EFFECTS OF IMPORT AND INVENTORY AMOUNTS ON CHANGES IN WHOLESALE PRICES OF SALMON IN JAPAN

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ABSTRACT

Japanese salmon fishery is facing a juncture of existence and pressed for the improvement of constitution. The decline of high seas salmon fisheries was taken and the import amount increased rapidly. In addition, domestic production by coastal set net fisheries has increased with a success of salmon enhancement in Japan. Salmon market has internationalized consequently, decreasing wholesale prices of domestic salmon in Japan. Factors on short-term and long-term changes in the wholesale prices of salmon at the main landing ports in Hokkaido were examined. The wholesale price increased in the year when the landing amount of salmon decreased from the previous year. A negative correlation between the landing amount and prices of salmon at the landing ports indicated that the prices of salmon were influenced by the landing amount. It was also clarified that the import amount of salmon influenced the wholesale price of salmon. The wholesale price of salmon in the entire Hokkaido showed the long-term variability depending on the amount of imported salmon, and the wholesale price of salmon in the regions showed the short-term variability depending on the amount of landing salmon. Factors on wholesale price function of salmon in Japan were analyzed by econometric method. It was clarified that wholesale price of fresh salmon decreased when inventory amount of fresh salmon or import amount of fresh salmon increased and wholesale price of fresh salmon decreased when inventory amount of salted salmon roe and fishery production of fresh salmon increased. Increase in the inventory amount of fresh salmon in recent years was caused because of increase in the import amount of fresh salmon produced by aquaculture in winter.

Keywords: Salmon; Wholesale price; Landing amount; Import amount; Inventory amount

INTRODUCTION

Japanese salmon fishery is facing a juncture of existence and pressed for the improvement of constitution. Fishery production of matured salmon returned coastal area increased rapidly in 1980’s in the northern part of Japan. On the other hand, wholesale price of domestic salmon showed a peak in 1988. It fell afterwards and decreased a one-third in a peak recently. If the decrease of wholesale price of salmon depends on a factor of economic structure surrounding salmon fishery, it is necessary to change in production structure corresponding to economic environment. Therefore, it is important to investigate economic appearance related to salmon fishery, particularly a supply and demand trend of domestic salmon. It was elucidated that a trend of domestic production amount and import amount as a supply side of salmon, and a trend of domestic consumption and a characteristic of foreign demand (export amount) as a demand side of salmon to survey relationship between internal salmon production and consumption in Japan. It was considered that a change of structure to be found in a change of demand and supply which is a basic frame deciding market price of salmon in Japan (Shimizu 2001).

The recent years are severe age for salmon set net fishery because the difference with an income and management expense of set net fishery has reduced depends on the decrease of wholesale price. What kind of cause will bring about a slump in wholesale price of autumn salmon? In the latter half of 1980’s the import amount of salmon was increasing rapidly and the wholesale price of domestic salmon was sluggish by competition with the import salmon. Has the import price of salmon influenced the changes in wholesale prices of domestic salmon? Thus changes of average prices of domestic salmon at the landing ports in Hokkaido were investigated and factors on short-term and long-term changes in wholesale prices of salmon (Shimizu 2002).
What kind of relation between landing amount of domestic salmon and import amount of salmon have influenced wholesale prices of domestic salmon? It has not been discussed whether the formation of wholesale prices had some kinds of relation to change of landing amount, import amount and inventory amount. A wholesale price of salmon was established not only by landing amount but also by inventory amount of the beginning of the year (Taya 1988). The observation period between 1979 and 1986 by Taya was the age when wild salmon predominated in import amount of fresh salmon and different from the current. Therefore, it was clarified that the causation with changes of landing amount, import amount and inventory amount by analysis method of econometrics about long-term changes of wholesale prices of fresh salmon (Shimizu 2004).

**Structural Factors on Changes in the Supply and Demand of Salmon in Japan**

The percentage of the domestic production amount of salmon accounts in the whole fishery production in Japan was only 1.5% until the first half of 1980’s. The domestic production amount of salmon increased rapidly from the latter half of 1980’s and that percentage reached 5% of the whole fishery production currently. While the whole fishery production amount was in a reduction tendency, the domestic production amount of salmon showed an increase tendency. The percentage of the fishery production amount by mother ship fishery and drift net fishery toward the domestic production amount of salmon in Japan was accounting about 50% until about 1973. But it decreased year by year and was less than 20% after 1985 when the production amount by mother ship fishery and drift net fishery declined. On the other hand, the percentage of the production by salmon set net fishery less than 50% before 1977 and it was over 70% in 1984. Compared with annual production amount of salmon by set net fishery and by other fishery except set net, the amount by other fishery except set net was more than 90,000 tons until 1975, less than 50,000 tons after 1978 and 30,000-40,000 tons level afterwards. Though the amount by set net fishery was 20,000-40,000 tons until about 1974, more than 100,000 tons after 1983 and reached 150,000 tons in 1989. Furthermore, the production amount of salmon by set net fishery increased in 230,000 tons in 1997 and the percentage accounted in the domestic production amount reached 86% (Fig. 1).

![Figure 1. Changes in fishery production and import amounts of salmon in Japan from 1975 to 2002.](image)

The household consumption of salmon increased from 1977 to 1982 and the import amount of fresh and frozen salmon increased rapidly. But the export amount of salmon decreased after the latter half of
1970’s. The annual import amount of salmon was 50,000 tons in the first half of 1980’s and it increased rapidly afterward. The annual import amount of salmon reached about 250,000 tons at the peak of the first half of 1990’s. It changed by 210,000-230,000 tons in the latter half of 1990’s. In the background where the import amount of salmon increased rapidly, there were development of a strong yen, reduction of offshore fishery in the North Pacific Ocean and pressure to market expansion by America and Canada. The import amount of salmon in 1999 was Chile (74,000 tons), Norway (67,000 tons), America (54,000 tons), Russia (25,000 tons) and Canada (7,000 tons) by 238,000 tons (134,000 million yen). The import amount of salmon from Chile and Norway accounted 59% (63% by money) in the whole import amount of salmon. Though the increase tendency of import amount of salmon from Chile slowed down a little and the import amount of salmon from America decreased, the import amount from Norway increased rapidly in this several years (Fig.2).

Furthermore, an increase tendency of import amount of salmon was strengthened because consuming structure in Japan changed into fresh salmon from salted one. The demand amount of salmon has been large and salmon has had a stable position in main fishery products in Japan. Compared annual consumption per a person with salted salmon and fresh salmon in Japan, salted salmon accounted 80% of the consumption of salmon between 1979 and 1985. However, the consumption of fresh salmon increased rapidly after 1989 and the consumption of fresh salmon and salted salmon became almost equal in 1994. Afterward the consumption of fresh salmon has increased than one of salted salmon.

Total supply amount (fishery production and import amount) of salmon has been more than about 500,000 tons a year recently and has come to exceed consumption amount greatly. Inventory amount of salmon has been near 100,000 tons after 1994. It is necessary to make increase the internal consumption and the export amount for the expansion of demand of salmon. Domestic salmon prices are determined by the inventory amount, the import amount and the current production amount by salmon set net fishery. The

![Figure 2. Changes in import amounts of salmon from main countries.](image)
wholesale prices of domestic salmon were influenced by prices of imported salmon. Though there is a lot of consumption of salmon in the northern and eastern part of Japan, there may be a capability of demand expansion in the western part of Japan. Freshness, commodity-making, development of new markets for consumer and conservation of food safety will be important for the stability of wholesale prices of domestic salmon.

**Factors on Short- and Long-Term Changes in Wholesale Prices of Salmon in Hokkaido**

Because chum salmon (*Oncorhynchus keta*) was a main fish in the products caught with salmon set nets, the change of a wholesale price of salmon was examined by an average price of fishery products with set nets. While the non-set net fishery whose main fishery was a mother ship fishery declined by the problem of 200 miles fishery zone, an exchange rate of yen for dollar changed in 103 yen of 1994 from 237 yen of 1984. Because a price of salmon produced in foreign countries decreased relatively by a strong yen, an import amount of fresh salmon increased rapidly. The relationship between import amount (I, tons) of fresh salmon in Japan and average prices (P, yen per kg) of fresh salmon in Hokkaido from 1978 to 2000 was shown at the following correlation. $P=1200-3.75\times 10^{-3}I$, $r^2=0.798$, $p<0.001$. In addition, the relationship between import prices (IP, yen per kg) of fresh salmon and average prices (P, yen per kg) of fresh salmon in Hokkaido from 1978 to 2000 was shown at the following correlation. $P=1.173IP-268$, $r^2=0.754$, $p<0.001$.

The following tendency was shown in the relationship between fishery production amount of salmon with set nets and average prices of salmon. An average price increased in the year when the fishery production amount decreased less than the previous year and an average price decreased in the year when the fishery production amount increased more than last year. Also the following tendency was shown in the relationship between landing amounts of fresh salmon and wholesale prices at the landing ports in Hokkaido. Though a wholesale price in the year when the landing amount decreased less than the previous year increased more than the previous year, a wholesale price in the year when the landing amount increased more than the previous year decreased less than the previous year at the landing ports in Hokkaido. It became clear that a wholesale price of fresh salmon fell down when a landing amount (a quantity of supply) of fresh salmon increased and a wholesale price rose when a quantity of supply decreased. In other words, the demand of fresh salmon at landing ports means to be about fixed.

From the relationship between landing amounts and wholesale prices in Hokkaido, it was found out that an average wholesale price around less than 300 yen per kg when a landing amount exceeded 4,000 tons at main landing ports in Hokkaido. I thought that a phenomenon caused in short-term changes of wholesale prices of fresh salmon was repeated in long-term changes and led to down of wholesale prices. Because import amount of fresh salmon in Japan and wholesale prices of fresh salmon in Hokkaido showed negative correlation, it became clear that wholesale prices were down by influence of import amount. In other words, wholesale prices of fresh salmon in whole Hokkaido showed long-term changes by influence of increase of import amount and wholesale prices of fresh salmon at landing ports showed short-term changes by influence of landing amount.

**Effects of Import and Inventory Amounts of Salmon on Wholesale Prices Function of Fresh Salmon in Japan**

The wholesale prices of fresh “Sake”, salted “Sake”, fresh “Masu” and salted “Masu” showed an increase tendency in the latter half of 1970’s in Japan. Most of “Sake” is chum salmon and most of “Masu” is pink salmon (*Oncorhynchus gorbuscha*) in Japan. The wholesale price of salted “Sake” increased rapidly from 1,600 yen per kg to 2,500 yen per kg between 1975 and 1978. However, the wholesale prices of salmon include salted “Sake” showed a fail tendency after 1978. The influence of landing amount of salmon by mother ship fishery in the North Pacific Ocean increased the wholesale price of salted “Sake”
before 1978. A remarkable rise of wholesale prices before 1978 was caused by commodity prices made by
the oil crisis and the deficiency of supply by 200 miles regulation. On the other hand, salmon fishery
production declined in the North Pacific Ocean and landing amount of salmon decreased. Wholesale prices
of salmon continued to decrease as a result of that. Japanese economy was in the low growth phase after the
oil shock in 1973 and standard level of consumption of Japanese became a slump state. Import expansion of
salmon was attempted to correct the disparity of fishery production in the north seas and domestic demand.
Amount of domestic supply has increased by the rise of a landing amount of domestic salmon due to
success of the artificial salmon enhancement. Though the wholesale price of salmon decreased, the
consumption of salmon per a person showed a minute increase tendency (Shimizu 2001).

Economic parameters were analyzed by TSP (Time Series Processor) econometric method (Wada
and Ban 1988) to clear a change factor of wholesale prices of fresh salmon in Japan between 1975 and 2001.
It was divided in two periods, 1975 to 1992 and 1988 to 2001, from the difference of the number of landing
ports. Fresh “Sake” (PF), salted “Sake” (PS), fresh “Masu” (PM) and import salmon (PI) were used as a
parameter of a price. Fresh “Sake” (QF), salted “Sake” (QS), fresh “Masu” (QM) and import salmon (QI)
were used as a parameter of a production amount. Fresh “Sake” (ZF), salted “Sake” (ZS) and salted salmon
roe (ZE) were used as a parameter of an inventory amount. Private final consumer expenditure (C) was used
as a parameter of income. OLS (Ordinary least Squares) or ML (Maximum Likelihood) was used as a
method of estimation.

The factors established the following correlation estimated wholesale prices of fresh “Sake”.
From 1975 to 1992; lnPF=-14.64-0.610lnQF-0.609lnZE-0.992lnC, AdjR^2=0.847, DW=2.09, by OLS.
From 1988 to 2001; lnPF=112.28-0.754lnQF-0.705lnZE-2.75lnC, AdjR^2=0.941, DW=1.82, by OLS.
It was clarified that wholesale prices of fresh salmon were established not only by landing amounts of fresh
salmon but also by inventory amounts of salted salmon roe. The factor established the next correlation
estimated import amounts of salmon.
From 1988 to 2001; lnQI=21.08-0.825lnPI-0.319lnZF, AdjR^2=0.880, DW=2.23, by ML.
It was clarified that import amounts of salmon were established by import prices of salmon and inventory
amounts of fresh salmon, and import amounts of salmon decreased not only by rise of import prices of
salmon but also by increase of inventory amounts of fresh salmon.

As a result of econometric analysis of wholesale prices, it was clarified that the wholesale price
function of fresh salmon was influenced by inventory amounts of fresh salmon and salted salmon roe.
Inventory amounts of fresh salmon were established by landing amounts in the previous year more than
import amounts in the previous year between 1975 and 1992. They were affected by import amounts in the
previous year between 1988 and 2001. Compared inventory amounts fresh salmon in the end of December
with in the end of March, the decrease amount of inventory in the end of March was bigger before 1998 and
it was smaller after 1999 (Fig. 3). I thought that the big seasonal variation of inventory amounts in recent
years was according to the difference of a pattern of import of fresh salmon in winter. The import amounts
of fresh salmon have turned a shift from wild salmon to culture salmon recently, and cultured salmon have
been imported in the winter season without the chance when wild salmon were imported. Wild salmon were
imported from America and Russia in summer (from July to September) and cultured salmon from Chile
were imported in winter. The import countries of fresh salmon were different by a season.
Figure 3. Annual variations in the inventory amounts of fresh salmon in the beginning of the year, the ends of March, July and December from 1975 to 2001.

On the other hand, the import of cultured salmon from Norway has not been concentrated in specific season and the import amounts from Chile and Norway have increased remarkably in winter. The fresh salmon were imported from summer to autumn at the first half of 1990’s when wild salmon were imported mainly. The ratio of cultured salmon and wild salmon in the import fresh salmon in 1995 was 8.1% and 85.3%, respectively. But the fresh salmon imported from winter to spring in the recent years when cultured salmon were imported mainly. The ratio of cultured salmon and wild salmon in the import fresh salmon in 2001 was 72.1% and 23.7%, respectively. I thought that a price of cultured salmon imported between winter and spring went ahead and the price system of fresh salmon was formed.

The inventory amounts were adjusted in winter season when was the off-crop season of salmon supply. Because cultured salmon were imported in winter and quantity of supply of fresh salmon became excessive, the consumption of inventory amounts stopped proceeding. It is necessary to make a countermeasure to reduce year-end inventory amounts because wholesale prices of autumn salmon by the increase of returned salmon resources. Analysis of a demand trend of salmon and grasp of consumer needs are important for the supply side to take enhancement production and fishery production of salmon.
CONCLUSIONS

Wholesale prices of fresh salmon in whole Hokkaido showed long-term changes by influence of increase of import amounts and wholesale prices of fresh salmon at landing ports showed short-term changes by influence of landing amounts.

Big seasonal variation of inventory amounts in recent years was according to the difference of a pattern of import of fresh salmon in winter. Import amounts of fresh salmon have turned a shift from wild salmon to cultured salmon recently.

Cultured salmon have been imported in winter without the chance when wild salmon were imported. Prices of cultured salmon imported in winter went ahead and the price system of fresh salmon was formed.

REFERENCES


