Economic effects of Japanese pickles industry

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1. Introduction

Recently, Asian food draws international attention. As to Japanese food, it is such high-level food or drink as sushi or refined sake that are well known in the world and they are not what ordinary people eat in a daily life. The economic impact of those food, therefore are limited. Then, this paper sets a focus on the pickles of vegetable or *Tsukemono* in Japanese that all Japanese eat almost every day and introduces relative position of pickles in Japanese economy and estimates its economic effects.

In this report, we begin by overviewing *Tsukemono*, the pickles industry in Japan by looking into the consumption basket of Japanese households or calculating the import dependency in the supply of pickles in Japan. And then, we introduce *Tsukemono*, the pickles industry using measures of traditional input-output analysis such as backward and forward linkage, output ripple effects and final demand dependency. We estimate economic direct or indirect effects of demand increase in *Tsukemono*, the pickles industry. Lastly, we set a focus on supply side and examine economic contribution of *Tsukemono*, the pickles industry to the entire economy in Japan.

2. Overview of *Tsukemono*, the pickles industry

In the recent Japanese input-output table, *Tsukemono*, the pickles industry is included in the industry of preservation food of farming production (except jar and canned food) with code 11602. And according to the recent I-O table for the year 2011, *Tsukemono*, the pickles industry covers

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wide range of products such as dehydrated vegetables like dried gourd shavings, dried strips of radish ,frozen vegetables, dried fruits besides pickles, cupped jam, and mashed potato[1].

In this section, we use two recent I-O tables. The one is 2011 I-O table whose size of the part of intermediate transactions is 518 rows by 397 columns and the other is 2005 I-O table whose size of the part of intermediate transactions is 520 rows by 407 rows. Upon analysis, we aggregate sectors of each I-O table. As for 2011 I-O table, the number of sectors to be 393 and for 2005 I-O table, the number of sectors to be 400 in a similar manner[2].

Let us begin by examining the size of the *Tsukemono*, the pickles industry in Japan. Table 1 shows the size of the industries based on two recent I-O tables. As mentioned above, since *Tsukemono*, the pickles industry is included in the industry of preservation food of farming production in recent Japanese I-O table, here, we compare two industries: the industry of preservation food of farming production and the food industry both from supply side and demand side.

Seen from supply side, as of 2011, the size of the industry of preservation foods of farming production is about ￥60.8 billion, which account for 2.4 % of the food industry. If compared to the year 2005, this sector is greatly expanding. More precisely, the industry expanded by 38.4 points, while the entire food industry increased by 16.1 points during the same period (from 2005 to 2011). Seen from demand side, the size of the industry is about ￥1.1 trillion and its share toward the food industry is 3.4 %. Here again, we can see huge expansion of the industry compared to the increase ratio of the entire food industry (by 20.2 point and 5.1 point, respectively).

To sum, there is a growing trend both in the size of *Tsukemono*, the pickles industry in Japan and its share towards the food industry. The proportion of the share, however, remains relatively small.

Table 1 The size of *Tsukemono*, the pickles industry in Japan

(JPY million, %)

	Supply side(column):		Demand side(row):	
	Domestic production (gross output)		Total demand	
	2005	2011	2005	2011
009:The food industry	24,152,903	25,620,219	28,440,461	29,889,015
48:The industry of preservation food of farming production	439,332	608,148	836,411	1,005,945
share	1.8%	2.4%	2.9%	3.4%

Source: I-O table for the year 2011 and 2005 in Japan

Table 2 shows the supply of *Tsukemono*, the pickles in Japan. The data is based on Japanese I-O tables for the year 2005 and 2011. We have three findings through the examination of Table 2, Table 3 and Table 4.

First, as shown in Table 2, the ratio of the import dependency in the supply of pickles is 39.5 %, or the self-sufficiency ratio is no more than 60.5 %. If we compare its import dependency ratio to that of other sector's included in 009: The food industry, we can observe the percentage of the import dependency is high in 48: the industry of preservation food of farming production (Table

3). As of 2011, the percentage is the second highest among food industry in Japan, following 37: Frozen fish and shellfish (39.5 % and 48.8 %, respectively). Other sectors with relatively high ratio of import dependency are 33: Meat (36.2 %), 34: Processed meat products (25.3 %), 47: Bottled or canned vegetables and fruits (35.8 %) and 52: Animal oil and fats, vegetable oil and meal (26.9 %). In these sectors, high custom tariff rate are can be seen in some sector's products (see Table 4). This means that sectors with heavy dependence on imported supply are protected by customs high tariff rate. As there is no tariff imposed on the products of 48: the industry of preservation food of farming production, which means that *Tsukemono*, the pickles market in Japan is considered to be relatively open. It is a sharp contrast with other protected food related sectors.

Second, if we look at the Table 2 more precisely, we can see the import dependency ratio of the total of intermediate sector is very high, the highest in the listed data. As of 2011, drop by 15.5 points from 2005 however, the ratio records 63.5 %. This means intermediate sectors' large dependence on imported pickles as intermediate inputs. As for final demand, the percentage of import dependency is 39.5 % in 2011 and has a declining trend. In addition, the ratio of each final demand components: Investment and Consumption are 41% and 29.6 % respectively in 2011[3].

Third, in terms of the amount of the supply of *Tsukemono*, the pickles, ¥39.8 billion are imported as final products in 2011, while ¥19 billion are imported as intermediate inputs. This represent that most of *Tsukemono*, the pickles are imported as a final products.

To sum up, *Tsukemono*, the pickles market in Japan is relatively open. In particular, the import dependency ratio in the total of the intermediate sector is very high. Around 70 to 80 % of imported *Tsukemono*, the pickles are used as intermediate inputs. In terms of the amount, however, the majority of the supply of *Tsukemono*, the pickles is imported as final products. Therefore, how much imported pickles are consumed in Japan greatly depend on the selection of domestic consumers.

Table 2 The import dependency in the supply of pickles in Japan

(JPY million, %)

		Total supply		domestic supply		Imported supply		The self-sufficiency ratio		Import dependency	
		2005	2011	2005	2011	2005	2011	2005	2011	2005	2011
Total of intermediate sectors		224,784	299,485	47,232	109,356	177,552	190,129	21.0%	36.5%	79.0%	63.5%
Final demand	Consumption	599,295	697,631	381,277	491,384	218,018	206,247	63.6%	70.4%	36.4%	29.6%
	Investment	6,442	3,464	4,933	2,043	1,509	1,421	76.6%	59.0%	23.4%	41.0%
Total final demand		611,627	706,460	392,100	498,792	219,527	207,668	64.1%	70.6%	35.9%	29.4%
Total demand		836,411	1,005,945	439,332	608,148	397,079	397,797	52.5%	60.5%	47.5%	39.5%

Source: I-O table for the year 2011 and 2005 in Japan

Table 3 The import dependency in the food industries in Japan

2005			2011		
	Sector	Import dependency		Sector	Import dependency
33	Meat processing	41.7%	33	Meat	36.2%
34	Processed meat products	23.3%	34	Processed meat products	25.3%
35	Bottled or canned meat products	12.3%	35	Bottled or canned meat products	7.0%
36	Dairy farm products	8.0%	36	Dairy farm products	8.8%
37	Frozen fish and shellfish	44.2%	37	Frozen fish and shellfish	48.8%
38	Salted, dried or smoked seafood	9.4%	38	Salted, dried or smoked seafood	8.6%
39	Bottled or canned seafood	13.9%	39	Bottled or canned seafood	17.5%
40	Fish paste	0.0%	40	Fish paste	0.0%
41	Other processed seafood	27.8%	41	Other processed seafood	25.8%
42	Grain milling	1.5%	42	Grain milling	2.4%
43	Flour and other grain milled products	1.2%	43	Flour and other grain milled products	1.4%
44	Noodles	4.4%	44	Noodles	4.1%
45	Bread	0.3%	45	Bread	0.3%
46	Confectionery	5.1%	46	Confectionery	4.4%
47	Bottled or canned vegetables and fruits	46.4%	47	Bottled or canned vegetables and fruits	35.8%
48	Preserved agricultural foodstuffs (except bottled or canned)	47.5%	48	Preserved agricultural foodstuffs (except bottled or canned)	39.5%
49	Sugar	15.3%	49	Sugar	21.5%
50	Starch	8.6%	50	Starch	7.6%
51	Dextrose, syrup and isomerized sugar	5.5%	51	Dextrose, syrup and isomerized sugar	3.8%
52	Vegetable oils and meal	21.7%	52	Animal oil and fats, vegetable oil and meal	26.9%
53	Animal oils and fats	34.4%			
54	Condiments and seasonings	4.3%	53	Condiments and seasonings	4.0%
55	Prepared frozen foods	0.2%	54	Prepared frozen foods	0.3%
56	Retort foods	0.1%	55	Retort foods	0.1%
57	Dishes, sushi and lunch boxes	0.1%	56	Dishes, sushi and lunch boxes	0.2%
58	School lunch (public)	0.0%	57	School lunch (public)	0.0%
59	School lunch (private)	0.0%	58	School lunch (private)	0.0%
60	Other foods	14.8%	59	Miscellaneous foods	8.6%

Source: I-O table for the year 2011 and 2005 in Japan

Table 4 Custom Tariffs in Japan (As of April 2016)

code	Sector Name	Description	Tariff rate(general)
33	Meat	Beef	50%
		Goose meat	12.50%
34	Processed meat products	Ham, Bacon	10%
		Sausage	10%
37	Frozen fish and shellfish	Crab	6% or 9.6%
		Norway lobster	4% or 4.8%
		Shrimp	4% or4.8%
		Other shellfish	9.6% or 10%
52	Animal oil and fats, vegetable oil and meal	Margarine(except liquid)	35%
		Shortening	15%
		Rapeseed oil	JPY 20.70/kg or JPY 17/kg (Acid value 0.6 or over)
		Sunflower oil	
		Sesame oil	

Source: Trade Statistics of Japan, available at the following site. < http://customs.go.jp/tariff/2016_4/ > (accessed 2016/5/19)

3. Output ripple effects and Final demand dependency

From here, we use measures of traditional input-output analysis. We begin by examining output ripple effects and Final demand dependency and then move on to consider backward and forward linkage.

In general, equilibrium output: $\mathbf{x}$ that meets all demand in product markets throughout the economy is given by

$$\mathbf{x} = [\mathbf{I} - \mathbf{A}^d]^{-1}[\mathbf{f}^d + \mathbf{e}] \tag{1}$$

where $\mathbf{A}^d$ is domestic input coefficient matrix, $\mathbf{f}^d$ is total domestic final demand, $\mathbf{e}$ is export. Total domestic final demand $\mathbf{f}^d$ and export $\mathbf{e}$ are exogenous variables. Given exogenous variables, the left-hand side of the equation (1) represents the level of the total output necessary to satisfy the final demand. Seen from a different angle, the left-hand can be seen as the production inducement amount generated by a certain amount of final demand. As final demand can be divided into 3 components: "Consumption (private and government)", "Investment", and "Export", we pick up each component and examine the degree of contribution in terms of inducing additional production. This proportion is called the ratio of final demand dependency

If we let (c,q,e) be the vector of each items of final demand composition. $\mathbf{x}_c$ represents the production inducement amount induced by consumption demand, $\mathbf{x}_q$ represents the production inducement amount induced by investment demand and $\mathbf{x}_e$ represents he production inducement amount induced by export demand.

$$\mathbf{x}_c = [\mathbf{I} - \mathbf{A}^d]^{-1}\mathbf{c}^d \tag{2}$$

$$\mathbf{x}_q = [\mathbf{I} - \mathbf{A}^d]^{-1}\mathbf{q}^d \tag{3}$$

$$\mathbf{x_e} = [\mathbf{I} - \mathbf{A^d}]^{-1}\mathbf{e} \tag{4}$$

Table 5 shows output ripple effects and final demand dependency of the industry of preservation food of farming production in Japan, which are calculated by the equations (2),(3),and(4).

As of 2011, ¥ 60.8 billion is induced by the total final demand of the industry. If we look into to see which final demand component has the biggest impact on production inducement in the sector, the percentage of the final demand dependency shows that the greatest contributor is "Consumption (private and government)", which induced ¥59.9 billion, 98.6 % of the total of the production inducement amount. In the same year, the final demand dependency ratio of "Investment" is 0.4 %, and that of "Export" is 1.0 %. This means that production of the industry highly depend on consumption. In addition, if we compare 2011 and 2005, there seem to be an increasing trend in "Consumption" (from 97.4 to 98.6 %), however, as for "Investment" and "Export", the trend is opposite (from 1.1 to 0.4 %, from 1.5 to 1.0% respectively).

To sum, the production of *Tsukemono*, the pickles in Japan largely depends on consumption demand for the sector's products. It is a stark contrast with the industry of passenger motor car, which is largely depends on export demand.

Table 5   The production inducement amount and Final demand dependency

(JPY million, %)

48: The industry of preservation food of farming production

		The production inducement amount		Final demand dependency	
		2005	2011	2005	2011
Final demand	Consumption	427,772	599,564	97.4%	98.6%
	Investment	4,991	2,199	1.1%	0.4%
	Export	6,568	6,385	1.5%	1.0%
	Total	439,332	608,148		

243: The industry of passenger motor car

		The production inducement amount		Final demand dependency	
		2005	2011	2005	2011
Final demand	Consumption	4,011,437	4,198,717	27.4%	35.5%
	Investment	2,899,521	1,245,799	19.8%	10.5%
	Export	7,710,450	6,391,877	52.7%	54.0%
	Total	14,621,408	11,836,393		

Source: I-O table for the year 2011 and 2005 in Japan

4. Backward Forward linkage of the industry

Another way to see the interdependence of sectors in the whole economy is to observe backward forward linkage of the industry. In doing so, we use two figures: the power dispersion and the sensitivity dispersion. The power dispersion represents backward effects and the sensitivity dispersion represents forward effects.

The j th column of Leontief inverse tells us the change of output volume in other sectors by the one unit of demand increase for sector j's product. Thus, the j th column sum of Leontief inverse represents total of direct and indirect effects toward whole economy generated by the one unit of demand increase for sector j's product. In other words, we can see the backward linkage of the sector by calculating the column sum of Leontief inverse. The figure is called the power dispersion. If the figure is over 1, we can say that the sector has influential power in terms of increasing the total output of the whole economy.

As shown in Table 6, the power dispersion of 48: the industry of preservation food of farming production is 2.019 in 2011 and there is a growing trend. This represents that one unit of final demand increase against the industry raise the total output level of the whole economy in Japan by 2.019 units. Thus, we can say that *Tsukemono*, the pickles industry has an influential power to the whole economy in Japan. The following sectors have similar influential powers in the same year: 44: Noodles (1.983), 54: Prepared frozen foods (2.011) and 55: Retort foods (1.942).

On the other hand, the i th row of Leontief inverse tells us the change of output volume of sector i's product, given that the one unit of demand increase for all sectors' product. Thus, the i th row sum of Leontief inverse represents the total output increase of sector i's product, generated by the one unit of demand increase for all sectors' product. In other words, we can see the forward linkage of the sector by calculating the row sum of Leontief inverse. The figure is called the sensitivity dispersion. If the figure is over 1, we can say that the sector is sensitive to demand increase for other sector's product.

The sensitivity dispersion of 48: the industry of preservation food of farming production is 1.061 in 2011 and it has a growing trend. This represents that one unit of demand increase against all sectors raise the sector's total output volume by 1.061 units. It doesn't mean that, *Tsukemono*, the pickles industry is not sensitive to demand increase against other sector's product. Similar figures can be seen in the following food related sectors as well as beverage sectors in the in the same year: 40: Fish paste (1.062), 45: Bread (1.053), 54: Prepared frozen foods (1.055), 61: Malt liquors (1.072).

Table 6 Backward and Forward linkage (2005, 2011)

(P: The Power dispersion, S: The Sensitivity dispersion)

	2005 Sector	P	S		2011 Sector	P	S
33	Meat processing	3.285	1.591	33	Meat	3.065	1.407
34	Processed meat products	1.742	1.089	34	Processed meat products	1.839	1.087
35	Bottled or canned meat products	2.047	1.005	35	Bottled or canned meat products	2.097	1.002
36	Dairy farm products	2.473	1.714	36	Dairy farm products	2.401	1.683
37	Frozen fish and shellfish	2.072	1.472	37	Frozen fish and shellfish	2.276	1.317
38	Salted, dried or smoked seafood	1.861	1.055	38	Salted, dried or smoked seafood	1.963	1.040
39	Bottled or canned seafood	2.063	1.011	39	Bottled or canned seafood	2.154	1.009
40	Fish paste	1.900	1.082	40	Fish paste	1.808	1.062
41	Other processed seafood	2.015	1.090	41	Other processed seafood	2.144	1.081
42	Grain milling	2.510	1.504	42	Grain milling	2.614	1.439
43	Flour and other grain milled products	1.985	1.535	43	Flour and other grain milled products	1.484	1.566
44	Noodles	2.153	1.047	44	Noodles	1.983	1.033
45	Bread	1.908	1.071	45	Bread	1.923	1.053
46	Confectionery	1.902	1.043	46	Confectionery	1.917	1.037
47	Bottled or canned vegetables and fruits	2.275	1.055	47	Bottled or canned vegetables and fruits	2.027	1.041
48	Preserved agricultural foodstuffs (except bottled or canned)	1.996	1.029	48	Preserved agricultural foodstuffs (except bottled or canned)	2.019	1.061
49	Sugar	1.992	1.204	49	Sugar	1.731	1.252
50	Starch	1.701	1.732	50	Starch	1.575	1.742
51	Dextrose, syrup and isomerized sugar	2.318	1.125	51	Dextrose, syrup and isomerized sugar	2.167	1.151
52	Vegetable oils and meal	1.742	1.962	52	Animal oil and fats, vegetable oil and meal	1.690	2.047
53	Animal oils and fats	2.460	1.223				
54	Condiments and seasonings	2.006	1.394	53	Condiments and seasonings	1.930	1.501
55	Prepared frozen foods	2.026	1.073	54	Prepared frozen foods	2.011	1.055
56	Retort foods	2.130	1.012	55	Retort foods	1.942	1.011
57	Dishes, sushi and lunch boxes	2.221	1.034	56	Dishes, sushi and lunch boxes	2.152	1.015
58	School lunch (public)	2.125	1.000	57	School lunch (public)	2.244	1.000
59	School lunch (private)	2.176	1.000	58	School lunch (private)	2.389	1.000
60	Other foods	1.949	1.282	59	Miscellaneous foods	2.200	1.831
61	Refined sake	1.902	1.028	60	Refined sake	1.858	1.021
62	Beer	1.481	1.137	61	Malt liquors	1.516	1.072
63	Whiskey and brandy	1.657	1.018	62	Whiskey and brandy	1.521	1.018
64	Other liquors	1.820	1.043	63	Miscellaneous liquors	1.685	1.035
65	Tea and roasted coffee	1.867	1.134	64	Tea and roasted coffee	1.751	1.188
66	Soft drinks	2.029	1.103	65	Soft drinks	2.111	1.035
67	Manufactured ice	1.830	1.044	66	Manufactured ice	1.930	1.044

Source: I-O table for the year 2011 and 2005 in Japan

5. Economic contribution of *Tsukemono*, the pickles industry

Finally, we set focus on supply side and examine economic contribution of *Tsukemono*, the pickles industry to Japanese economy in terms of increasing income. It is natural to assume that some of the additional value generated in production process is likely to leak outside the country. Therefore, in order to accurately assess the additional value and then examine economic contribution, we use three commonly used indexes: the ratio of domestic intermediate input, the ratio of imported intermediate input, the ratio of value added, and two additional indexes: Total import ratio and Total value added ratio to better understand the situation.

Suppose that equilibrium output: x that meets all demand in product markets throughout the economy is given by the equation (1). Then, we can calculate three indexes by the following equations from (5) to (9). Every calculation is based on the recent I-O tables.

$$dm_j = \sum_i x_{ij}^d / x_j \tag{5}$$

$$im_j = \sum_i x_{ij}^m / x_j \tag{6}$$

$$v_j = V_j / x_j \tag{7}$$

where we use x_j to represent the output of sector j, x_j^d to represent the domestic intermediate input of the industry j, x_j^m to represent the imported intermediate input of the industry j, dm_j to represent the ratio of domestic input, im_j to represent the ratio of imported input, v_j to represent additional value generated by the one unit of total output of the industry j, and V_j to represent the total value added in the industry j.

The ratio of domestic intermediate input dm_j tells us how much domestic intermediate goods are used in order to produce the one unit of sector j's product, which is given by the equation(5). Similarly, the rate of imported intermediate input im_j used to produce the one unit of sector j's product is given by the equation (6). The value added ratio v_j explains how much additional value is generated by the one unit increase of sector j's product. The examination of dm_j, im_j and v_j tells us the degree of import dependency of the production activity in sector j. In other words, we can see how much intermediate inputs are imported by sector j and to what degree sector j contribute to the whole economy by generating additional value.

Precisely speaking, however, there is one important thing to note here as mentioned above. In order to examine the net contribution of sector j to the whole economy, it is necessary to look into the production process of the domestic intermediate inputs used in sector j. Since it is almost likely that in the process of producing domestic intermediate inputs used in sector j, imported intermediate inputs are also used and another additional value is generated. Therefore, in order to accurately assess the additional value, we divide domestic intermediate inputs used in each sector's production into two parts: imported intermediate inputs used in the production process of domestic intermediate inputs itself and additional value generated in the production process of domestic intermediate

inputs. And then, we estimate net additional value, or additional value that stays in the country, which is generated by the one unit increase of corresponding sector's product. We use the following two indexes: Total import ratio and Total value added ratio. The former tells us how much additional value generated by the one unit increase of corresponding sector's product leak outside the country. We write it as **pm**:

$$\mathbf{pm} = \iota \mathbf{A^m}[\mathbf{I} - \mathbf{A^d}]^{-1} \tag{8}$$

where $\mathbf{A^m}$ is imported input coefficient matrix. In a similar manner, total value added ratio PV represents how much net additional value stays in the country. In other words, it tells us the degree of sector's economic impact in terms of domestic income increase. We write it as **pv**:

$$\mathbf{pv} = \iota \hat{\mathbf{v}}[\mathbf{I} - \mathbf{A^d}]^{-1} \tag{9}$$

where $\mathbf{A^d}$ is domestic input coefficient matrix. We estimate **pm** and **pv** by the equation (8) and (9) and have three findings through examination.

First, the ratio of value added of the industry of preservation food of farming production remains relatively low level among the food industry, which are 0.375 in 2005 and 0.377 in 2011.

Second, total value added ratio tells us different result, however. Total value added ratio of the industry of preservation food of farming production is 0.877 in 2011, which means that one unit of output increase in the industry of preservation food of farming production generates additional demand which stay in the country by 0.877 units. In other words, about 90 % of additional value generated through the production activity in the sector remains in the country. It is the second highest ratio following 42: Grain milling (0.913). Thus, the sector highly contributes to the domestic economy by increasing income level In addition, the year 2005 also has a similar ratio (see Table 7).

Third, as shown in Table 7 and Table 8, Total value added ratio of most food related sectors in Japan exceed 80 %, however, there are several exceptions. In 2011, for example, in the following three sectors, total value added ratio remains 60 % or less, which are 43: Flour and miscellaneous grain milled products, 50: Starch and 52: Animal oil and fats, vegetable oil and meal in industry code order. Then, if we look at these sectors' ratio of imported inputs, we can see the proportions in each sector is relatively high. This means that there is a high dependence on imported intermediate inputs in these three sectors.

To sum, *Tsukemono*, the pickles industry highly contributes to domestic economy by increasing income level.

Table 7 Total value added ratio and total import ratio (2005)

	Sector	The ratio of domestic inputs	The ratio of imported inputs	The ratio of value added	Total import ratio	Total value added ratio
33	Meat processing	0.953	0.000	0.046	0.209	0.791
34	Processed meat products	0.370	0.353	0.277	0.392	0.608
35	Bottled or canned meat products	0.544	0.097	0.358	0.152	0.848
36	Dairy farm products	0.750	0.036	0.214	0.151	0.849
37	Frozen fish and shellfish	0.642	0.048	0.309	0.119	0.881
38	Salted, dried or smoked seafood	0.495	0.189	0.315	0.240	0.760
39	Bottled or canned seafood	0.569	0.084	0.347	0.150	0.850
40	Fish paste	0.483	0.152	0.365	0.209	0.791
41	Other processed seafood	0.572	0.095	0.333	0.156	0.844
42	Grain milling	0.881	0.003	0.116	0.062	0.938
43	Flour and other grain milled products	0.511	0.296	0.193	0.346	0.654
44	Noodles	0.595	0.041	0.364	0.162	0.838
45	Bread	0.481	0.046	0.473	0.140	0.860
46	Confectionery	0.471	0.090	0.439	0.159	0.841
47	Bottled or canned vegetables and fruits	0.685	0.081	0.234	0.146	0.854
48	Preserved agricultural foodstuffs (other than bottled or canned)	0.565	0.061	0.375	0.108	0.892
49	Sugar	0.566	0.144	0.290	0.212	0.788
50	Starch	0.419	0.408	0.173	0.450	0.550
51	Dextrose, syrup and isomerized sugar	0.768	0.022	0.211	0.281	0.719
52	Vegetable oils and meal	0.399	0.445	0.155	0.512	0.488
53	Animal oils and fats	0.627	0.064	0.309	0.178	0.822
54	Condiments and seasonings	0.518	0.068	0.414	0.143	0.857
55	Prepared frozen foods	0.532	0.118	0.350	0.186	0.814
56	Retort foods	0.606	0.101	0.292	0.178	0.822
57	Dishes, sushi and lunch boxes	0.620	0.094	0.287	0.164	0.836
58	School lunch (public)	0.556	0.031	0.413	0.101	0.899
59	School lunch (private)	0.583	0.034	0.382	0.107	0.893
60	Other foods	0.499	0.094	0.407	0.165	0.835
61	Refined sake	0.475	0.005	0.520	0.046	0.954
62	Beer	0.248	0.020	0.732	0.048	0.952
63	Whiskey and brandy	0.349	0.035	0.617	0.066	0.934
64	Other liquors	0.430	0.045	0.525	0.090	0.910
65	Tea and roasted coffee	0.477	0.132	0.391	0.176	0.824
66	Soft drinks	0.515	0.034	0.451	0.101	0.899
67	Manufactured ice	0.436	0.003	0.561	0.064	0.936

Source: I-O table for the year 2011 and 2005 in Japan

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Table 8 Total value added ratio and total import ratio Indexes (2011)

	Sector	The ratio of domestic inputs	The ratio of imported inputs	The ratio of value added	Total import ratio	Total value added ratio
33	Meat	0.893	0.002	0.105	0.261	0.739
34	Processed meat products	0.422	0.323	0.255	0.385	0.615
35	Bottled or canned meat products	0.572	0.062	0.365	0.148	0.852
36	Dairy farm products	0.724	0.036	0.241	0.171	0.829
37	Frozen fish and shellfish	0.766	0.045	0.189	0.151	0.849
38	Salted, dried or smoked seafood	0.565	0.134	0.301	0.211	0.789
39	Bottled or canned seafood	0.619	0.048	0.333	0.147	0.853
40	Fish paste	0.436	0.161	0.403	0.228	0.772
41	Miscellaneous processed seafood	0.622	0.069	0.309	0.170	0.830
42	Grain milling	0.955	0.003	0.042	0.087	0.913
43	Flour and other grain milled products	0.240	0.393	0.367	0.428	0.572
44	Noodles	0.574	0.035	0.391	0.187	0.813
45	Bread	0.527	0.057	0.416	0.191	0.809
46	Confectionery	0.489	0.087	0.424	0.183	0.817
47	Bottled or canned vegetables and fruits	0.539	0.118	0.343	0.197	0.803
48	Preserved agricultural foodstuffs (except bottled or canned)	0.570	0.054	0.377	0.123	0.877
49	Sugar	0.402	0.257	0.341	0.340	0.660
50	Starch	0.347	0.507	0.147	0.562	0.438
51	Dextrose, syrup and isomerized sugar	0.727	0.042	0.231	0.359	0.641
52	Animal oil and fats, vegetable oil and meal	0.378	0.473	0.149	0.574	0.426
53	Condiments and seasonings	0.478	0.065	0.457	0.164	0.836
54	Prepared frozen foods	0.528	0.128	0.344	0.217	0.783
55	Retort foods	0.507	0.077	0.416	0.160	0.840
56	Dishes, sushi and lunch boxes	0.587	0.084	0.329	0.170	0.830
57	School lunch (public)	0.625	0.020	0.355	0.117	0.883
58	School lunch (private)	0.702	0.025	0.273	0.134	0.866
59	Miscellaneous foods	0.609	0.088	0.302	0.205	0.795
60	Refined sake	0.428	0.015	0.557	0.078	0.922
61	Malt liquors (Beer)	0.256	0.017	0.727	0.057	0.943
62	Whiskey and brandy	0.269	0.031	0.699	0.067	0.933
63	Miscellaneous liquors	0.350	0.062	0.589	0.111	0.889
64	Tea and roasted coffee	0.407	0.221	0.372	0.285	0.715
65	Soft drinks	0.570	0.041	0.389	0.154	0.846
66	Manufactured ice	0.487	0.005	0.508	0.110	0.890

Source: I-O table for the year 2011 and 2005 in Japan

6. Conclusion

In this report, we begin by overviewing *Tsukemono*, the pickles industry, by looking into the consumption basket of Japanese households and calculating the import dependency in the supply of pickles in Japan. Findings of each part are as follows:

(1) The size of *Tsukemono*, the pickles industry in Japan

● In supply side, the industry size is about ¥ 60.8 billion, which account for 2.4 % of the food industry in 2011

● In demand side, the industry size is about ¥1.1 trillion and which account for 3.4 % of the food industry in 2011.

● There is a growing trend both in the size of *Tsukemono*, the pickles industry in Japan and its share towards the food industry. The proportion of the share, however, remains relatively small.

(2) The import dependency and the self-sufficiency ratio

● As of 2011, import dependency in the supply of pickles in Japan is 39.5 %, or the self-sufficiency ratio for total demand is no more than 60.5 %. Thus, *Tsukemono*, the pickles market in Japan is relatively open.

● In particular, the import dependency ratio in the total of the intermediate sector is very high in both 2011 and 2005 (79 % and 63.5 %, respectively). Around 70 to 80 % of imported *Tsukemono*, the pickles are used as intermediate inputs.

● In terms of the amount, however, the majority of the supply of *Tsukemono*, the pickles is imported as final products.

● Therefore, how much imported pickles are consumed in Japan greatly depends on the selection of domestic consumers.

Findings from the examination output ripple effects and final demand dependency are as follows:

(1) As of 2011, the production inducement amount of the industry of preservation food of farming production is estimated ¥ 60.81 billion.

(2) In particular, ¥ 59.95 billion is induced by "Consumption", one of the final demand components of the industry.

(3) The production of *Tsukemono*, the pickles in Japan is considered to be largely dependent on consumption demand. It is a stark contrast with the industry of passenger motor car, which are largely depend on export demand.

As for backward forward linkage, we have two findings.

(1) The power dispersion of the industry of preservation food of farming production is 2.019 in 2011 and there is a growing trend. Thus, *Tsukemono*, the pickles industry has an influential power to the whole economy in Japan. The following sectors have similar influential power in the same year: 44: Noodles (1.983), 54: Prepared frozen foods (2.011) and 55: Retort foods (1.942).

(2) The sensitivity dispersion of the industry of preservation food of farming production is 1.061 in 2011 and it has a growing trend. It doesn't mean that, *Tsukemono*, the pickles industry is not sensitive to demand increase against other sector's product. Similar figures can be seen in the

following food related sectors as well as beverage sectors in the in the same year: 40: Fish paste (1.062), 45: Bread (1.053), 54: Prepared frozen foods (1.055), 61: Malt liquors (1.072).

Lastly about economic contribution of *Tsukemono*, the pickles industry, we have three findings.

(1) The ratio of value added of the industry of preservation food of farming production remains relatively low level among the food industry, which are 0.375 in 2005 and 0.377 in 2011.

(2) However, the Total value added ratio of the sector shows the second highest level (0.892 in 2005 and 0.877 in 2011). This means that almost 90 % of additional value generated through the production activity in the sector remains in the country.

(3) *Tsukemono*, the pickles industry highly contributes to domestic economy by increasing income level.

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[1] The official definition of the industry of preservation food of farming production is available at the following site: http://www.soumu.go.jp/main_content/000291351.pdf (accessed 2015/5/14)

[2] As already mentioned, *Tsukemono*, the pickles industry is included in the industry of preservation food of farming production (except jar and canned food) with code 11602 in the recent I-O tables in Japan. Also, the industry of preservation food of farming production itself is included in the food industry with the code 009 in 37 Sector Classification. In this report, the code of *Tsukemono*, the pickles industry is 48.

[3] In this report, the component parts of final demand are grouped in order to simplify and to better understand the effect of each components. "Consumption expenditure outside households", "Consumption expenditure (private)", and "Consumption expenditure of general government" are grouped into "Consumption". And in a similar manner, "Gross domestic fixed capital formation (public and private)" and "Increase in stocks" are grouped into "Investment".