Analysis of income elasticity regarding the consumption of cut flowers in Japan

Katstushi Mizuno (Meiji University) Go Igusa (Matsuyama University)

1. 1. Foreword

The cut flower market in Japan used to be gorgeous, but in the 21st century, the scale of the cut flower market has shrunk. It can be said that consumers are away from cut flowers. I want to stop the shrinking of the flower market. As a first step, we decided to investigate the actual situation of the cut flower market. In econometric figures, let's look at which flower should decline and which flower should be revived.

As a previous study, Go Igusa Katsushi Mizuno, Yukie Morita (2019) analyzed the consumption of potted flowers. The difference between the analysis and this time is that the previous research focused on pots, but here we focus on cut flowers, which are consumed more. The main cut flowers are carnations, roses, texas bluebell, gerberas and chrysanthemums. We will analyze these based on the consumption theory.

2. Japanese cut flower market and data

1) Concentration analysis of cut flower market

"Kaki(Japanese)" is a plant used exclusively for ornamental purposes[1]. According to the Ministry of Agriculture, Forestry and Fisheries[2], the domestic production of flowers in 2017 was 368.7 billion yen, accounting for 4% of the domestic agricultural production. The breakdown is 60% for cut flowers, 30% for pots, and 10% for flowerbed seedlings. In this study, the analysis was performed based on the published statistics up to 2017 before the COVID19.

2) Herfindahl index

The flowers to be analyzed were carnations, roses, and chrysanthemums, which are the most typical, as well as texas bluebell and gerbera, which have a wide range of demand applications.

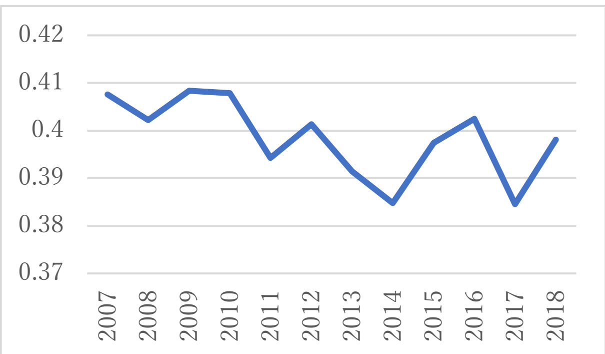

Figure 1.Herfindahl index
(Created by the author from the Ministry of Agriculture, Forestry and Fisheries ″Floring Tree Production Status Survey″)

Figure 1 shows the Herfindahl index calculated from 2005 to 2018 for the five species. As you can see from the figure, the value of the Herfindahl index fluctuates between approximately 0.41 and 0.38. It can be seen that the concentration level is gradually decreasing. The reason is that the applications are diversified.

3. model

1) Model-System-wide・approach-

The system-wide・approach consumption theory demand equation used here consists of the relative price equation of the differential demand equation. The left side shows the demand for each flower. The first term on the right-hand side represents the income (Divisia quantity index), and the second and subsequent terms on the right-hand side represent the price of each flower. In the case of five goods, the following four simultaneous equations hold.Subtract "dlnp_5" from the price term on the right-hand side.

$$w_1 \mathrm{dln} q_1 = \theta_1 \mathrm{dlnQ} + \Pi_{11}(\mathrm{dlnp}_1 - \mathrm{dlnp}_5) + \Pi_{12}(\mathrm{dlnp}_2 - \mathrm{dlnp}_5) + \Pi_{13}(\mathrm{dlnp}_3 - \mathrm{dlnp}_5) + \Pi_{14}(\mathrm{dlnp}_4 - \mathrm{dlnp}_5)$$
$$w_2 \mathrm{dln} q_2 = \theta_2 \mathrm{dlnQ} + \Pi_{21}(\mathrm{dlnp}_1 - \mathrm{dlnp}_5) + \Pi_{22}(\mathrm{dlnp}_2 - \mathrm{dlnp}_5) + \Pi_{23}(\mathrm{dlnp}_3 - \mathrm{dlnp}_5) + \Pi_{24}(\mathrm{dlnp}_4 - \mathrm{dlnp}_5)$$
$$w_3 \mathrm{dln} q_3 = \theta_3 \mathrm{dlnQ} + \Pi_{31}(\mathrm{dlnp}_1 - \mathrm{dlnp}_5) + \Pi_{32}(\mathrm{dlnp}_2 - \mathrm{dlnp}_5) + \Pi_{33}(\mathrm{dlnp}_3 - \mathrm{dlnp}_5) + \Pi_{34}(\mathrm{dlnp}_4 - \mathrm{dlnp}_5)$$
$$w_4 \mathrm{dln} q_4 = \theta_4 \mathrm{dlnQ} + \Pi_{41}(\mathrm{dlnp}_1 - \mathrm{dlnp}_5) + \Pi_{42}(\mathrm{dlnp}_2 - \mathrm{dlnp}_5) + \Pi_{43}(\mathrm{dlnp}_3 - \mathrm{dlnp}_5) + \Pi_{44}(\mathrm{dlnp}_4 - \mathrm{dlnp}_5) \quad \text{-(1)}$$

q_1: Carnation quantity, q_2: Gerbera quantity, q_3: texas bluebell quantity, q_4: Rose quantity, q_5: Chrysanthemums quantity,p_1: Carnation price, p_2: Gerbera price, p_3: texas bluebell price p_4: Rose price p_5: Chrysanthemums price

w_i (i = 1,2,3,4,5) is the budget share of each good in the budget. It has the property of becoming 1 when added. $\theta_i (=p_i q_i / \Sigma p_i q_i \quad :i=1,2,3,4,5)$ represents the marginal share (the ratio of how much the share of each good increases when the budget increases), and is 1 when added. In addition, dlnQ in Eq. (1) is a Divijia quantity index.

$$\mathrm{dlnQ} = w_1 \mathrm{dln} q_1 + w_2 \mathrm{dln} q_2 + w_3 \mathrm{dln} q_3 + w_4 \mathrm{dln} q_4 + w_5 \mathrm{dln} q_5 \qquad (2)$$

This is a weighted average of quantity Infinitesimal changes (quantity increase rate) with budget share as a weight. Finally, ϕ is the elasticity of income. Tile analyzes this by setting it to −0.5.That is $\phi = -0.5$.

Here, we add the symmetry of Sultsky in the five cases. The Sultsky coefficient has the following parameter constraints.

$$\Sigma \Pi_{ij} = 0 \qquad \text{Total for } j$$

$$\Pi_{ij} = \Pi_{ji} \quad i, j = 1,2,3,4,5 \qquad (3)$$

2) Calculation result of each parameter

Equation (1) was estimated by the constrained three-step least squares method taking into account the symmetry of the parameters. The estimation results of the four formulas of carnation, gerbera, texas bluebell, and rose are as follows. The estimated period is 2008-2018. The coefficient of determination was 0.8825 for the first equation, 0.7219 for the second equation, 0.6247 for the third equation, and 0.9318 for the fourth equation. The explanation of the P value is omitted.

	Divisia quantity index	Carnation price	Gerbera price	texas bluebell price	Rose price	Chrysanthemums price (Calculated from constraints)
Carnation	**0.1982**	**-0.1086**	**0.0201**	**0.0425**	**-0.0075**	0.0535
Gerbera	**0.0275**	**0.0201**	**-0.0121**	**-0.0048**	**0.0002**	-0.0035
texas bluebell	**0.0160**	**0.0425**	**-0.0048**	**-0.0359**	**0.0072**	-0.0090
Rose	**0.2148**	**-0.0075**	**0.0002**	**0.0072**	**-0.0159**	0.016

Table1 :Parameter estimators

	Divisia quantity index	Carnation price	Gerbera price	texas bluebell price	Rose price	Chrysanthemums price (Calculated from constraints)
Chrysanthemums	0.5435	0.0535	-0.0034	-0.009	0.016	-0.057

Table2 : Chrysanthemums parameter estimators(Calculated from the above table)

The coefficient of the Divizia index is the marginal share estimator. It looks like this:

$$\theta_1=0.1982、\theta_2=0.0275、\theta_3=0.0160、\theta_4=0.2148、\theta_5=0.5435$$

3) Survey of each income elasticity

Calculate income elasticity from the data. Clarify the relationship between substitute goods and complementary goods. The income elasticity of demand for a good is an indicator of the effect of an increase in income on the demand for that good. If this value is less than 0, the lower goods (the higher the income, the lower the consumption).If this value is greater than 0, it is a high-grade good (a good whose consumption increases as income increases). In addition, the superior goods are luxury goods (goods whose demand increases more than the increase in income) if the income elasticity is greater than 1, and necessities (goods whose consumption does not increase more than the increase in income) if the income elasticity is less than 1.

① Optimal income elasticity

When finding the optimum income elasticity value, use the calculation "parameter estimators" as the parameters of the Divizia quantity index of each flower (= marginal share of each flower / share of each flower in each year, that is θ_i/w_i). w_i, θ_i have already been used. Use it because it is calculated. For we can calculate Optimal income elasticity as θ_i/w_i.

② Actual income elasticity

There are several ways to calculate the value of income elasticity, but in this paper, when calculating the actual value of income elasticity, as defined, "rate of increase in consumption of each flower / consumption of the entire flower". We will use the formula "increase rate".

Next, the calculation result of the optimum income elasticity and the "actual income elasticity value" is shown in a graph. Since the data on actual income elasticity started in 2008, the period of the graph has changed from 2008 to 2018.

Orange line: actual　　Blue line: optimal

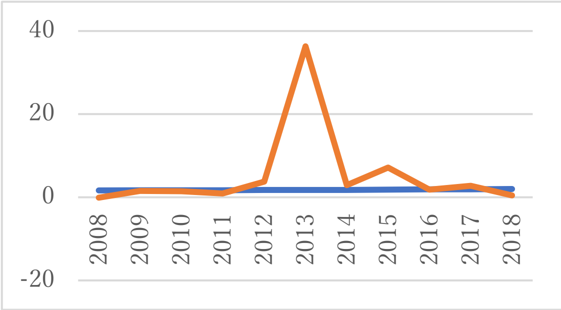

Figure 2: Comparison of carnation income elasticity

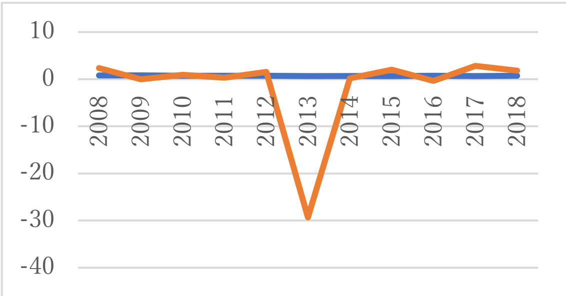

Figure3：Comparison of gerberas income elasticity

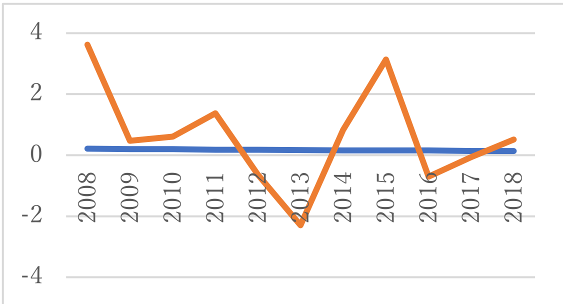

Figure4：Comparison of texas bluebell income elasticity

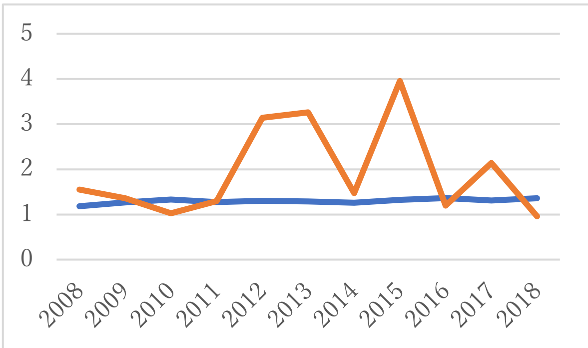

Figure5：Comparison of roses income elasticity

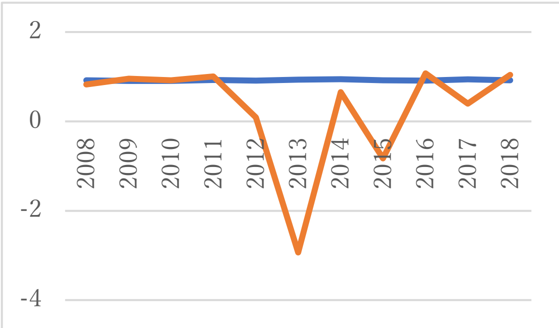

Figure6 : Comparison of chrysanthemums income elasticity

As you can see from the graph, there is a discrepancy between the optimum value and the actual value for each flower. The two flowers, carnation and rose, were more likely to have values above 1 in both optimal and actual income elasticity. On the other hand, the three flowers of gerbera, texas bluebell, and chrysanthemum had more income elasticity values below 1 in both optimal and actual conditions. This means that carnations and roses tend to be luxury goods, even if the nature of the good is assessed using both optimal and actual income elasticity.

In addition, the actual income elasticity often fluctuated more than the optimum value, and sometimes took a value less than 0, which was not seen in the optimum income elasticity. A flower with an income elasticity value of less than 0 indicates an inferior good property in which consumption decreases as income increases, and flowers that have had one or more years showing such a property are carnations, gerbera, texas bluebell, and chrysanthemum. In addition, since the number of years in which the value of less than 0 was taken was the highest at 4 years, it can be seen that the texas bluebell good is the good with the strongest inferior goods.

5. Conclusion

In this paper, in order to obtain insights to stop the shrinking of the flower market, we conducted multiple analyzes on the five most representative or widely-demanded cut flowers.

From the analysis using the Herfindahl index, it was found that competition is progressing more competitive. The cut flower market is becoming even more exhausted due to increasing competition.

In the analysis using the income elasticity values for 5 kinds of cut flowers, it was found that there was a discrepancy between the optimum income elasticity values and the actual values. Looking at the optimum value of income elasticity, it can be said that all flowers are superior goods because the value of income elasticity has always exceeded

0 for all five kinds of flowers. However, on the other hand, when looking at the actual value of income elasticity, there was a period when the values were below 0 for the four flowers of carnation, gerbera, texas bluebell, and chrysanthemum. In addition, texas bluebell had the highest number of years below zero. It can be said that the texas bluebell is a good with a strong tendency toward inferior goods among the five cut flowers. Also, what is common to all five flowers is that the difference between the actual value of income elasticity and the optimum elasticity is large, so the properties of the goods of the five kinds of cut flowers are inefficient.
If we aim to increase the consumption of flowers, it is important that the properties of flowers as goods have the properties of superior goods whose consumption increases as income increases. For that purpose, first, it is necessary to narrow the gap between the optimum value of the income elasticity of each flower and the actual value, and to improve the efficiency as a good. Secondly, it is necessary to increase the value of income elasticity of flowers that tend to take low values such as texas bluebell.

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Footnotes

1. Article 2 of the Act on Promotion of Flowers (Act No. 102 of 2014)
2. Ministry of Agriculture, Forestry and Fisheries "Current Situation of Flowers" 2019.12

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