

An Analysis of Food Consumption Patterns Using Input-Output Tables¹

By
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Abstract

This paper attempts to provide a comprehensive description and systematic analysis of the changing patterns of Japanese food consumption during the period of 1963-1991 and also tries to develop methods for the analysis of consumer's behavior using *input-output tables*. In Japan, food consumption patterns have undergone tremendous changes over the past three decades. These changes are analyzed largely through data from *the Family Income and Expenditure Survey*. *Input-Output Tables* can be used to shed light on certain aspects of food consumption which are not readily apparent from this survey. Total contributions, including indirect effects, of primary industries, food processing industries, distributive services, and restaurants, to food consumption expenditures are estimated respectively. Shares of domestic products and imports in the contributions of primary industries and food processing industries are also estimated.

1. Introduction

Food consumption in Japan has gone through tremendous changes both in quantitative and qualitative terms since the end of the World War II. For several years following the War, the level of food consumption was only enough to satisfy the minimal nutritive requirements. During the period of rapid economic growth in the 1960s and 1970s, however, remarkable shifts from starch to protein foods took place due mainly to the rise in per capita income. Among protein foods, fish meats were replaced with animal meats, dairy products and eggs. These changes are usually referred to as the Westernization of food consumption patterns. The average calorie intake per capita per day increased from 2104 kcal in 1955 to 2287 kcal in 1971.

Later, as Japanese economy overcame the two oil crises and reached the stage of relatively slow and stable growth, food consumption also reached the period of maturity. Changes in food consumption became slow. However, there are still some obvious trends in it².

There are a number of studies on food consumption patterns in Japan³. Most of them use the data from *the Family Income and Expenditure Survey*. The following section gives a brief explanation and major points of one of our recent studies on changes in food consumption patterns based on *the Family Income and Expenditure Survey*. The third section discusses the characteristics of *Input-Output Tables* which are available in Japan for the analysis of food consumption patterns. The fourth section provides an estimation of the share of imports in the total expenditure for food and beverages and shows that the original contribution of imports is not more than 10% in terms of money value. The fifth section compares changes in food consumption patterns shown in *Input-Output Tables* with changes in *the Family Income and Expenditure Survey*. The final section summarizes the major findings of this study.

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¹This is a revised edition of Tokoyama, H.[9]

²See Fujita, N. [1] and Morishima, M., Aita, T. and Nakagawa, M.[4]

³For example, see Higuchi, T.[2]

Price Quant.	Fall	Fluctuate	Rise	Total
Decrease	Butter 2	Canned meat 1 Butter 3,4 Pork 5 Chicken 5	Beef 1 Milk 2 Powdered milk 3 Canned meat 4 Ham4,5 Eggs 5	13
Fluctuate	Powdered milk 2 Eggs2,3,4	Butter 1 Milk3,4 Canned meat 3 Cheese 4 Pork4 Powdered milk 4,5 Minced meat 5 Bacon 5	Bacon 1 Sausages 3	16
Increase	Eggs1 Chees1,2 Pork1,2,3 Chicken1,2,3,4 Milk 5 Butter 5 Yogurt 5	Ham 1 Sausages 1,2 Powdered milk 1 Bacon2,3,4 Cheese 3,5 Beef 4,5	Milk 1 Beef2,3 Ham 2,3 Canned meat2 Sausages 4,5	32
Total	18	26	17	61

Source: *The Family Income and Expenditure Survey* (each year).

Note: The attached number shows the sub-period. 1 1963-1968 2 1969-1974 3 1975-1980
4 1981-1986 5 1987-1991

Figure 1: Changes in per Capita Consumption and Prices by Food Items:An Example(Meats, Dairy Products and Eggs)

2. An Analysis of Food Consumption Patterns Using the Data from the Family Income and Expenditure Survey

To examine the changes in food consumption patterns, annual per capita consumption was calculated for more than one hundred items of foods for the years 1963–1991. The data on family size and annual average amount of food consumption for all households were taken from *the Family Income and Expenditure Survey* (each year). The whole period was divided into five sub-periods ; I(1963–68), II(1969–74), III(1975–80), IV(1981–86), and V(1987–91).

For each sub-period, the food items were classified into three groups: ‘increase’, ‘decrease’, and ‘fluctuate’ according to the changes in per capita consumption. Similarly, the changes in prices are classified into three groups: ‘rise’, ‘fall’, and ‘fluctuate’. The quantity of each consumption item is measured in physical terms, and prices are respectively deflated by the price-index representing each of the twelve food categories(by middle classification).

The matrix prepared for food items in the category Meats, Dairy Products, and Eggs is shown in Figure 1. Similarly, eleven other matrices are obtained for other groups of foods such as Cereals, Fishes, Vegetables and etc.

Figure 1 consists of 61 cases (14 items for 5 sub-periods, of which 9 cases are lacking). Per capita consumption increased for 32 cases, decreased for 13 cases, and fluctuated for the remaining 16 cases without any definite upward or downward trends. In 13 cases placed in the bottom-left cell and 7 cases placed in the top-right cell, changes in per capita consumption are consistent with the corresponding changes in prices. In the other 25 cases, however, changes in per capita consumption do not coincide with price changes. These 25 cases need to be accounted for by some factors other than price effects.

Many factors have been pointed out to interpret changes in food consumption patterns⁴.

⁴See Tokoyama, H. and Egaitus, F. [7].

The major factors, other than the price effects, can be categorized into 1) consumers' preference for higher quality foods (Q), 2) consumers' preference for more convenient types of foods (C), 3) trends towards diversification of the menu (D), and 4) increasing health consciousness (H). These four factors are given clear definitions, as shown below, which can be used as the operational indicators to classify each case of change in per capita consumption unequivocally.

The shifts towards higher quality foods are mainly induced by the increase in incomes. This category includes three sub-categories⁵.

Q1: A shift towards foods of higher unit prices within the same item.

A typical case is the shift from low-quality/low-price rice distributed by the Government Food Agency to high-quality/high-price rice distributed by commercial traders.

Q2: A shift towards foods of higher unit prices within a group of similar items.

An example of this category is a move from sardines (which are cheap in Japan) to yellow-tail (which is more expensive).

Q3: A shift towards foods with higher unit costs per energy content.

Prices are not comparable among different items of foods, but unit costs per energy content can be compared. The shift from cereals to meats is an example.

The shift towards more convenient types of foods is induced by the rise in the opportunity costs of home-cooking labor. This includes two sub-categories.

C1: A shift towards foods which require less cooking time.

For example, fishes and vegetables for boiling have been replaced by raw fish for *sashimi* and salad vegetables.

C2: Substitution of household cooking by commercial cooking.

The greater use of cooked or semi-cooked foods and more eating out are two examples in this sub-category.

Diversification is derived from the rise in income, changes in relative prices of foods, changes in consumers' preference, the entry of new products and other changes on the supply side. It can be divided into three sub-categories.

D1: A shift from 'large quantity consumption of few items' to 'small quantity consumption of many items' of foods.

A typical example is the case of tea. Traditionally green tea dominated in Japan. Now, a considerable amount of coffee and black tea is consumed side by side with a decreased amount of green tea.

D2: The entry of new types of foods.

Tropical and other new varieties of fruits and vegetables from abroad are added to the Japanese diet. Food processing industries have also made a marked contribution to widening the menu by providing a variety of new products.

D3: Product differentiation in foods.

⁵Characteristics of sub-categories are illustrated in examples cited in Tokoyama, H. and Egaitsu, F. [7], [8].

Table 1: Changes in per Capita Consumption of Foods: Shares of Increase, Decrease and Fluctuation

	(%)			
	Increase	Decrease	Fluct.	Total
I	46.5	19.3	34.2	100.0
II	34.9	22.5	42.6	100.0
III	23.3	27.1	49.6	100.0
IV	20.3	37.3	42.4	100.0
V	16.7	39.1	44.2	100.0

Source: Prime Minister's Office, Annual Report on *Family Income and Expenditure Survey*, each year.

Note: 1) Increase, Decrease, and Fluctuate respectively shows the percent of food items of which per capita consumption increased, decreased, and fluctuated through each sub-period.

2) Sub-periods are as follows.

I 1963-1968, II 1969-1974, III 1975-1980, IV 1981-1986, V 1987-1991

3) Total number of food items is;

114 for I, 129 for II, 129 for III, 118 for IV, 138 for V

There are many examples representing this category with respect to beer, instant noodles, ham and sausages, and other processed foods.

The last category is the choice of foods affected by health consideration. This category has gained importance in recent years because of the recent increase in adult diseases and the number of aged people. It includes two sub-categories,

H1: Choice of foods from the nutrition point of view.

A decline in the consumption of foods which have high sugar or salt content is a representative case in this sub-category. A switch from butter to margarine is another example.

H2: Choice (avoidance) of foods which are believed to be good (bad) for health.

In Japan, traditional foods such as *nori* (seaweeds), *natto* (fermented soybeans) and *umeboshi* (pickled Japanese apricot) are widely believed to be good for health. Consumption of these foods has increased.

The cases tabulated in the twelve matrices were examined with respect to the four categories: Q, C, D, and H. The results were classified as shown in Table 1 and Table 2.

Table 1 shows the shares of food items of which per capita consumption increased, decreased and fluctuated through each sub-period. While the share of 'increase' declined sharply in recent years, the share of 'decrease' was on a rising trend. The share of 'fluctuate' stayed around 40% since the second sub-period.

Table 2 shows the percentage shares of the cases examined by the above-mentioned four categories. Over the whole period, on the average, convenience, quality, diversification and health consciousness accounts for 32%, 23%, 19% and 14% of the cases respectively. The remaining 12% do not fall in any of the four categories, but more than half of them are explained by changes in relative prices.

Consumers' preference for higher quality foods played an important role in the earlier sub-periods when income rose rapidly, but its role declined in the fourth and fifth sub-periods. Health consciousness gained significance in recent years. The respective share of convenience and diversification has also increased recently.

Table 2: Changes in per Capita Consumption of Foods:Shares by Categories

	Quality	Conveni.	Divers	Health	Others	(%) Total
I	37.5	29.5	14.8	8.0	10.2	100.0
II	29.5	28.4	15.9	10.2	15.9	100.0
III	23.5	37.6	22.4	11.8	4.7	100.0
IV	15.1	31.4	20.9	18.6	14.0	100.0
V	10.1	32.6	21.3	20.2	15.7	100.0
Total	23.2	31.9	19.0	13.8	12.2	100.0

- Note: 1) Cases which meet the definitions of more than one categories are counted in duplication.
 2) "Others" are cases which do not meet the definition of any categories.
 3) Cases in which per capita consumption fluctuates are not included.

The preference for higher quality foods lost its significance by the early 1980s because low quality foods have mostly disappeared. Then, convenience, diversification and health consciousness increased their significance in dietary choices. Through all the sub-periods, the four non-economic factors have played larger roles than the direct economic factors such as income and prices in explaining the changes in food consumption patterns⁶.

3. Food Consumption Patterns as Shown in the 1985 Input-Output Tables

In Japan, the Ministry of Agriculture, Forestry and Fisheries(MAFF) prepares specific input-output tables (*MAFF Input-Output Tables*) for the analysis of agribusiness industries. The *MAFF Input-Output Tables* consist of 100 intermediate sectors, of which 64 concern agriculture, fisheries and food processing industries, 6 value-added sectors and 7 final demand sectors. They are available for every five years since 1970.

In the 1985 *MAFF Input Table*, the amount of inputs to productive sectors as well as to final demand sectors are shown by their origins, domestic or foreign. The column on consumption expenditures of households shows the breakdown of consumption by industrial sectors. The column, however, does not show the exact amount paid by consumers since in the *Input Table* all the amount are shown in producers prices. Distributive trade margins and domestic transportation fees should be added to make up the differences between producers and purchasers prices in order to make these data comparable to the data from the *Family Income and Expenditure Survey*.

The necessary additional information is obtained from the *Output Table*. The *Output Table* shows the appropriation of the products of each industrial sector to materials for intermediate sectors and to consumption and investments for final demand sectors at purchasers prices.

For example, according to the 1985 *MAFF Output Table*, the output of the Vegetable sector appropriated for household consumption amounts to ¥ 2368.8 billion, which is equal to the household consumption expenditures for Vegetables. On the other hand, according to the *Input Table*, the household consumption of Vegetables consists of domestic products amounting to ¥1387.7 billion and imports amounting to ¥9.9 billion, totaling ¥ 1399.6 billion. The difference between ¥2368.8 billion, in the *Output Table* and ¥1399.6 billion in the *Input Table* makes up

⁶Senauer, B. [6] points out similar factors about changes in food consumption patterns in the United States. Also see Popkin, B.M., Guilkey, D.K., and Haines, P.S.[5]

the total distributive margins, of which ¥915.0 billion are trade margins and the remaining ¥54.1 billion are transportation fees.

Table 3 shows the breakdown of household expenditures for foods and beverages from the 1985 *MAFF Table*. The first to the fourth columns show the proportions of domestic products, imports, trade margins and transportation fees in the total household expenditures for the output of each sector. The total amount of household expenditures and their percentage shares by sectors are shown in the fifth and the sixth column respectively.

According to Table 3, the total household consumption expenditures in 1985 amounted to ¥188.7 trillion, of which ¥47.4 trillion (25.2%) are for foods and beverages. The total expenditures for foods and beverages are divided into: 1) the consumption of primary products from agriculture and fisheries (row 1 to 12), 2) the consumption of outputs from food processing industries (row 13 to 39), and 3) the eating out at restaurants. The relative shares of the above are 13%, 68%, and 19% respectively. Food processing industries have a dominant share. The share of eating out is larger than the share of agriculture and fisheries.

As mentioned above, the food processing industries include Grain milling (rice) and Slaughtering (fresh meats). If these two groups of products are transferred to primary products, the relative shares of primary industries, food processing industries, and restaurants will become 25%, 56% and 19% respectively.

The relative shares of domestic supplies, imports, and distributive margins in total expenditures for foods and beverages are 72%, 2% and 26% respectively. In the case of Fresh fish, Fresh fruits, Other processed marine and agricultural products, more than 10% are imports. In the case of restaurants, imports(1.7%) represent expenditures made by Japanese overseas travelers. In total, imports account for less than 2%. The reasons for this small share of imports will be discussed in the next section.

Relatively high share of distributive margins(25-plus%) characterizes the consumption expenditure for foods and beverages in contrast to other categories of consumption expenditures. Especially in the case of primary agriculture and fisheries, trade margins take up 41.2% of the total amount of consumption. Only two other sectors show higher shares of trade margins in consumption – Textile products(48.3%) and Other chemical products such as Medicaid and Cosmetics(47.2%). In contrast, the output from food processing industries (except Tobacco which has a specific distribution route) has the lowest share for trade margins(27.1%).

Transportation fees account for more than 2% of the total consumption expenditures for both outputs from primary agriculture and fisheries, and food processing industries, compared with around 1% for other consumer goods. A relatively high share of transportation fees for foods and beverages results from special ways of delivery such as frequent-small-portion delivery and delivery by refrigerator vans for keeping foods afresh.

The analysis so far refers only to household consumption as shown in the 1985 *MAFF Input-Output Tables*. The total food consumption includes non-household expenditures which account for about one-seventh of the total expenditures for foods and beverages. This item covers the food consumption related to productive activities of firms and consists of completely different components from household food consumption. Lunches on business and other expenditures at restaurants account for 87%, foods as gifts account for 11%, and primary agricultural and fisheries products account for only 2%. This is the reason why non-household expenditures are excluded from the analysis above.

4. The Share of Imported Foods and Beverages

Imported food stuffs are not frequently purchased directly by final consumers. However, they are widely used by food processing industries. Similarly, a large amount of outputs from primary agriculture and fisheries are used by food processing industries. Primary industries are the

Table 3: Breakdown of Private Consumption Expenditures for Foods and Beverages by Sectors

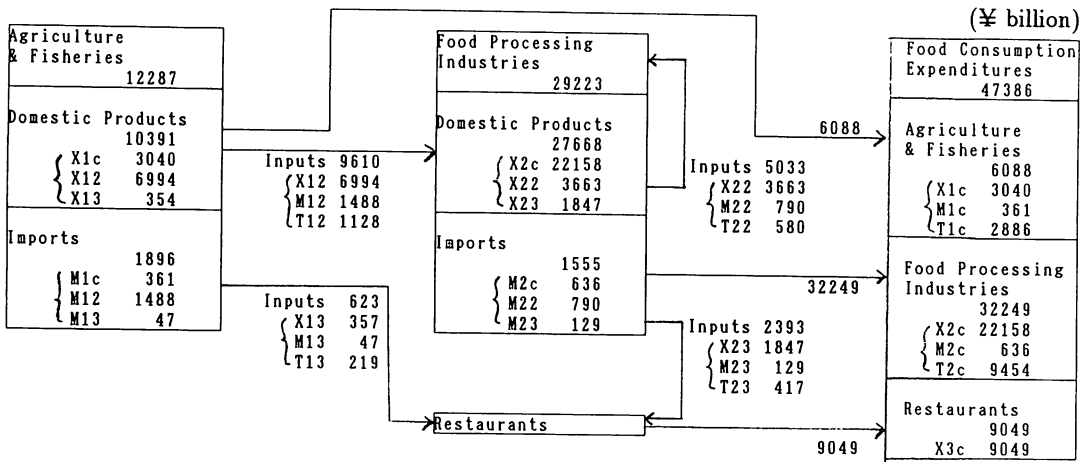
	Domes. Pro	Imports	Trad. Marg.	Trans. Fee	Consumption	
	%	%	%	%	¥ million	%
Potatos and sweet potatos	64.3	0.0	31.4	4.4	138550	0.3
Pulses	61.2	5.6	31.3	1.9	3995	0.0
Vegetables	58.7	0.4	38.6	2.3	2368831	5.0
Fruit	44.2	12.5	40.1	3.1	1380295	2.9
Other edible crops	0.0	93.9	4.0	2.1	718	0.0
Layers	76.8	0.1	22.4	0.7	370922	0.8
Coastal fisheries	26.7	24.2	47.0	2.1	517485	1.1
Off-shore fisheries	39.6	1.4	57.0	2.0	303676	0.6
Distant water fisheries	10.7	9.6	73.0	6.7	216911	0.5
Marine culture	47.3	0.2	49.8	2.7	552149	1.2
Inland water fisheries	63.7	0.0	34.1	2.1	56897	0.1
Inland water culture	48.0	14.8	34.8	2.4	177088	0.4
Slaughtering	63.3	6.3	29.0	1.5	2169709	4.6
Canned or bottled meat product	70.3	6.3	20.2	3.1	72866	0.2
Processed meat products	71.2	0.5	26.5	1.9	871504	1.8
Dairy farm products	67.0	1.5	28.2	3.3	1678258	3.5
Frozen fishes and shellfishes	54.4	4.6	37.6	3.4	2429969	5.1
Salted, dried or smoked seafood	56.5	6.5	34.1	3.0	1156618	2.4
Canned or bottled seafoods	69.5	2.5	25.0	2.9	147510	0.3
Fish paste	73.4	0.0	24.1	2.5	451853	1.0
Other processed seafoods	63.7	0.0	33.6	2.7	887509	1.9
Grain milling	83.8	0.0	15.7	0.5	3456744	7.3
Flour and other grain milling	70.1	0.0	24.7	5.1	63148	0.1
Noodles	67.8	0.6	29.6	2.1	965761	2.0
Bread and confectionery	63.2	0.6	34.4	1.8	4018556	8.5
Canned or bottled vegetables	56.8	8.0	32.4	2.8	359468	0.8
Sugar	67.4	0.2	27.1	5.4	149522	0.3
Starch	62.2	0.0	28.1	9.7	3446	0.0
Vegetable oil and meal	69.0	0.1	28.2	2.7	302052	0.6
Other vegetable products	57.8	6.3	32.7	3.2	797257	1.7
Salt	76.2	0.0	15.5	8.2	10360	0.0
Flavouring	63.1	0.1	34.8	2.0	1226886	2.6
Retort foods	64.9	0.1	33.0	1.9	58951	0.1
Prepared frozen foods	69.5	0.0	27.9	2.6	372768	0.8
Other foods	80.5	0.2	17.6	1.7	4331308	9.1
Liquors	69.7	3.5	23.8	2.9	3551424	7.5
Tea and roasted coffee	59.0	2.9	36.4	1.7	920974	1.9
Soft drinks	73.3	0.1	22.6	4.0	1788213	3.8
Manufactured ice	57.0	0.0	39.4	3.6	6256	0.0
Restaurants	98.3	1.7	0.0	0.0	9049842	19.1
Total food consumption expend.	71.9	2.4	23.8	1.9	47386249	100.0
Agriculture and fisheries	49.9	5.9	41.5	2.6	6087517	3.2
Food processing industries	68.7	2.0	27.1	2.2	32248890	17.1
Restaurants	98.3	1.7	0.0	0.0	9049842	4.8
Tobacco	89.0	2.5	7.6	0.9	2771275	1.5
Textile products	46.4	4.4	48.2	0.9	12825401	6.8
Chemical products	49.1	3.0	47.2	0.6	4198290	2.2
Printing and publishing	58.2	0.6	40.0	1.2	1910611	1.0
Rubber and plastic products	50.0	6.2	42.7	1.0	3068218	1.6
Petroleum and coal products	60.0	2.8	35.6	1.6	4636202	2.5
Machinery	63.7	2.0	33.5	0.8	12996182	6.9
Other manufacturing products	54.9	15.8	28.2	1.1	2397045	1.3
Total consumption expenditures	97.9	2.1	0.0	0.0	188313417	100.0

Source: 1985 MAFF Input-Output Tables.

Note:1) In the top half, column 1,2,3 and 4 respectively shows the relative contribution of domestic products, imports, trade margins, and transportation fees to consumption expenditures shown in column 5.

2) The column 6 shows the relative shares of the total consumption expenditures for foods and beverages(¥47,386 billion) by sectors.

3) In the bottom half, the same breakdown is shown for the total consumption expenditures for major eleven industrial sectors.



Source: 1985 MAFF Input-Output Tables

Note: X_{ij} , M_{ij} , T_{ij} respectively denotes input of domestic produce, imports, and distributive margins from sector i to sector j. Sectors are as follows:

1. Agriculture and Fisheries,
2. Food Processing Industries,
3. Restaurants,
- c. Food Consumption Expenditures.

Figure 2: Streams of Inputs to Food Consumption Expenditures

major suppliers of vegetables, fish, and other material food stuffs to food processing industries. Thus, the problem is how to estimate the original contributions to the consumption expenditures for foods and beverages made by domestic sectors and imports, or by primary industries, food processing industries, restaurants and distribution sectors.

In Figure 2, household expenditures for foods and beverages based on 1985 MAFF Input-Output Tables are shown on the right hand side. A simplified method is applied to estimate the elements in the streams of inputs to food consumption expenditures.

Firstly, the amount of eating out at restaurants shown in the right hand bottom of Figure 2 leads to the equivalent amount of output in the restaurant sector. Then, it leads to the amount of inputs from primary agriculture and fisheries, and food processing industries, each of which is divided into domestic supplies and imports. All the estimates are obtained by applying input coefficients to the amount of output in the restaurant sector.

Secondly, the outputs of domestic food processing industries and the amount of processed food imports are separately estimated. These estimates are obtained by summing up the amount of direct household consumption, the amount of inputs to the restaurant sector which was calculated in the first step, and the amount of inputs to food processing industries. These estimates thus determined the necessary amount of inputs from primary agriculture and fisheries.

Lastly, the outputs of domestic primary agriculture and fisheries and the amount of imports of primary products are estimated. These estimates are obtained by aggregating the amount of direct household consumption, the amount of inputs to the restaurant sector which was calculated in the first step, and the amount of inputs to food processing industries which was calculated in the second step. As for transactions between sectors, distribution margins are estimated by inter-sectoral rates of margin. The major results of the estimation captured in Figure 2 are shown in Table 4.

Table 4: Breakdown of Total Consumption Expenditures for Foods and Beverages by Origins

	A		B	
	¥ billion	%	¥billion	%
Domestic Products	25,198	53.1	23,461	46.4
Primary industries	3,040	6.4	10,391	21.9
Food processing industries	22,158	46.7	13,025	27.5
Imports	979	2.1	3,451	7.3
Primary industries	361	0.8	1,896	4.0
Food processing industries	636	1.3	1,555	3.3
Restaurants	9,049	19.1	6,033	12.7
Distributive margins	12,140	25.7	14,484	30.6
Total	47,386	100.0	47,386	100.0

- Note: 1) A shows the breakdown of final consumption expenditures for foods and beverages.
 2) B shows the breakdown when the primary indirect effects are taken into account.

In Table 4, the percentage contribution of domestic primary sectors to household consumption expenditures for foods and beverages is 21.9% in column B, much larger than the 6.4% in column A. In column B, vegetables and fish used in restaurants and all the primary products used in food processing industries are included in the contribution of agriculture and fisheries. Consequently, the relative contribution of domestic food processing industries declined from 46.7% to 27.5%. Further the contribution of restaurants decreased from 19.1% to 12.7%.

The total contribution of distributive margins, inclusive of those paid in inter-sectoral transactions, is more than 30% in column B, compared with about 25% in column A which refers only to direct household expenditures.

The contribution of imports increased from 2.1% in column A to 7.3% in column B. The increase in the contribution of imports is less than expected. This is because the simplified methods of estimation used here ignores the secondary and tertiary interaction effects. For example, the inputs of beef cattle, swine and poultry from domestic livestock sectors and imports are subtracted from the contribution of Slaughtering (supplier of fresh meats), but the contribution of imported feeds are not separated from the output of domestic livestock sectors.

The share of imports in the total expenditures for foods and beverages will not exceed 10% even though all the original contribution of imports is taken into consideration. The relatively low dependence of food consumption on imports seems to contradict with Japan's low rate of self-sufficiency in foods (47% in terms of original calorie in 1990). The discrepancy stems from the large contributions of value-added and distributive margins to consumption expenditures on foods and beverages. Imported food-stuffs do not contribute much in terms of money value although they contribute much in terms of calorie. It has two implications. Firstly, the increase in the imports of food material does not significantly influence the import ratio in money terms. Secondly, changes in prices of imported food materials due to changes in currency exchange rates and/or fluctuations in the world market situation do not significantly influence domestic prices of processed foods.

On the contrary, the imports of processed foods may have significant impact on domestic food prices as well as food import ratio. The import of processed foods has been small since consumers prefer domestic products on account of taste and safety. In the future, however, it may increase remarkably if the further appreciation of yen will to widen gaps between domestic and world food prices. The increase in the import of processed foods will then bring about a sudden rise in the import ratio and, at the same time reducing the level of Japanese food prices which is now the highest in the world.

5. Changes in Food Consumption Patterns as Shown in Input-Output Tables

In Table 5, breakdown of food consumption expenditures are compared between the *MAFF Input-Output Tables* and the *Family Income and Expenditure Survey* for the years 1970, 1975, 1980 and 1985. The top half of Table 5 is obtained from the *MAFF Input-Output Tables*. Here, consumption expenditures for foods are classified by industrial sectors which produce them. Food producing industries are, however, integrated and rearranged to make comparison easier. The 20th to the 23rd row of the top table show the relative contribution(%) of domestic products, imports, trade margins, and transportation fees to the total food consumption expenditure. The Engel's coefficients are shown in the 24th row. The bottom half of Table 5 shows similarly arranged food expenditures by the *Family Income and Expenditure Survey*.

According to Table 5, the share of expenditures for foods and beverages in the total consumption expenditures declined steadily from 32% in 1970 to 25% in 1985 in accordance with the rise in income. In particular, the share of Grain milling and Flour declined by 4.5 percent points from 12% in 1970 to 7.4% in 1985 due to the sharp decline in expenditures for Rice. While Fresh fish, Fresh meats, and Fresh vegetables and fruit declined in their shares, the shares of corresponding processed products increased. In 1970, fresh and processed products of these three items accounted for 24% and 13% of total expenditures for foods and beverages respectively. In 1985, the share of fresh products decreased to 17% while that of processed products increased to 15%.

The largest decline in the share of expenditures during the fifteen years to 1985 arises in the case of Eggs, followed by Rice and wheat flour. The share of Eggs also declined sharply in England and the U.S.A. in spite of the fall in egg price⁷. The share of Dairy products also declined. More detailed data will show the decline in the share of Milk and Butter and the rise in the share of Cheese and Yogurt.

Fats and oils, Sugar, and Condiments gained their shares during 1970 to 1975, but declined thereafter. In particular, the share of expenditure for Sugar decreased from 1.3% in 1975 to 0.3% in 1985.

Other foods and Eating out at restaurants are typical items which show gain in shares. The share of cooked foods such as Retort foods(included in Other foods) has largely increased. While Other foods showed a large increase in their shares in recent years, the share of Eating out declined during 1980 to 1985. The share of Soft drinks increased, while the shares of Liquors declined slightly.

Turning to the relative contribution of domestic supplies, imports, and distributive margins to the total consumption expenditures for foods and beverages, no definite trends are observed over the fifteen years to 1985. More detailed analysis, including indirect effects and on different stages of distribution, may lead to more interesting findings. In particular, in Japan, remarkable changes have been observed in the distribution of foods over the past decade. Changes are still going on and they are influencing distributive margins differently by food items and by the stages of distribution. These points need further studies.

Although the relative shares of food items are considerably different between the top half of Table 5 (*MAFF Input-Output Tables*) and the bottom half of the table (*the Family Income and Expenditure Survey*), their changes over time are rather similar. The differences between the two estimates of sectoral shares obtained from respective data sources was partly resulted from the differences in the definitions of items. The most important source of discrepancy is, however, the differences in the coverage of the two data sources.

The Family Income and Expenditure Survey does not cover farm households and single-person households. In contrast, the *Input-Output Tables* cover all consumption expenditures, except

⁷See Senauer, B. [6]

Table 5: Changes in Food Consumption Patterns

	(%)			
	1970	1975	1980	1985
MAFF INPUT-OUTPUT TABLES				
Grain milling & flour	11.97	8.68	7.46	7.43
Noodles bread & cake	11.53	10.88	10.65	10.52
Fisheries	5.99	5.40	6.03	3.85
Processed seafoods	8.82	8.78	8.83	10.71
Slaughtering	6.17	7.84	6.91	4.58
Processed meat pro.	1.34	1.74	1.94	2.12
Dairy products	4.89	4.04	4.43	3.54
Layers	2.09	1.70	1.13	0.78
Vegetables	7.46	6.76	6.43	5.30
Fruits	4.63	3.82	2.97	2.91
Processed vege. & fruits	2.35	2.81	2.92	2.45
Vegetable oil & meal	0.78	0.94	0.72	0.64
Suger	0.96	1.32	0.70	0.32
Flavouring	3.00	3.33	3.18	2.61
Other foods	5.43	5.55	5.65	11.88
Spark & still beve.	0.00	2.75	2.67	3.77
Liquor	9.73	7.81	7.99	7.49
Restaurants	12.87	15.85	19.38	19.10
Food consumption exp.	100.00	100.00	100.00	100.00
Domestic products	72.21	71.96	70.92	71.95
Imports	2.65	3.44	3.89	2.43
Trade margins	23.54	22.94	22.97	23.76
Transportaion fees	1.59	1.66	2.22	1.86
Engel's coefficient	32.37	30.97	27.37	25.16
FAMIRY INCOME AND EXPENDITURE SURVEY				
Rice and flour	12.19	8.72	8.17	7.95
Noodles bread & cake	10.36	11.47	11.58	11.79
Fresh fish	7.68	8.40	8.34	7.88
Processed seafoods	5.22	5.51	5.67	5.70
Freash meats	7.90	9.01	8.63	8.18
Processed meats	1.68	1.98	1.99	1.93
Dairy products	4.28	3.76	3.39	3.24
Eggs	2.89	2.34	1.69	1.36
Fresh vegetables	8.40	7.71	7.99	7.54
Fresh fruits	6.51	5.99	5.05	5.26
Pro. vege. & fruits	4.55	4.64	4.44	4.45
Oils & fats	0.65	0.85	0.67	0.63
Sugar	0.75	0.75	0.42	0.32
Condiments	3.49	3.40	3.12	3.18
Oter foods	4.08	5.04	6.27	6.88
Beverages	4.18	4.04	3.83	3.60
Alcoholic beverages	5.28	5.06	4.93	5.03
Eating out	9.90	11.35	13.83	15.08
Food consumption exp.	100.00	100.00	100.00	100.00

for non-household consumption expenditures which are separately tabulated. Thus *the Family Income and Expenditure Survey* provides excellent data for the analysis of the consumption expenditures by typical non-farm, non-single-person households, while the *MAFF Input-Output Tables* provide overall features of the consumption expenditures covering the whole economy.

The *Family Income and Expenditure Survey* provides data on consumption expenditures, the quantities consumed, and unit prices for about 150 food items. Price indices for the same food items are available in the *Consumers Price Index* published by the Prime Minister's Office.

The *MAFF Input-Output Tables* have data on about 40 industrial sectors concerning foods and beverages. No definite information is, however, available for the relationship between industrial sectors and food items. Input-output tables are the only available data source for the breakdown of consumption expenditures between domestic supplies, imports, and distributive margins. Input-output tables can be widely used for the analysis of derived demand and the interaction between industrial sectors. In the *MAFF Input-Output Tables*, data at constant prices are available for consumption expenditures, but not for inter-sectoral transactions.

While the *Family Income and Expenditure Survey* is available every year, the *MAFF Input-Output Tables* is only available once every five years.

In input-output analysis, sectors are often integrated to reduce the size of model for convenience of calculation with respect to the interaction among outputs and among prices. Input-output tables provide, however, an enormous source of economic data which are consistent all over the economy through input-output relationship. This analysis of food consumption patterns is an example of the wide-range of studies which can result from the different approaches to input-output tables⁸.

6. Conclusion

The major fact findings are as follows:

1. For the majority of food items, the amount of per capita consumption increased in the first decade, and decreased in the last decade, of the period 1960-1990. About 40% of the food items did not show any definite changes in per capita consumption over the three decades.
2. The most important factor for the changes in per capita consumption of foods was the preference for higher quality in the first decade and health consciousness in the last decade. The preference for convenience foods accounted for about 30% of changes in per capita consumption through the whole period.
3. According to the analysis of the *Input-Output Tables*, the contribution of the domestic production, imports, distribution services, and restaurants to the consumption expenditures for foods and beverages was estimated to be 53.1%, 2.1%, 19.1% and 25.7% respectively in 1985.
4. Taking the interaction between sectors into consideration, the original contribution of each of the above four sectors was estimated to be 49.4%, 7.3%, 12.7% and 30.6% respectively.
5. The breakdown of the distributive margins into trade and transportation showed: 1) transportation costs account for a relatively high share of the final expenditure both in the case of primary food products and processed foods, and 2) trade margins account for a very high share of the final consumption of primary food products but only a very small share in the case of the processed foods.

⁸Kanai, M., Sawada, Y. and Sawada, M. [3] briefly summarizes available statistical data sources on food consumption in Japan.

6. In money terms, the contribution of imports to food consumption expenditures was less than 10% while the rate of self sufficiency in foods in terms of original dietary energy was only 46%. This apparent contradiction is the result of a very high share of material foods in imports. The imports of processed foods, which were limited so far due to the consumers preference for traditional taste and food safety, may increase rapidly in the future with the further appreciation of yen.

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