

IMPORT DEMAND FOR THAI FROZEN SEAFOOD IN JAPAN

Ruangrai Tokrisna, Department of Agricultural and Resource Economics,
Faculty of Economics, Kasetsart University, Bangkok, Thailand, ruangrai.t@ku.ac.th
Walaiporn Thambamrung, Department of Agricultural and Resource Economics,
Faculty of Economics, Kasetsart University, Bangkok, Thailand

ABSTRACT

Import demand for three types of frozen Thai seafood i.e. shrimp, cuttlefish and squid, and crab were estimated using Almost Ideal Demand System via Seemingly Unrelated Regression method. For Thai frozen shrimp important factors affecting the demand were import prices from Thailand as well as Vietnam and Indonesia. Main competitor for Thai frozen shrimp in Japan was Vietnam whose own-price elasticity was higher than Thailand. For Thai frozen cuttlefish and squid important factors affecting import demand were import prices from China and the total expenses. Income elasticity of demand for cuttlefish and squid from Thailand was lower than that from Vietnam who had been an exporter of quality frozen cuttlefish and squid as well as Thailand. For Thai frozen crab important factor affecting import demand were import prices from China, Indonesia and India. To maintain Thai frozen seafood market in Japan, priority should be on product standard and quality.

Keywords: import demand, Thai frozen seafood, Japan

INTRODUCTION

Japan had been one of the most important importers of Thai frozen seafood, but with a decreasing trend. Thai frozen seafood import share in Japanese market had been decreasing from more than 30% in the early 1990s to around 20% recently. Main imported seafood items from Thailand were shrimp, cuttlefish and squid. For shrimp the share of Thai frozen shrimp in Japanese market was about 8% with an import value of US\$156million while cuttlefish and squid shared 31% with an import value of US\$64million. Share of Thai frozen crab in Japanese import market was 4% or US\$0.8million. The larger shrimp exporters to Japanese market included Vietnam, Indonesia, India and China respectively. Thailand was the top exporter for cuttlefish and squid in Japanese market. The other important exporters were China and Vietnam.

This study aimed at the estimation of import demands for Thai frozen seafood in the Japanese market. Import demands from major exporters in Japanese market were also estimated. Linear approximation almost ideal demand system was employed for the estimation. Own price elasticity, cross price elasticity, and income elasticity were calculated to identify competing capacity of Thai frozen shrimp, cuttlefish and squid, and crab in the Japanese market.

THE MODEL

Let x be Japanese expenditure on selected imported frozen seafood, p_i be price of frozen seafood imported from country i , and q_i be import quantity of frozen seafood from country i , then

$$x = \sum_i p_i q_i \dots\dots\dots(1)$$

From Deaton and Muellbauer (1980), the minimum expenditure, $C(u, p)$ can be written as

$$\ln C(u, \mathbf{p}) = (1 - u) \ln[a(\mathbf{p})] + u \ln[b(\mathbf{p})] \dots\dots\dots (2)$$

- u = utility, $0 \leq u \leq 1$
- \mathbf{p} = price vector
- $a(\mathbf{p})$ = expense on basic necessities
- $b(\mathbf{p})$ = expenses on others

$$\ln[a(\mathbf{p})] = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j \dots\dots\dots (3)$$

$$\ln[b(\mathbf{p})] = \ln[a(\mathbf{p})] + u\beta_0 \prod_k p_k^{\beta_k} \dots\dots\dots (4)$$

By Sheppard's lemma,

$$\frac{\partial}{\partial p_i} C(u, \mathbf{p}) = q_i(u, \mathbf{p}) = q_i \dots\dots\dots (5)$$

Let w_i be Japanese expenditure share on import from country i.

$$w_i(u, \mathbf{p}) = \frac{p_i q_i}{C(u, \mathbf{p})} \dots\dots\dots (6)$$

Take derivative equation (2) with respect to p_i ,

$$\frac{\partial}{\partial p_i} \ln C(u, \mathbf{p}) = \frac{\alpha_i}{p_i} + \frac{1}{2p_i} \left[2\gamma_{ii} \ln p_i + 2 \sum_{j, j \neq i} \gamma_{ij} \ln p_j \right] + u\beta_0 \beta_i p_i^{\beta_i - 1} \prod_{k, k \neq i} p_k^{\beta_k} \dots\dots\dots (7)$$

$$\frac{p_i}{C(u, \mathbf{p})} \frac{\partial}{\partial p_i} C(u, \mathbf{p}) = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \left[u\beta_0 \prod_k p_k^{\beta_k} \right] \dots\dots\dots (8)$$

From equation (5) and (6), and substitute u from equation (2) and (4).

$$w_i(u, \mathbf{p}) = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \left[\frac{\ln C(u, \mathbf{p}) - \ln a(\mathbf{p})}{\beta_0 \prod_k p_k^{\beta_k}} \beta_0 \prod_k p_k^{\beta_k} \right] \dots\dots\dots (9)$$

$$\therefore w_i(u, \mathbf{p}) = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln \left(\frac{x}{\mathbf{P}} \right) \dots\dots\dots (10)$$

$$\ln \mathbf{P} = \ln[a(\mathbf{p})] = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j$$

$$\text{Using Stone price index; } \ln \mathbf{P} = \ln \mathbf{P}^S = \sum_i w_i \ln p_i \dots\dots\dots (11)$$

The estimated equation would become

$$w_{it} = \alpha_i + \sum_j \gamma_{ij} \ln(p_{jt}) + \beta_i \left(\ln x_t - \sum_i w_{i,t} \ln p_{it} \right) \dots\dots\dots (12)$$

- w_{it} = share of Japanese import value of selected frozen seafood from country i in year t
- p_{jt} = price of selected frozen seafood imported from country j in year t
- p_{it} = price of selected frozen seafood imported from country i in year t
- x_t = Japanese total expense on imported selected frozen seafood in year t

The equations were estimated for Japanese expenditure shares on import of frozen shrimp (HS 030613000), frozen cuttlefish and squid (HS 030749190) and frozen crab (HS 030614030) from Thailand as well as from other main exporters to Japanese market including China, Vietnam, Indonesia, and India for shrimp; China and Vietnam for cuttlefish and squid and China, Vietnam, Indonesia and India for crab. Annual data during 1988-2004 were employed for frozen shrimp and frozen cuttlefish and squid while annual data during 1990- 2004 were employed for frozen crab. Seemingly unrelated regression was employed for the estimation of the above almost ideal demand systems.

From the estimated equations, own price elasticity, cross price elasticity, and income elasticity were calculated (Greene and Alston, 1990).

Own price elasticity	$\varepsilon_{ii} = \frac{\gamma_{ij}}{w_{i,t}} - \beta_i - 1$
Cross price elasticity	$\varepsilon_{ij} = \frac{\gamma_{ij}}{w_{i,t}} - \beta_i \frac{w_{j,t}}{w_{i,t}}$
Income elasticity	$\varepsilon_{ix} = \frac{\beta_i}{w_{i,t}} + 1$

THE RESULT

The estimated equations were in Tables 1, 3 and 5 for each type of frozen seafood and the calculated elasticity in Tables 2, 4 and 6.

Frozen shrimp

From Table 1, 90.13% of variation in Japanese import demand for frozen shrimp from Thailand could be explained by import prices from Thailand, China, Vietnam, Indonesia and India as well as the average import prices from other countries, and the Japanese expenses on imported frozen shrimp. The variation of import from China, Vietnam, Indonesia and India could be explained by same set of explanatory variables at 75.41%, 95.02%, 78.59% and 88.19% accordingly.

For import from Thailand significant explanatory variables were import prices from Thailand, Vietnam, Indonesia and others. The increase in import price from Thailand would lead to reduction in Japanese import from Thailand as expected. The higher import price from Indonesia and countries other than

China, Vietnam and India would also lead to decrease in import from Thailand, significantly. Nevertheless if import price of Vietnam increased, Japan would significantly import more from Thailand.

In case of import from China, increases in import price from China, Indonesia and others would significantly lead to decrease in import from China while increase in import price from India would turn Japan to import more from China.

In case of import from Vietnam, increase in import price from Vietnam and Indonesia would significantly lead to decrease in import from Vietnam while increase in import price from Thailand and India would turn Japan to import more from Vietnam.

In case of Indonesia increase in import price from Indonesia as well as all other countries would significantly lead to reduction in Japanese import from Indonesia.

In case of India, import price from India was not significant. If import price from Indonesia increased, Japan would import less from India while increase in import price from China and Vietnam would lead to more import from India.

As total expense on import of frozen shrimp increased, Japan would import significantly less from China and Indonesia.

Table 1: The estimated Japanese import demand for frozen shrimp

Explanatory variable	Japanese import demand for frozen shrimp from				
	Thailand	China	Vietnam	Indonesia	India
constant	39.2503	-56.3850	20.2824	-121.9718	-65.4515
Import price from					
Thailand	-11.3376	0.7520	7.4334	-7.2634	2.0466
China	0.7520	-3.8276	-1.5049	-3.4439	6.4804
Vietnam	7.4334	-1.5049	-11.2131	-7.8717	4.1608
Indonesia	-7.2634	-3.4439	-7.8717	-10.0261	-11.2413
India	2.0466	6.4804	4.1608	-11.2413	-1.8039
Others	-11.8084	-16.2274	2.6542	-15.2349	4.4241
Expense	-0.1734	-0.4394	-0.0652	-1.2753	-0.1890
Statistics					
R-square	0.9013	0.7541	0.9502	0.7859	0.8819
U-Theil	0.5935	0.7221	0.4749	0.7386	0.8027
D.W.	2.3231	1.0430	2.3949	2.1091	1.4197

Note: Bold numbers indicate level of confidence of at least 90%

In Table 2 own price, cross price, and income elasticity were given. For own price elasticity, import price from Vietnam had the highest elasticity (-2.1759), higher than own price elasticity of import from Thailand (-1.6165), followed by India (-1.5104) and China (-1.1159). Import from Indonesia had inelastic own price elasticity (-0.1575). The change in import price from Indonesia would not lead to a high change in Japanese import demand for frozen shrimp from Indonesia.

For import demand of frozen shrimp from Thailand, own price elasticity was the most elastic. One percent increase in import price from Thailand would lead to 1.6165 percent decrease in import from Thailand. One percent increase in import price from Vietnam, India and China would lead to an increase of 0.6271, 0.3158 and 0.1357 percent increase in import from Thailand while a one percent increase in

import price from Thailand would lead to 0.9264% increase in import from Vietnam, indicating their being competitors in Japanese market. While a one percent increase in import price, from Indonesia and others, would lead to 0.2262 percent and 0.4334 percent decrease in import from Thailand indicating that they were not competitors.

For China the competitors in Japanese market were India, Thailand, Indonesia and Vietnam while the competitors for Vietnam were Thailand, India and the others. For Indonesia competitors were the others, India, China, and Vietnam. For India, competitors were the others, China, Vietnam and Thailand.

Income elasticity was almost unitary, being 0.9449 for Indonesia and 0.9363 for China but were not statistically significant for the other countries.

Table 2: Own price, cross price and income elasticity of Japanese demand for frozen shrimp

Japanese demand for frozen shrimp from	Price of imported frozen shrimp from						Income
	Thailand	China	Vietnam	Indonesia	India	Others	
Thailand	-1.6165	0.1357	0.6271	-0.2262	0.3158	-0.4334	0.9879
China	1.0238	-1.1159	0.3575	0.9766	1.8536	-0.3003	0.9363
Vietnam	0.9264	-0.1168	-2.1759	-0.7040	0.5640	0.5265	0.9928
Indonesia	0.4764	0.2309	0.1576	-0.1575	0.3040	1.1164	0.9449
India	0.3320	0.5430	0.4094	-0.4788	-1.5104	0.7335	0.9868

Frozen cuttlefish and squid

In case of cuttlefish and squid the demand functions were estimated for Japanese import demand from the three main exporters to this market including Thailand, China and Vietnam. The variation of Japanese import demand for frozen cuttlefish and squid from Thailand could be explained by import prices from Thailand, China, Vietnam and other countries, and Japanese total expenses on import of frozen cuttlefish and squid at 62.46% while these explanatory variables could explain the variation in Japanese import by 90.42% and 88.46% respectively. (Table 3)

Significant explanatory variables for Japanese import demand for cuttlefish and squid from Thailand were import price from China and others, both of them were positive indicating that as import price from China and the other countries (beside Vietnam and China) increased, Japan would import more from Thailand. Import price of Thailand was not statistically significant which could be explained by the multi-collinearity with import prices from other countries. Nevertheless, as the expense on Japanese import of this item increased, Japan would still import more from Thailand.

For China, as import price from China increased, Japan would reduce import from China. However if import price from Thailand and others increased, Japan would turn to import more from China.

In case of Vietnam as price of import from Vietnam increased, Japan would reduce import from Vietnam. Increase in import price of other countries would turn Japan to import more from Vietnam.

As expenses on import of this item increased, Japan would still import more from Thailand and Vietnam.

Table 3: The estimated Japanese import demand for frozen cuttlefish and squid

Explanatory variable	Japanese import demand for frozen cuttlefish and squid from		
	Thailand	China	Vietnam
constant	185.5240	103.9246	91.0153
Import price from			
Thailand	-4.6810	3.5073	-0.1025
China	3.5073	-4.4582	-0.1219
Vietnam	-0.1025	-0.1219	-0.7765
Others	18.0454	12.1000	5.1536
Statistics			
Expense	0.7421	0.4044	0.3405
R-square	0.6246	0.9042	0.8846
U-Theil	0.5772	0.4444	0.3014
D.W.	2.2859	2.3454	1.1130

Note: Bold numbers indicate level of confidence of at least 90%

Table 4 revealed the own price, cross price, and income elasticity of Japanese import demand for frozen cuttlefish and squid. For import from Thailand, own price elasticity was highly elastic being -1.9014. As price of import from the others, China, and Vietnam increased by one percent, Japanese import demand for frozen cuttlefish and squid from Thailand would also reduce by 0.5865, 0.2671 and 0.2001 percent accordingly, relatively inelastic. These exporters were not competitors for import from Thailand. Income elasticity was 1.0253, almost unitary.

For own price elasticity, the most elastic was import from Thailand (-1.9014), followed by China (-1.6958), Vietnam (-1.4403); all were elastic. One percent increase in price led to more than one percent decrease in import demand.

In case of import demand from China, one percent increase in import price from Thailand and others also led to a decrease of 0.5473% and 0.4657% in Japanese import demand from China implying that Thailand and others were not competitors of China for this commodity in Japanese market.

For import demand from Vietnam all other exporters, were not competitors for Vietnam. This might be explained by the limited availability of frozen cuttlefish and squid imported to Japan.

Income elasticity was almost unitary for Japanese import demand for frozen cuttlefish and squid from all exporters.

Table 4: Own price, cross price and income elasticity of Japanese import demand for frozen cuttlefish and squid

Japanese demand for frozen cuttlefish and squid from	Price of imported frozen cuttlefish and squid from				Income
	Thailand	China	Vietnam	Others	
Thailand	-1.9014	-0.2671	-0.2001	-0.5865	1.0253
China	-0.5473	-1.6958	-0.2137	-0.4657	1.0264
Vietnam	-1.2985	-0.6851	-1.4403	-1.4177	1.0438

Frozen crab

Japanese import demand for frozen crabs from Thailand, China, Vietnam, Indonesia, and India had been estimated. Due to volume variation as results of fluctuation in catches, limited numbers of explanatory variables were significant for this commodity. Import price from these countries and the total Japanese import expense could explain the variation in Japanese import demand from these countries by 71.90%, 72.00%, 71.92%, 68.66%, and 49.72% respectively. (Table 5)

In case of Thailand as import price from China and Indonesia increased, Japan would significantly decrease import from Thailand. But if import price from the others and India increased Japan would increase import from Thailand.

For import from China, as import price from China and also India increased, Japan would significantly decrease import from China. But if the import price from Indonesia increased Japan would import significantly more from China.

For import from Vietnam, if import price from Vietnam and India increased, Japan would reduce import from Vietnam.

Japanese import demand from Indonesia would decrease significantly as import price from Thailand increased while it would increase as import price from China increased.

Japanese import demand from India would still increase as import price from India increased and so did the import price from Thailand. Japanese import demand from India would decrease, as import price from China and Vietnam increased.

The increase in expense on Japanese import of frozen crabs could not statistically explain the change in import demand of these countries.

Table 5: The estimated Japanese import demand for frozen crab

Explanatory variables.	Japanese import demand for frozen crab from				
	Thailand	China	Vietnam	Indonesia	India
constant	-10.5068	175.0626	-120.6312	29.8437	-0.3345
Import price from					
Thailand	-0.0215	-3.1249	0.2977	-0.2698	0.7745
China	-3.1249	-6.3334	2.1005	2.6633	-6.9033
Vietnam	0.2977	2.1005	-6.5834	-0.3166	-3.1341
Indonesia	-0.2698	2.6633	-0.3166	-0.2106	0.0762
India	0.7745	-6.9033	-3.1341	0.0762	6.1612
Others	1.1354	-6.5367	2.0073	0.4021	1.1375
Expense	-0.0453	0.2138	-0.6399	0.1181	-0.0011
Statistics					
R-square	0.7190	0.7200	0.7192	0.6866	0.4972
U-Theil	0.2181	0.2255	0.2931	0.5185	0.4021
D.W.	2.6910	2.1428	2.2191	1.8546	2.2057

Note: Bold numbers indicate level of confidence of at least 90%

From Table 6 own price elasticity of Japanese import demand for frozen crab from China and Indonesia were elastic being -1.3194 and -1.2028 respectively One percent increase in import price from Vietnam led to only 0.7150 percent decrease in Japanese demand while it was only 0.2701 percent for import from India. A one percent increase in import price from Thailand would lead an increase of 0.9963 percent increase in Japanese import demand.

Cross price elasticity was inelastic for import demand from Thailand. An increase by one percent in import price from China and Indonesia would also lead to a decrease of 0.2200 and 0.0852 percent decrease in Japanese import demand from Thailand. Nevertheless one percent increase in import price from others, India and Vietnam would increase Japanese import demand for crab from Thailand by 0.8294, 0.6276 and 0.6173 percent respectively. India, the others, and Vietnam were competitors for Thai frozen crab in Japanese market.

In case of import from China, one percent increase in import price from India, Thailand and the others would also lead to a decrease in Japanese import demand from China by 0.1453, 0.0587, and, 0.1401 percent, inelastic cross price elasticity of Japanese import demand from China. Nevertheless one percent increase in import price from Indonesia would slightly increase Japanese import demand from China by 0.0356 percent. Indonesia was the only competitor for China in Japanese market.

For Vietnam, the important competitor in Japanese market was China with elastic cross price elasticity of 2.1815. For other competitors including the others, India, Thailand and Indonesia the cross price elasticity was inelastic..

In case of Indonesia there was not any competitor in Japanese market. All own and cross price elasticity was negative.

For India the competitor were the others, Thailand and Indonesia and with inelastic cross price elasticity. One percent in increase in import price from China and Vietnam would also lead to a decrease of 0.8085 and 0.3682 percent, both inelastic.

The income elasticity for Japanese import demand for frozen crab from all exporters was almost unitary.

Table 6: Own price, cross price and income elasticity of Japanese import demand for frozen crab

Japanese import demand for frozen crab from	Price of frozen crab from						Income
	Thailand	China	Vietnam	Indonesia	India	Others	
Thailand	0.9663	-0.2200	0.6173	-0.0852	0.6276	0.8294	0.9754
China	-0.0587	-1.3194	-0.0311	0.0356	-0.1453	-0.1401	1.0036
Vietnam	0.0792	2.1815	-0.7150	0.0686	0.1227	0.4085	0.9655
Indonesia	-0.1962	-1.7768	-1.0087	-1.2028	-0.3710	-0.2518	1.0425
India	0.0919	-0.8085	-0.3682	0.0093	-0.2701	0.1357	0.9999

Rank of own price elasticity, income elasticity, and competitors of Thai frozen seafood in Japanese market were given in Table 7.

Table 7: Rank of own price elasticity, income elasticity, and competitors for Thai frozen seafood in Japanese market

Frozen shrimp			Frozen cuttlefish and squid			Frozen crab		
Own price	Income	Competitors	Own price	Income	Competitors	Own price	Income	Competitors
Vietnam (2.1759)	Vietnam (0.9928)	Vietnam (0.6271)	Thailand (-1.9014)	Vietnam (1.0438)	None	China (-1.3194)	Indonesia (1.0425)	Others (0.8294)
Thailand (-1.6165)	Thailand (0.9879)	India (0.3158)	China (-1.6958)	China (1.0264)	None	Indonesia (-1.2028)	China (1.0036)	India (0.6276)
China (-1.1159)	India (0.9868)	China (0.1357)	Vietnam (-1.4403)	Thailand (1.0253)	None	Vietnam (-0.7150)	India (0.9999)	Vietnam (0.6173)
India (-1.5104)	Indonesia (0.9449)					India (-0.2701)	Thailand (0.9754)	
Indonesia (-0.1575)	China (0.9363)					Thailand (0.9663)	Vietnam (0.9655)	

CONCLUSION

For import of frozen shrimp, own price elasticity was elastic for Vietnam, Thailand and China in respective order. Main competitor for Thai frozen shrimp in Japanese market was Vietnam whose own price elasticity was higher than Thai frozen shrimp. The relative change in import price from Vietnam led to greater change in import from Vietnam. Thus, price policy was relatively more restricted for Thailand. Beside the price was given by the importer rather than Thai exporter. Nevertheless as import price from Vietnam changed by one percent the change in Japanese demand for Thai frozen shrimp was still inelastic i.e. would change by 0.6271 percent in the same direction. Income elasticity was about unitary for Japanese import demand for frozen shrimp from every countries. Betterment in Japanese economy would provide opportunity to increase export to this market more or less equally among the exporting countries.

For frozen cuttlefish and squid, own price elasticity was still elastic, change in price led to relatively greater change in Japanese import demand in the opposite direction. Due to limited resource abundance, Thailand had been importing for re-export, thus import price from Thailand correlated with price from the other countries which could also be exporters to Japanese market. Nevertheless there was not any competitor for Thai frozen cuttlefish and squid in Japanese market. Income elasticity was also almost unitary for frozen cuttlefish and squid in Japanese market.

For frozen crab if the import price from Thailand increased by one percent, Japanese import demand for Thai frozen would still increased by 0.9663 percent. Own price elasticity was elastic for import from China and Vietnam and inelastic for import from Vietnam and India. Competitors of Thai frozen crab in Japanese market were the others, India and Vietnam. Income elasticity was almost unitary from import from all exporters. The statistical insignificance in estimation for Japanese import demands for frozen crab might also be explained by fluctuation in import volume due to limited resource abundance for this item.

Frozen shrimp from Thailand was still favorable in Japanese market but Thailand had faced a strong competition from Vietnam. For frozen cuttlefish and squid and frozen crab the competitiveness of Thai exports were constrained by production potential. To maintain foreign exchange earning from Japanese market, product standard and quality were important.

REFERENCES

Deaton, Angus and John Muellbauer, 1980, *Economics and Consumer Behavior*, Cambridge University Press, pp.60-85.

Green, Richard and Julian M. Alston, 1990, Elasticities in AIDS Model, *American Journal of Agricultural Economics*, 72(2), Pp.443-445.

Greene, William H.,2003. *Econometric Analysis*, Fifth edition, Prentice Hall, pp.340-361

Thambamrung, Walaiporn 2007, *An Analysis of Import demand for Thai Frozen Seafood in Japan*, Graduate School, Kasetsart University, Bangkok, Thailand, 123p., (In Thai).