



Trends in Agricultural Economics

ISSN 1994-7933

science
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Japanese Household Fresh Fruits Demand Pattern

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ABSTRACT

Japanese people consumed at the average of 45.2 kg capita⁻¹ in 1965 and had reached the peak of 54.6 kg capita⁻¹ in 1973 but decreased to 27.5 kg capita⁻¹ in 2006. Fresh fruits household expenses in Japan can be divided into 2 eras which is increasing era (1973-1992) and decreasing era (1992-2006) that shows the consumption pattern for the commodity. In Japan, fruits consumption distribution shows different pattern due to each fruit have different consumption characteristic and trend of demand. Therefore, it is crucial to understand economic characteristic for each fruit by understanding its price and expenditure elasticity. Present study covers the comparison study for the demand of fresh fruits by Japanese household across all over Japan for the period of 1973-1992 and 1992-2006. In this study, we analyze demand elasticity for fruits in general and other 14 fresh fruits available in Japanese market such as apple, pear, peach, persimmon, mandarin orange, orange, other citrus, grapefruits, watermelon, melon, strawberry, grape, banana and other fruit. The demand elasticity estimation was carried out using differentiated double logarithmic demand function. We used SHAZAM software for present regression analysis in this study. Present study have found the demand for fresh fruits by Japanese household are inferior goods and highly affected by the price. Generally, the demand for the fresh fruits by Japanese household is decrease. This study provides important information about the Japanese consumer demand for fresh fruits which could serve as guidelines for understanding consumer spending on fresh fruits as well as making structural marketing adjustments.

Key words: Japanese household, fresh fruits, price elasticity, expenditure elasticity, double logarithmic demand function

INTRODUCTION

Fresh fruit plays a significant part of the Japanese diet and is usually eaten as a dessert or snack. Statistical data has shown that the quantity demand for the fresh fruits by Japanese household had declined since 1973. Japanese household consumed at the average of 45.2 kg capita⁻¹ in 1965 and had reached the peak of 54.6 kg capita⁻¹ in 1973 but decreased to 27.5 kg capita⁻¹ in 2006. The decreases in quantity demand from 1973 to 1992 maybe due to the increases in the price of fresh fruits. However, the decreases in the quantity demand after 1992 are due to the decreases in the average of household income that leads to the decreases in household total expenditure including expenditure for food that also affected the spending allocation for fresh fruits. It is also believed that substantial change in Japanese diets in general has transferred from rice, fish, fresh fruits and vegetables to soy-based food, dairy, meat and poultry products (Chern, 2002).

The other reason for the declining of fresh fruits consumption in Japan may be due to the entirely sharp increases in consumption for fruit juices. Recent trend shows that Japanese young and old generation prefer fruit juices more than fresh fruits. Fruit juices are easier to consume, tastier and believed to be healthier since some pack of juices contain mixture of fruits fortified with variety of vitamins. Japanese household spend at the average of 9258 yen per year for fruit juices in 2005 as compared to only 872 yen per year in 1965. Among other factors causing the declining of fresh fruits consumption are the fluctuations of fresh fruit own price, prices of other fruits (complement and substitute) and per capita income. Knowledge of price and income elasticity for fresh fruits is very useful to estimate the demand for particular fruits. The price elasticity values for fresh fruits are very important in order to make strong assumptions about consumer demand as well as to make a projection demand for the commodity (Pollack, 2000).

Fresh fruits demand in Japan is a complex interaction between price and income. Identification of main factors affecting fruits demands could serve as guidelines to understand consumer spending behavior as well as making the best structural marketing adjustments for the commodity. Not much research on Japanese fresh fruits demand focusing on the factors affecting fruit consumption has been carried out. Most research on fruit demand is based on inference from experience such as the study by Gehrt and Shim (1998) entitled *The Role of Fruit in the Japanese Gift Market: Situationally Defined Markets* which focused on fruits for gift in Japan. Less research has focused on relationship analysis between fruits demand on the view of price and expenditure elasticity. The ability to extract the main factors from the demand system and to use quantitative analysis to explore interaction mechanisms of these price and elasticity factors is very important (Tanishita, 2005).

Present study covers the comparison study for the demand of fresh fruits by Japanese household across Japan for the period of 1973-1992 and 1992-2006. Household expenses for fresh fruits in Japan can be divided into 2 eras which is increasing era (1973-1992) and decreasing era (1992-2006) that shows the consumption pattern for the commodity. In Japan, distribution of 14 fresh fruits consumption shows different pattern due to each fresh fruit has different consumption characteristic and trend of demand. Therefore, it is crucial to understand economic characteristic for each fruit by understanding its price and expenditure elasticity. This study will estimate the demand elasticity matrixes for fresh fruits (in general) and 14 fresh fruits (in specific) available in Japanese market that shows significant impact on the demand direction for the commodities at consumer level for 49 cities in Japan.

The first objective of this study is to estimate the price and expenditure elasticity of Japanese household demand for fresh fruits and how it changes for the period of 1973-1992 and 1992-2006 which we believe is applicable to explain the demand for fresh fruits in Japan. Second objective is to recognize Japanese household responses on fresh fruits consumption by cities based on both elasticity values at specific price and expenditure.

MATERIALS AND METHODS

Analyzed data in this study are the time series data of quantities and prices for fresh fruits, per capita income and expenditure, number per household and general consumer price index. All needed annual data for the period of 1973-2006 were obtained from various issues of Annual Report on the Family Income and Expenditure Survey, Statistics Bureau, Ministry of Internal Affairs and Communications, Japan, 1975-2008. Selected 49 cities from 47 prefectures in Japan are shown in Table 1.

Table 1: 49 Cities from 47 Prefectures in Japan

Region	Cities
Hokkaido	Sapporo
Tohoku	Akita, Aomori, Fukushima, Marioka, Sendai, Yamagata
Kanto	Chiba, Kawasaki, Ku-Areas, Maebashi, Mito, Saitama, Utsunomiya, Yokohama
Chubu	Fukui, Gifu, Kanazawa, Kofu, Nagano, Nagoya, Niigata, Shizuoka, Toyama
Kansai	Kobe, Kyoto, Nara, Tsu, Osaka, Otsu, Wakayama
Shikoku	Kochi, Matsuyama, Takamatsu, Tokushima
Chugoku	Hiroshima, Matsue, Okayama, Tottori, Yamaguchi
Kyushu	Fukuoka, Kagoshima, Kumamoto, Kitakyushu, Miyazaki, Nagasaki, Naha, Oita, Saga

Source: http://en.wikipedia.org/wiki/Cities_of_Japan, 2008

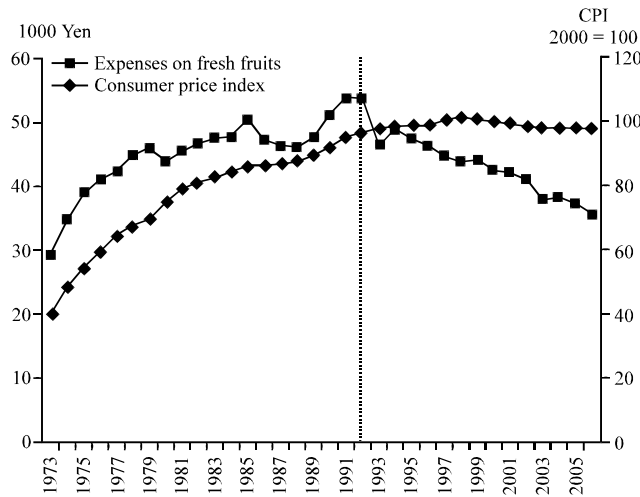


Fig. 1: Japanese household annual expenses on fresh fruits and the Japan’s consumer price index, 1973-2006; Source: Annual report on the family income and expenditure survey, annual report on the consumer price index and monthly statistics of Agriculture, Forestry and Fisheries (1965-2007)

We segregated present analysis into two periods of 1973-1992 and 1992-2006 due to the completely reverse trend in Japanese household expenses for fresh fruits for both period as shown in Fig. 1. Even though the consumer price index decrease from 1998-2006, Japanese spending on fresh fruits continuously decrease for that period.

Figure 2 shows the decrease in price for fresh fruits starts from 1991-2006 did not help to create positive demand for fresh fruits. The demand for fresh fruits keep decline continuously. Based on these 2 situations, it is very necessary to analyze Japanese household responses to fresh fruits expenses towards the changes of price and income (expenditure) especially for the period of 1973-1992 and 1992-2006. Fresh fruits included in the study are fresh fruits in general, apple, pear, peach, persimmon, mandarin orange, orange, other citrus, grapefruits, watermelon, melon, strawberry, grape, banana and other fruits. Other fruits item includes tropical fresh fruits and small volume of other fruits traded in the market. Our preliminary assumption suggest that every household fresh fruits demand in different cities differ from each other due to several factors such as income, fresh fruits prices, fruits availability and culture.

The estimation was carried out using differentiated double logarithmic demand function. Double logarithmic function easy to work compared to linear model because elasticity are simple constants.

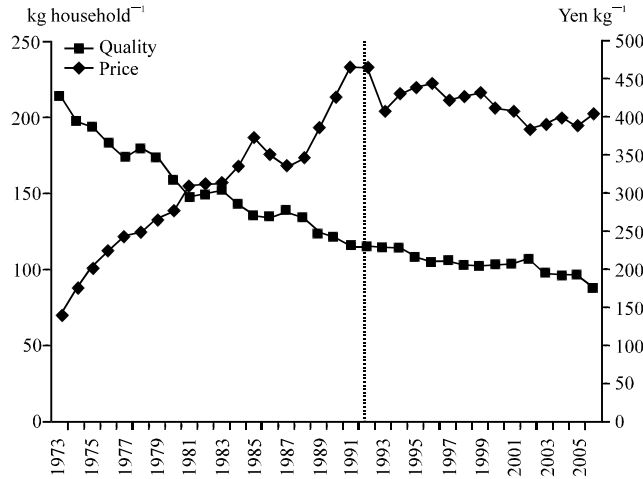


Fig. 2: Japanese household consumption and the price for fresh fruits, 1973-2006; Source: Annual report on the family income and expenditure survey, annual report on the consumer price index and monthly statistics of Agriculture, Forestry and Fisheries (1965-2007)

It depends on either one of price or quantity. Also the elasticity in a double logarithmic demand function is constant and equal to the exponential value.

Let the demand system derived from a consumer's utility maximization be:

$$\Delta \log Q = \alpha + \beta \Delta \log (P/CPI) + \gamma \Delta \log (Y/CPI)$$

where, Q: Quantity demanded, α : Trend, P: Nominal price, β : Price elasticity, Y: Nominal living expenditure, γ : Expenditure elasticity, CPI: Consumer price index (general), estimated by the generalized least squares method.

From the equation, we can derive the elasticity values for the commodities. We used SHAZAM software for our regression analysis in this study.

RESULTS

In general, the household demand analyses for the fresh fruits for all 49 cities in Japan have shown different results for every city as shown in Table 2 and 3. Referring to Table 2, in general, almost all of the price and expenditure elasticity for all types of fresh fruits belong to Type 1, 2 and 6 with majority belonging to Type 2 for the period of 1973-1992. It means; generally, Japanese fruits consumption is very price elastic that explains the fruits consumption in Japan depends so much on price. According to Table 2, all fruits except grape have shown the majority of positive expenditure elasticity (normal goods) that portrays the allocation of money on fresh fruits by Japanese household depends so much on income. Japanese household will consume more fruits when they have more money. In Table 2, more than 20% of the cities considered pear, persimmon, orange, other citrus, watermelon, strawberry, grape and other fruits as luxury fruits with price and expenditure elasticity value more than 1. Most of these fruits are imported and low in local production. Scarcity of availability in the market at some cities makes these fruits price expensive.

For the period of 1973-1992, 239 combinations of 49 cities for different fresh fruits categories belong to fruits elasticity Type 2 which can be classified as normal fruits with high price elasticity.

Table 2: Number of cities by fruits and its elasticity types, 1973-1992

Fruit types elasticity types	Elasticity types							
	1	2	3	4	5	6	7	8
Fresh fruits	6	29	0	0	2	10	2	0
Apples	9	19	0	0	3	17	0	1
Pear	12	7	2	4	1	14	8	1
Peach	9	8	3	9	3	9	3	5
Persimmon	11	14	0	0	10	13	1	0
Mandarin oranges	9	21	1	3	2	10	2	1
Orange	15	10	1	3	9	11	0	0
Other citrus	19	12	2	3	5	4	2	2
Grapefruits	6	21	0	1	4	14	0	3
Watermelon	14	10	3	2	6	4	4	6
Melon	6	18	0	5	2	8	3	7
Strawberry	10	22	0	1	3	11	2	0
Grape	10	12	0	0	6	16	4	1
Banana	7	21	3	0	4	12	1	1
Other fruits	16	15	2	0	5	11	0	0

Sources: Self-projection; Type 1: Price elasticity>1, Expenditure elasticity>+1, Type 2: Price elasticity>1, Expenditure elasticity<+1, Type 3: Price elasticity<1, Expenditure elasticity>+1, Type 4: Price elasticity<1, Expenditure elasticity<+1, Type 5: Price elasticity>1, Expenditure elasticity>-1, Type 6: Price Elasticity>1, Expenditure elasticity<-1, Type 7: Price elasticity<1, Expenditure elasticity>-1, Type 8: Price elasticity<1, Expenditure elasticity<-1

Table 3: Number of cities by fruits and its elasticity types, 1992-2006

Fruit types	Elasticity types							
	1	2	3	4	5	6	7	8
Fresh fruits	0	27	0	6	0	12	0	4
Apples	0	25	0	4	0	19	0	1
Pear	8	21	0	6	0	11	1	2
Peach	3	21	1	2	2	12	3	5
Persimmon	3	24	1	0	0	17	3	1
Mandarin oranges	0	21	0	2	0	22	1	3
Orange	12	23	1	0	1	10	1	1
Other citrus	2	9	0	4	0	20	9	5
Grapefruits	2	21	0	2	0	19	2	3
Watermelon	4	26	1	0	0	18	0	0
Melon	8	22	0	4	0	11	2	2
Strawberry	1	20	0	5	1	17	1	4
Grape	9	16	3	1	1	15	4	0
Banana	1	18	0	8	0	14	0	8
Other fruits	3	18	0	2	1	22	3	0

Sources: Self-projection; Type 1: Price elasticity>1, Expenditure elasticity>+1, Type 2: Price elasticity>1, expenditure elasticity<+1, Type 3: Price elasticity<1, Expenditure elasticity>+1, Type 4: Price elasticity<1, Expenditure elasticity<+1, Type 5: Price elasticity>1, Expenditure elasticity>-1, Type 6: Price elasticity>1, Expenditure elasticity<-1, Type 7: Price elasticity<1, Expenditure elasticity>-1, Type 8: Price elasticity<1, Expenditure elasticity<-1

Other 164 combination cities belong to Type 6 which are very price elastic but are inferior fruits and 159 combination cities belong to Type 1 which considered fruits as luxury with very high expenditure elasticity values. For the period of 1973-1992, one-third of the cities in Japan agreed

that other citrus, orange, watermelon and other fruits are luxury fresh fruits. Other categories of fresh fruits are at small value for Type 3, 4, 5, 7 and 8 as shown in Table 2. Type 3, 4, 7 and 8 are for the price inelastic fruits. There are very few cities considered any category of fresh fruits as price inelastic.

All direct prices and expenditures elasticity in the period of 1992- 2006 for all 49 cities in Japan were reported in Table 3. Referring to Table 3, generally Japanese household considered fresh fruits as high price and expenditure elastic with the majority belong to Type 2 except for mandarin orange, other citrus and other fruits which belong to Type 6 that can be classified as high price elastic with expenditure inelasticity value less than -1. Most of the cities considered fresh fruits in general, apple, orange, pear, grape, persimmon, peach, watermelon, melon, strawberry and banana as a necessity and superior goods. None of the cities consider fresh fruits in general, apple and mandarin orange as luxury. Compared to Table 2 (1973-1992), only a few cities assume other 12 fresh fruits as luxury for the period of 1992-2006. For example, 12 among 49 cities agreed that orange is luxury. Another example; other citrus, grape, persimmon, banana watermelon and strawberry considered as luxury in KU Areas of Tokyo. On the other hand, many cities agree that mandarin oranges and grapefruits as either superior or inferior goods, while majority assumed other citrus and other fruits as inferior goods. Increase in local production and import creates high competition in price, more variety, easy access, more choice and much cheaper price for the fresh fruits for the period.

Table 4 on the other hand, shows the comparison number of cities and its elasticity for the period of 1973-1992 and 1992-2006. Except for fresh fruits in general, half of the fresh fruits category has changed the majority for the types of elasticity. These fresh fruits are pear, persimmon, mandarin orange, other citrus, grapefruits, grape and other fruits. Massive production for pear and persimmon has made these fresh fruits cheaper. Pear and persimmon are widely grown across Japan. In case of pear, Japanese *nashi* pears are grown in Chiba, Ibaraki, Tottori, Fukushima, Tochigi, Nagano, Niigata, Saitama and other prefectures except Okinawa. More

Table 4: Comparison number of cities and its elasticity for the period of 1973-1992 and 1992-2006

Fruits types	1973-1992		1992-2006		Majority
	Type 1-4	Type 5-8	Type 1-4	Type 5-8	
Fresh fruits	35	14	33	16	N/A
Apples	28	21	29	20	N/A
Pear	25	24	35	14	Change
Peach	29	20	27	22	N/A
Persimmon	25	24	28	21	Change
Mandarin oranges	34	15	23	26	Change
Orange	29	20	36	13	N/A
Other citrus	36	13	15	34	Change
Grapefruits	28	21	25	24	Change
Watermelon	29	20	31	18	N/A
Melon	29	20	34	15	N/A
Strawberry	33	16	26	23	N/A
Grape	22	27	29	20	Change
Banana	31	18	27	22	N/A
Other fruits	33	16	23	26	Change

Sources: Self-projection; Type 1-4: Positive expenditure elasticity, Type 5-8: Negative expenditure elasticity, N/A: Not available

variety of grapes has been introduced for local production such as kyoho, delaware, muscat and pione which provide more choices for the consumer. An increase in import for mandarin orange, other citrus, grapefruits, grape and other fruits especially from the United States has made these fruits widely available in the market with cheaper price. The most interesting fruit is other citrus. There are completely reverse change in the number of the cities in the elasticity types for these 2 periods. Currently, Japan is the largest importer for the other citrus especially for lemon and lime from South Australia, surpassing the United States. Japan also has increased other citrus importation from Mexico, United States and some other countries especially for the period of 1992-2006.

DISCUSSION

Demand responses for 14 fresh fruits to the changes in prices and income (expenditure) are modeled using differentiated double logarithmic demand function. Since the prices and expenditures elasticity are obtained directly from the estimated demand systems specified, their statistical inferences are straightforward. All own-price elasticity obtained is less than unity. More than 90 percent of our estimations on the Japanese household demand for fresh fruits for 49 cities in Japan for both period of 1973-1992 and 1992-2006 are significant statistically with the Durbin-Watson value closed to 2 and the R-square (R^2) value closed to 1 which is consistent with the research using double-logarithmic function by Mbala (1992).

Fresh fruits price elasticity in Japan was found homogeneous from area bases but not homogeneous in whole Japan. Japanese fruits consumption shows price elasticity bigger than 1 that explains the fruits consumption in Japan depend so much on price. The increases or decreases in price will affect the Japanese spending on fresh fruits. Therefore, in order to sell the fresh fruits, the retailers should put consideration on pricing as well as some added value to the fruits such as health benefits the consumer may get by consume that particular fruits. On the other hand, Japanese fruits expenditure elasticity shows that fresh fruits consumption becomes more expenditure oriented which has change from positive expenditure elasticity for the first period to negative for the latter period. The increases of Japanese household income lead to the fall in fresh fruits demand. From the study, we have found that the demand for fresh fruits by Japanese household are highly affected by the price and fresh fruits has transferred from normal to inferior goods in Japan.

The observation for 14 fresh fruits demand has shown the decreasing expenses of Japanese household for fresh fruits which is agreeable with the previous research by Mori *et al.* (2008). Mori *et al.* (2008) also has reported the production and consumption for other citrus for the whole Japan has been decline; our study however shows that the demand for other citrus increase at a small percentage. We also found the recent trends for orange, peach, watermelon and bananas for majority of the cities still hold positive demand at different levels. Recent popularity of tropical fresh fruits such as mangoes, pineapples and avocados are not sure to last since the analysis results shows that the other fruits category has move from promising in the period of 1973-1992 to less promising for the period of 1992-2006. The demand drive for fresh fruits in Japan is affected by many economic, social and cultural factors. Mori *et al.* (2008) suggested the probability of younger generations in Japan have moved away from eating fresh fruit for unknown reason (Mori *et al.*, 2008). The previous market analysis by Japan Fresh Produce Import and Safety Association (NISSEIKYO) also found the young Japanese generation prefers supplements or the convenience of fruit-based beverages as compared to fresh fruits.

Market segmentation analysis is very important to analyze the situation much further. Furthermore, the view point of market segmentation is really important because expenditure elasticity changed geographically. To better understand the fruits demand behavior in Japan, the research should be conducted in locality. The researcher should identify interesting character in the localities of 49 cities because these cities have very different character in fruits demand. Even though the study is far more than complete, the current study, however, provides important information about the Japanese consumer demand for fresh fruits.

ACKNOWLEDGMENT

We would like to thank The United Graduate School, Tottori University for financial support on the research project. We also would like to express our gratitude to University of Malaya, Malaysia and Malaysian Ministry of High Education for their financial support to our first writer, Alias Abdullah.

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