ito and Oyama (1985), Yuize (1978), and Nishimura (1990). See note (8) for further reasons supporting this assertion.

(4) The DW is not significant in the price function but the result is almost the same in the studies of Yuize (1978) and Ishizaki (1997). This is one of the methodological problems of partial equilibrium approach and one solution is to use CGE, but is not the focus target of this study, so we use this model. The 2sls cannot avoid the over discernment and the results of 3sls's is best, therefore, we use it.

(5) One difference in our result from that in the study by Ariji (2006) is considered to come from estimated time differences. As salmon consumption preference has recently changed from salted to raw, this change is considered one factor leading to increased income elasticity.

(6) This study mentioned that fisheries find it difficult to react to current prices. This fact is important in analyzing management decisions. In the long term, fisherman can react to price and so they change their capital and fishery tools, but in the short term, reacting to the current price is difficult because the fisherman is a price taker, as such, faces the acquisition in advance competition problem.

(7) The simulation time length is set for 20 years from the current year (2012).

(8) The size of the global salmon market is 2.4 million metric tons (2008), at least in exports, and its growth rate since 1990 has averaged 9%. Japan's domestic salmon market is 0.25 million metric tons (2008), one-tenth of the global market. Japan's export price is USD 2.3/kg while North America's export price is USD 5.6/kg.

(9) We should emphasize the Japanese fishing industry's much needed interventions in terms of increasing profits in the global market, creating domestic employment, and investing in entry barrier removal (EUHACCP).

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