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Econometric Analysis on Factors of Food Demand in the Household : Comparative Study between Korea and Japan

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가계 식품수요 요인의 계량분석

- 한국과 일본의 비교 -

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요 약

본 논문은 한일 양국의 가계에 있어서의 식품수요에 미치는 요인을 파악하기 위해서 종래의 수요모델에 코호트(cohort, 행동을 같이 한 집합체) 분석적인 생각을 도입하여 한일 양국의 식품수요 형태분석을 하였다. 여기에 제시한 새로운 수요분석 모델은 소비지출과 가격이 식료수요에 미치는 경제적 효과 이외에 세대주 연령효과나 출생연도와 같은 비경제적효과 등도 계량한 것이 특징이다. 분석한 결과를 요약하면 다음과 같다.

1. 한일 양국의 식품수요의 품목군별 탄력성을 보면 유지류, 음료, 조리식품의 수요탄력성은 한국보다 일본이 더 탄력적이었지만, 다른 모든 품목은 일본보다 한국이 탄력적이었다. 곡류, 육류, 외식의 외부화 식품의 소비지출과 가격탄력성은 한국의 큰 품목과 일본의 큰 품목이 서로 상충하고 있어서 일정한 경향 파악이 곤란하다. 그러나 신선식품에 대한 소비지출과 가격의 탄력성은 모두 일본보다 한국이 크다.
2. 식품에 대한 지출액은 세대 구성원의 연령을 반영하여 비교하여 볼 때 한국과 일본의 결과가 비슷하였다. 즉 세대주 연령이 젊은 계층의 가족에는 유아가 있기 때문에 유란류의 지출액이, 또한 중년층에서는 청소년이 많기 때문에 과자류의 지출액이 다른 연령계층에 비하여 많았다. 한국은 연령계층이 높을수록 2세대 가족이 많기 때문에 다수 품목에 지출액이 많고, 일본의 중년층은 과자류를 포함하여 특히 곡류, 육류 등의 에너지 식품이나 외식의 지출액이 많다. 그러나 연령이 높은 계층에서는 세대 구성원이 거의 성인이며 평균연령이 높기 때문에 곡류, 육류, 외식 등의 지출액이 적었지만 어패류, 야채류 등의 전통식품이나 조리식품의 지출이 많았다.
3. 식품소비의 패턴은 세대주 출생연도별로 비교하면 한일 양국 모두 구세대일수록 주식 중시의 경향을 나타내고 신세대일수록 축산물, 유지류, 외부화 식품의 비중이 높았다. 그러나 품목 구성의 세대간 차이는 한국에 있어서는 매우 크지만 일본의 경우는 비교적 작았다. 따라서 식생활의 서구화, 외부화는 세대교체에 동반하여 한국에는 급속히 진행하지만 일본은 점진적으로 진행한다고 볼 수 있다.
4. 가계 식품 수요의 장기 변화에 미치는 요인은 소비지출, 가격, 세대주 출생연도, 연령 등의 네 가지 요인으로 나누어서 각각의 효과를 요인간으로 비교하면 한일 양국이 함께 가격의 효과가 가장 작다. 그러나 그 이외 요인별 효과의 상대적 중요성은 양국간에 다른데 한국은 소비지출의 효과가 출생연도나 연령 효과보다 크지만 일본은 경제적 요인인 소비지출보다 세대주의 출생연도나 연령 등의 비경제적 요인의 효과가 크다.

I. Introduction

In most studies on food demand in the household, estimation of demand function can be made in several ways. This estimation has been conducted using single or simultaneous equation approach[1),2),6),9)~15)]. When effects on economic consumption of economic factors such as expenditure, own price, price of substitution goods, *etc.*. were conspicuous, the result from this approach has contributed significantly to explaining the behavior of a household during the period of economic growth. The latest analysis model, which has further been improved and refined, is found useful for the demand analysis of food by items.

The diet in both countries, Korea and Japan have reached a saturation level of food since 1980s. This analysis shows that the pattern of food consumption has greatly been influenced by the life stage, which has shown either in family members or in the age group of the householder rather than by economic factors upon which emphasis was previously placed[7),10)]. The Showa 61(1986) and Heisei 3(1991) editions of Agricultural White Paper, Japan indicate that the impact of the above fact was great. Some studies show that consumption trends have been affected in a different way such as consumption of each food item. The research shows that the age effect of householder is econometrically clear as well as the income and price effects, which is based upon the tool of analysis for the food demand system of the household[7),9)]. All of these studies just determine the age effect on food demand in the household at a certain time or during a certain period. These studies, however, fail to analyze long-term effect of generation changes.

The object of this paper is to show an analysis of the long-term change in food expenditure by age groups of the householder both in Korea and Japan. One of the general facts show that food expenditure of household will be determined by non-economic factors such as age group or birth cohort of householder rather than economic factors such as expenditure and price.

During post World war, the food situation have remarkably changed up to the present day in both countries. The dietary pattern of householder can be influenced by food circumstances in their birth cohort, and food expenditure and its item composition, which differ among households. Although the birth cohort of the householder represents his age, it shifts to a higher age group as time passes. The pattern of the food demand in household could, therefore, be considered as different among time periods of different birth cohorts in the same-age groups of the householders. This paper is to quantify these effects by food item, and further to conduct a comparative analysis in respect to the similarity and difference of dietary patterns between the two countries, Korea and Japan.

The *Annual Report on the Family Income and Expenditure Survey published by the National Bureau of Statistics, Economic Planning Board, Korea* was used for Korean data, and the *Annual Report on the Family Income and Expenditure Survey published by the Statistics Bureau, Management and Coordination Agency, Japan* on the Japan side. The time period is for 23 years from 1970 to 1992 for which data by food item are available in both countries. Data by age groups of the household by food item are the average per capita of family members and are pooled for usage. Therefore, the sample size of each item is 184(8 age groups × 23 years) in Korea and 230(10 age groups × 23 years) in Japan. To compare year-to-year, the variables on monetary terms are deflated to the real term, and we use 1985 as a base year. More specifically, the conversion into the real terms, in respect to expenditure of the household, in Korea, is based upon the *Annual Report on the Price Survey published by the National Bureau of Statistics, Economic Planning Board, Korea,* and on Japan, based upon the *Annual Report on the Consumer Price Index published by the Statistics Bureau, Management and Coordination Agency, Japan,* and, for food expenditure and price by item, based upon the *Annual Report on the Price Survey and the Annual Report on the Consumer Price Index* by item with 1985 as the base year.

II. Non-economic Factors of Food Demand in the Household

Non-economic factors such as, per capita food demand in the household, the age groups, and birth cohort of the householder will be used to investigate the effect of each factor on food demands in the household.

1. Age Composition of Family Members by Age Groups of Householders

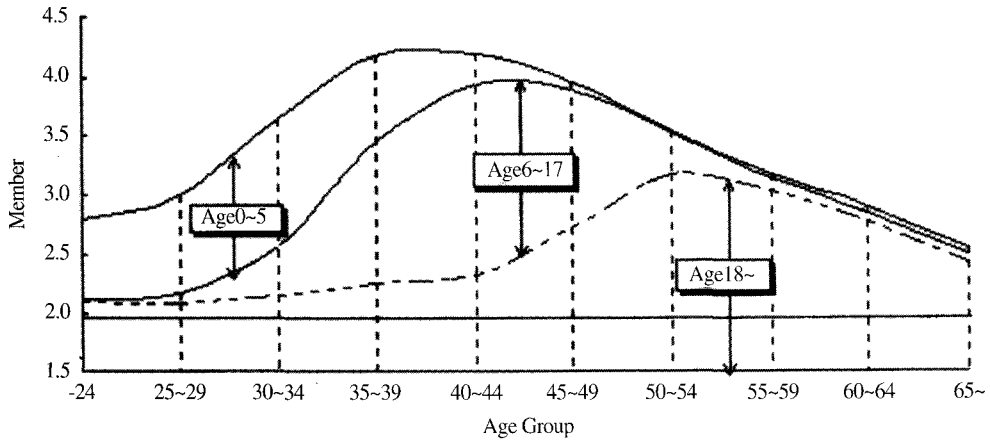
As the householder becomes older, the number of family members and their age composition changes. First, characteristics of family members by the age group of the householder (called age group hereafter) will be investigated. For the convenience of explanation, <Figure 1> shows the distribution of the number of family members by age groups of householders in 1992, then takes an example from Japan where detailed data were available.

Although this kind of data have been available since 1985, the data includes 1992 only because the trend is common to all the cohorts in that year. In this Figure a horizontal line was drawn at 2.0 as the number of family members in order to demonstrate that the two family members are man and wife. The number above the line of each age group may be considered as representing the average number of family members by age group besides the man and wife, particularly children.

Now, <Figure 1> indicates that the average household in the age group of under 29 is a three-member family, which is composed of young man and wife, and one infant under 5 years of age. This family composition is, however, found to change due to the birth and growth of the child or children as the householder gets older. That is to say, in the age groups from under 24 to 35-39, the share of young children increases. As time passes the active family members increase in number, and they become the leading members of the family in the age group of 55-59. In the age group over 55-59, however, the share of higher aged members increases. Although there is no sufficient data for Korea, it may be said that the Korean family composition by age group will not differ too much from that of Japan.

Then, <Table 1> shows the change over the year of the average number of family members by age group in both countries. In Korea, the average number of family members in the age group of 25-29 remained constant during the measuring period of 23 years. The number in the other age groups was on a downward trend until 1985, and then it remained constant. For the 23 year period, the decreasing rate of the average number of family members rises from 40 to 46% for the age group under 24 and rises from the 40 to 54 age group to 60% for the age group of over 55.

Thus, it shows that the family members in these age groups changed from the two-generation family to the core family. In respect to the two-generation family, the



<Figure 1> Distribution of Family Members by Age Groups of the Householder (Japan, 1992)

Notes : This figure indicates family members by age groups of the householder after family composition by age group being reclassified into 3 groups (0-5, 6-17, and over 18), based upon "Distribution of family members by age of householders" presented in Table 20 of "Annual Report on the Family Income and Expenditure Survey" (1992) published by *the Statistics Bureau, Management and Coordination Agency, Japan.*

<Table 1> Yearly Change of the Average Number of Family Members by Age Groups

(Unit: Member)

Countries	Age Group	1970	1975	1980	1985	1990	1992
Korea	-24	4.61	4.55	4.15	3.32	3.27	3.25
	25-29	3.54	3.84	3.55	3.40	3.11	3.20
	30-34	4.42	4.68	4.24	4.03	3.78	3.77
	35-39	5.46	5.59	4.87	4.58	4.31	4.21
	40-44	6.28	5.96	5.36	4.76	4.49	4.42
	45-49	6.28	5.85	5.32	4.96	4.58	4.48
	50-54	6.35	5.89	5.19	4.67	4.46	4.34
	55-	5.72	5.31	4.95	4.25	3.66	3.58
Japan	-24	2.88	2.82	2.86	2.76	2.74	2.77
	25-29	3.22	3.20	3.33	3.20	3.06	3.00
	30-34	3.84	3.86	3.88	3.74	3.65	3.64
	35-39	4.18	4.22	4.18	4.23	4.10	4.18
	40-44	4.20	4.21	4.21	4.23	4.19	4.20
	45-49	4.05	3.92	3.97	4.07	3.94	3.95
	50-54	3.88	3.60	3.57	3.51	3.55	3.53
	55-59	3.64	3.36	3.25	3.11	3.21	3.17
	60-64	3.59	3.21	2.98	2.86	2.80	2.90
	65-	3.13	2.99	2.74	2.51	2.60	2.56

Sources: 1) Korea, *Annual Report on the Family Income and Expenditure Survey*(1970-92) published by *the National Bureau of Statistics, Economic Planning Board, Korea.*

2) Japan, *Annual Report on the Family Income and Expenditure Survey*(1970-92) published by *the Statistics Bureau, Management and Coordination Agency, Japan.*

per capita expenditure seems to rise too high in older years because of the larger share of older family members, especially in the age group of over 40.

On the other hand, the average number of family members in the age groups of under 45-49 in Japan remained constant during the same period irrespective of age group. All the age groups over 50, the average number of family members had been on downward trend until 1985, and remained virtually unchanged thereafter. This is because the shift to the core family in the higher age group had been in progress until that year. However, the decrease rate of the average number of family members during the 23 years did not exceed the maximum of 24% for the age group of 60-64. Therefore, the changes of the composition of family members in these age groups has a relatively small effect on per capita food expenditure.

From the above analysis it can be concluded that, the share of the older members has decreased in Korea since the 1970s due to the movement toward the core family. That share in the same age group remains almost constant over the period of time in Japan. In the analysis of food demand, it is necessary to bear in mind that the change in the age composition of the family members especially in Korea.

2. Birth Cohort of the Householders

The per capita food expenditure by item can be shown in a standard cohort table as in <Table 2>, where the birth cohort is divided into five year segments in accordance with the age band of the age group of householders[4),5),8)]. In the table, the diagonal arrows from the upper left to the lower right indicate the food expenditure in the same birth cohort of the householder. Because of the limitation of data, the age groups in each five year column from the starting year of measurement (A_j) belong to the same birth cohort (C_k). For example, the age group of under 24 in 1970-74 belongs to the birth cohort of 1946-50 while the age group of 40-44 in 1975-79 belongs to the birth cohort of 1931-35.

In regard to the household in Korea, which is to be analyzed, the birth cohort of the householder (called "birth cohort" hereafter) is, as seen in <Table 2>, divided into 12 bands from the birth cohort of the years before 1915 to that of the years after 1966. The householders whose birth cohort is the years before 1941-45 are the generation who spent their growth period under the cultural and political colonization by Japan and who tolerated a poor diet because of their low income. Then, the householders in the birth cohort of 1946-55 are the generation who experienced food shortage in their childhood from the period right after the end of the World War II to the Post-Korean War period. In contrast, the householders whose birth cohort after the years of 1956, when food supply turned around. It can, therefore, be said that the Korea contains the householders in the older birth cohort who faced the longer food shortage.

In Japan, the birth cohort of the householder is

<Table 2> Standard Cohort Table of Food Expenditure (Korea)

Time Period($_i$)			1970-74	1975-79	1980-84	1985-89	1990-92	Birth Cohort (C_k)	
	– 24	γ_1	Q_{11}	Q_{21}	Q_{31}	Q_{41}	Q_{51}		
	25 – 29	γ_2	Q_{12}	Q_{22}	Q_{32}	Q_{42}	Q_{52}	δ_{12}	1966-
	30 – 34	γ_3	Q_{13}	Q_{23}	Q_{33}	Q_{43}	Q_{53}	δ_{11}	1961-66
Age Group	35 – 39	γ_4	Q_{14}	Q_{24}	Q_{34}	Q_{44}	Q_{54}	δ_{10}	1956-60
(A_j)	40 – 44	γ_5	Q_{15}	Q_{25}	Q_{35}	Q_{45}	Q_{55}	δ_9	1951-55
	45 – 49	γ_6	Q_{16}	Q_{26}	Q_{36}	Q_{46}	Q_{56}	δ_8	1946-50
	50 – 54	γ_7	Q_{17}	Q_{27}	Q_{37}	Q_{47}	Q_{57}	δ_7	1941-45
	55 –	γ_8	Q_{18}	Q_{28}	Q_3	Q_{48}	Q_{58}	δ_6	1936-40
Birth Cohort (C_k)				δ_1 -1915	δ_2 1916-20	δ_{43} 1921-25	δ_4 1926-30	δ_5	1931-35

Notes: This table is the standard cohort table of food expenditure in Korea. Similarly, in case of the standard table of Japan, age is expressed in terms of 10 groups($\gamma_{1\text{-}10}$), and birth cohort can be expressed in terms of 14 groups ($\delta_{1\text{-}14}$).

divided into 14 bands from the years before 1905 to the year after 1966. The householders in the birth cohort of the years before 1916-20 are the generation who spent their growth period before World War II when the food supply was relatively stable. The householders in the birth cohort of the years after 1951 are the generation who experienced economic growth in their growth period when the food supply was relatively ample. On the contrary, those householders whose birth cohort is 1921-50, are the generation who experienced the war-time and post-war food shortage. The age group of the householders whose birth cohort is near 1931-35, faced a longer period of food shortage. In this way, the food circumstances of the householders' growth period differ substantially depending upon their birth cohort.

As mentioned above, the food circumstances with which the householders experienced in their growth period are considered to have a significant impact upon the diet of the household in later years. From this point, we have decided to measure the degree of the food demand of the household, which is determined by the birth cohort of householder.

III. The Method of Analysis

From the above results, it has become clear that the per capita monthly food expenditure in real term in the household, considered to be determined by the non-economic factors such as the age group and birth cohort of householder in addition to the economic factors such as real expenditure and real price. If so, the food demand Q_{ij} in the year i and in the age group j is expressed in the following equation (1) in the form of normal linear equation of the four explanatory variables: P_i for food price index in year i, Y_{ij} for expenditure in year i and by age group j, A_j for the age group of householder, and C_k for a dummy variable expressing the birth cohort of householder:

$$Q_{ij} = \mu + \alpha P_i + \beta Y_{ij} + \Sigma \gamma_j A_j + \Sigma \delta_k C_k + \varepsilon_{ijk} \qquad (1)$$

However, in case of the Korea: i=1,2,...,23; j=1,2,...,8; k=1,2,...,12, in case of Japan: i=1,2,...,23; j=1,2,...,10; k=1,2,...,14
Here, μ: constant term. α, β, γ_j, δ_k: parameters for price, expenditure, age group and the effect of birth cohort which are to be estimated. ε_{ijk}: random disturbance.

Because A and C in the above equation are dummy variables which express qualitative variables, equation (1) is expressed, more specifically, like equation (2) with A and C as basis (A_1=0, C_1=0)[12]. α, β, γ_j, δ_k in equation (2) can be estimated through the ordinary least square method. In the following, the regression equation of equation (2) will be estimated for each food item. For additional information, equation (2) expresses a specific equation for estimation in the case of Japan.

$$
\begin{bmatrix} Q_{1.1} \\ Q_{1.2} \\ \cdots \\ \cdots \\ Q_{1.9} \\ Q_{1.10} \\ \cdots \\ \cdots \\ \cdots \\ Q_{23.1} \\ Q_{23.2} \\ \cdots \\ \cdots \\ Q_{23.9} \\ Q_{23.10} \end{bmatrix}
=
\begin{array}{c}
\begin{array}{cccccccccccc} \mu & P_i & Y_{ij} & A_2 & \cdots & A_9 & A_{10} & C_2 & \cdots & C_{13} & C_{14} \end{array} \\
\begin{bmatrix}
1 & P_1 & Y_{1.1} & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 & 0 \\
1 & P_1 & Y_{1.2} & 1 & \cdots & 0 & 0 & 0 & \cdots & 0 & 0 \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
1 & P_1 & Y_{1.9} & 0 & \cdots & 1 & 0 & 0 & \cdots & 0 & 0 \\
1 & P_1 & Y_{1.10} & 0 & \cdots & 0 & 1 & 0 & \cdots & 0 & 0 \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
1 & P_{23} & Y_{23.1} & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 & 1 \\
1 & P_{23} & Y_{23.2} & 1 & \cdots & 0 & 0 & 0 & \cdots & 1 & 0 \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot & \cdot & \cdots & \cdot & \cdot \\
1 & P_{23} & Y_{23.9} & 0 & \cdots & 1 & 0 & 0 & \cdots & 0 & 0 \\
1 & P_{23} & Y_{23.10} & 0 & \cdots & 0 & 1 & 0 & \cdots & 0 & 0
\end{bmatrix}
\end{array}
\begin{bmatrix} \mu \\ \alpha \\ \beta \\ \gamma_2 \\ \cdot\cdot \\ \cdot\cdot \\ \gamma_9 \\ \gamma_{10} \\ \delta_2 \\ \cdot\cdot \\ \cdot\cdot \\ \delta_{13} \\ \delta_{14} \end{bmatrix}
\qquad (2)
$$

IV. Effects on Food Demand by Factor

The results of estimation of demand functions by applying model equation (2), each food item can be shown as <Table 3>. In the Table the estimation of demand functions of each item is expressed in terms of dummy variables based upon the age group of the householder of the under 24 age group and the birth cohort of the years before 1915 in Korea, and the age group of under 24 and the birth cohort of the years before 1905 in Japan. Therefore, the constant term indicates limited value of expenditures in the case age group in both countries under 24, with the birth cohorts being the years before 1915 in Korea and the years before 1905 in Japan respectively, and expenditure and price are zero. The expenditures of other age groups and birth cohorts is expressed in terms of the sum of the constant term and the regression coefficient.

The overall results of estimation of demand function are that the coefficient of determination adjusted for degrees of freedom is relatively low in cereal and alcohol, which mark 0.71 and 0.51 respectively, but that it is so high in other items, which record nearly 0.90 or more, as to sustain high explicability of the estimation. The *t*-test of regression coefficient registers a 5% level, which is so high as to be significant, for expenditures of all the items and for the price of items except eating-out. For many groups the effect of the age of householder on food demand (called "age effect" hereafter) is not statistically significant in alcohol and cooked food, while the cohort effect (the effect of the birth cohort of householder on food demand) is not significant in dairy products/eggs, alcohol and cooked food. Except for the above, the results are favorable.

On the other hand, in respect to the results of the estimation of demand function in Japan, the coefficient of determination is high enough that the explicability of the regression equation exceeds 0.80, for all the items except 0.68 for alcohol and 0.75 for dairy products/eggs. The *t*-test reaches the 5% level highly significant for expenditure of all the items except vegetable/seaweed and alcohol, and for the price for all the items except cereal, dairy products/eggs, oil/fats, and eating-out. The results of the *t*-test are not significant for many groups in the age effect on meat, oil/fats and beverage and in the cohort effect on meat, oil/fats and eating-out. Except for the above, the results are favorable. In the following the factor-by-factor effects of food demand in Korea and in Japan will be investigated by food item, which is based upon the results of estimation in <Table 3>.

1. Effects of Expenditure and Price

<Table 4> shows the estimation of expenditure and price elasticities of the average demand of each item based upon the estimation of demand function by item to see the effects of expenditure and price on food

<Table 3> The Result of Estimation of Demand Function by Item (Korea)

(Unit: 100 Won)

Parameter	CE	FI	ME	DE	VE	OI	CA	FR	BE	AL	CO	EA
Intercept	44.99*	10.56* -	4.18+	9.83*	7.12*	-6.66*	1.11	3.97+	7.51*	6.50*	6.00*	0.28*
Expenditure	-0.011*	0.020*	0.026*	0.007*	0.016*	0.008*	0.018*	0.019*	0.0003*	0.003*	0.006*	0.002*
Price	-18.27*	-13.54*	-21.21*	-12.99*	-17.26*	-7.03	-6.16*	-17.16*	-2.19*	-4.18*	-2.91*	0.44
Age Group												
– 24	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*
25 – 29	-1.13	3.30*	8.04*	6.59*	4.53*	2.13*	2.79*	2.74*	1.79*	1.86*	0.33+	1.54*
30 – 34	-3.73+	5.05*	11.83*	9.78*	5.99*	2.50*	7.77*	5.06*	2.35*	0.70	-0.07	1.97*
35 – 39	1.91	5.16*	14.80*	9.00*	8.13*	4.20*	9.74*	6.56*	2.41*	-0.16	0.01	2.38*
40 – 44	13.53*	5.60*	16.79*	8.67*	11.19*	7.30*	8.76*	7.40*	2.35*	-0.78	-0.01	2.75*
45 – 49	24.90*	5.62*	19.42*	8.42*	14.49*	12.21*	6.95*	7.28*	2.51*	-1.20	0.16	3.34*
50 – 54	33.71*	7.24*	22.00*	7.96*	17.96*	16.12*	4.97*	8.66*	2.99*	-0.95	0.26	4.76*
55 –	48.45*	9.31*	28.27*	7.35*	22.81*	22.77*	3.49*	10.58*	3.50*	-0.43	0.41	5.79*
Birth Cohort												
– 1915	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*
1916 – 20	12.90*	-0.15	3.42*	-0.33	3.72*	5.58*	-1.71+	2.03*	1.21*	0.93	-0.08	1.18
1921 – 25	22.73*	1.06	7.27*	-0.32	7.39*	11.01*	-2.80*	4.12*	1.49*	1.35	0.13	1.82*
1926 – 30	32.83*	2.54+	12.21*	-0.23	11.10*	16.31*	-4.45*	5.18*	1.64*	1.10	0.47	2.49*
1931 – 35	40.34*	2.98+	13.28*	-0.61	13.79*	18.78*	-5.26*	6.14*	1.83*	0.99	0.67	3.02*
1936 – 40	47.08*	4.16*	17.48*	0.42	17.15*	21.20*	-3.91*	7.55*	2.22*	0.82	0.61	4.18*
1941 – 45	52.71*	5.26*	21.77*	2.09	20.32*	23.85*	-1.55	9.19*	2.70*	0.45	0.66	5.12*
1946 – 50	54.14*	5.22*	24.24*	4.54*	22.38*	24.72*	1.23	11.09*	3.17*	0.64	0.56	7.25*
1951 – 55	58.12*	5.07+	26.91*	6.67*	24.86*	26.27*	3.39	12.80*	3.85*	0.70	0.62	9.18*
1956 – 60	60.41*	5.96*	28.90*	8.77*	27.76*	28.09*	4.81+	14.35*	4.62*	0.48	0.97	13.23*
1961 – 65	60.83*	4.84+	29.58*	9.98*	28.97*	27.42*	6.34*	15.61*	6.22*	-0.06	–	17.82*
1966 –	59.72*	6.23+	32.50*	9.35*	31.38*	27.54*	6.10+	17.54*	7.19*	-0.15	–	21.18*
R^2	0.7069	0.8796	0.9565	0.9402	0.9549	0.9232	0.9670	0.9551	0.9831	0.5058	0.7946	0.9257

Notes: 1) CE:cereal; FI:fish/shellfish; ME:meat; DE:dairy/milk products/eggs; VE:vegetable/seaweed; OI:oil/fats; CA:cake; FR:fruit; BE:beverage; AL:alcohol; CO:cooked food; EA:eating-out.

2) *, + marks in the table indicate that as a result of the *t*-test of regression coefficient it was significance level of 5% and 15%, respectively.

3) *e* in the table indicates the categories which were omitted from the independent variables of the regression equation in the process of estimation.

4) R^2 expresses the determination coefficient adjusted for the degrees of freedom.

demand. According to <Table 4>, in Korea, cereal is included within the category of inferior goods because the expenditure elasticity is negative while fruit, cake and eating-out are in the category of superior goods because the elasticities are greater than 1. All other items fall into the category of ordinary goods because the expenditure elasticity is the negative figure smaller than 1. The price elasticities are negative for all the items except eating-out, meeting the condition of the positive and the negative mark. The absolute values of the price elasticities for dairy products/eggs, fruit and vegetable are greater than 1 and are regarded as elastic.

In Japan, while cereal with its expenditure elasticity being negative within the category of inferior goods, eating-out shows the only item of which expenditure elasticity exceeds the value of 1. All other items can be regarded as falling within the category of ordinary goods because their expenditure elasticities are less than 1. The price elasticities of all the items except cereal are negative, thus meeting the positive and the negative

Continued (Japan)

(Unit: 100 Yen)

Parameter	CE	FI	ME	DE	VE	OI	CA	FR	BE	AL	CO	EA
Intercept	39.67*	22.81*	12.96*	8.84*	11.16*	5.65*	9.18*	19.87*	4.13*	30.48*	9.84*	4.76
Expenditure	-0.004*	0.005*	0.016*	0.002*	0.005+	0.004*	0.005*	0.007*	0.009*	0.001	0.014*	0.038*
Price	3.76	-11.76*	-3.64*	-0.06	-9.84*	-0.27	-6.62*	-5.00*	-4.01*	-11.32*	-11.11*	-5.89
Age Group												
– 24	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*
25 – 29	-3.79*	-0.68+	-0.40	0.86*	– 0.36	-0.31*	1.30*	– 1.10*	0.35	-0.12	0.49	-1.33*
30 – 34	-5.24*	-1.25*	-0.24	-0.15	– 0.54	-0.37*	2.99*	-2.15*	0.31	-0.94*	1.99*	-0.95+
35 – 39	-4.55*	-0.58	0.90+	-1.58*	0.54	-0.25+	4.02*	-3.21*	-0.33	-2.13*	3.79*	3.17*
40 – 44	-2.04*	1.35*	2.53*	-1.90*	2.89*	0.02	4.44*	-4.10*	-1.11*	-3.21*	5.80*	4.16*
45 – 49	-0.80	4.23*	2.56*	-2.00*	5.73*	0.03	3.45*	-5.48*	-2.07*	-3.91*	6.52*	-1.53
50 – 54	-2.35*	8.05*	0.72	-2.16*	8.78*	-0.35	2.59*	-6.42*	-1.77*	-4.31*	6.19*	-5.90*
55 – 59	-4.05*	12.02*	-0.29	-1.87*	12.37*	-0.23	2.65*	-6.42*	-0.38	-4.71*	6.53*	-6.92*
60 – 64	-4.71*	15.10*	-0.40	-1.26*	16.38*	0.35	3.82*	-6.10*	1.38+	-5.95*	8.86*	-6.51*
65 –	-5.54*	17.67*	-1.66	-1.00	20.00*	0.38	4.44*	-5.93*	1.90+	-7.60*	9.97*	-6.71*
Birth Cohort												
– 1905	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*	*e*
1906 – 10	-0.05	1.14	-0.47	0.07	2.38*	0.03	0.38	0.44	– 0.25	-1.24*	0.39	-1.67+
1911 – 15	-1.08*	4.40*	-0.92	0.37	6.45*	0.25	1.28*	0.34	1.48*	-3.68*	1.26+	-2.53*
1916 – 20	-2.75*	5.77*	-1.30	0.61	8.67*	0.45+	1.94*	-0.42	2.18*	-4.86*	2.04*	-1.55
1921 – 25	-4.10*	7.26*	-1.98+	0.83+	10.13*	0.15	2.14*	-1.67*	3.09*	-6.39*	2.63*	-2.02
1926 – 30	-5.54*	8.01*	-2.02+	0.86+	11.85*	0.01	2.25*	-2.99*	3.45*	-7.57*	3.13*	-1.55
1931 – 35	-7.39*	8.16*	-1.40	0.93+	12.94*	-0.15	2.32*	-4.31*	3.73*	-8.54*	3.72*	0.03
1936 – 40	-9.77*	8.73*	-1.08	1.11+	14.06*	-0.15	2.48*	-5.55*	3.47*	-9.27*	5.46*	1.18
1941 – 45	-12.03*	8.44*	-1.22	1.18+	14.55*	-0.16	3.47*	-6.72*	3.26*	-9.96*	7.15*	2.70
1946 – 50	-14.37*	7.04*	-1.85	1.03	14.64*	-0.31	4.27*	-8.31*	3.03*	-10.83*	8.88*	4.46+
1951 – 55	-16.55*	4.86*	-2.71	0.82	14.09*	-0.59	4.66*	-10.40*	2.74*	-11.59*	9.98*	5.71*
1956 – 60	-18.67*	2.78	-3.89*	0.50	13.97*	-0.89+	5.12+	-12.87*	0.92	-11.16*	12.23*	8.82*
1961 – 65	-21.16*	-0.25	-3.82*	-0.28	12.49*	-0.15*	4.98*	-14.73*	-0.22	-11.05*	13.01*	8.03*
1966 –	-23.66*	-3.23	-5.72*	-0.48	10.08*	-1.93*	4.47*	-16.80*	-1.31	-11.61*	15.36*	11.35*
R^2	0.9690	0.9615	0.8641	0.7450	0.9084	0.8866	0.8135	0.9411	0.8742	0.6835	0.7975	0.8979

Notes: Ibid

mark. In respect to the absolute value of price elasticity, alcohol marks by far the largest value exceeding 1, thus elastic enough, and among other items, cooked food records a relatively large value of 0.7.

Comparing elasticities of food demand between Korea and Japan, the expenditure elasticities of oil/fats, beverage and cooked food are higher in Japan than in Korea. But, conversely, the elasticities of other food items are higher in Korea than in Japan. It is rather difficult to grasp a certain trend in regard to other items. In respect to the food items which are consumed in fresh form (fish/shellfish, meat, dairy products/eggs, vegetable/seaweed, fruit, *etc.*.), both expenditure and price elasticities of Japan are larger than those of Korea. The difference is attributable to the fact that the level of consumption is higher in Japan than in Korea.

2. Age Effect

In both countries, as the householder grows older, the share of older family members becomes higher. Consequently, the expenditure of each item tends to

<Table 4> Comparison of Expenditure and Price Elasticities between Korea & Japan

Item	Korea		Japan	
	Expenditure	Price	Expenditure	Price
CE(cereal)	-0.100	-0.244	0.131	-0.109
FI(fish/shellfish)	0.672	-0.595	0.151	-0.416
ME(meat)	0.666	-0.680	0.615	-0.207
DE(dairy/milk products/eggs)	0.512	-1.379	0.178	-0.007
VE(vegetable/seaweed)	0.407	-0.642	0.160	-0.431
OI(oil/fats)	0.270	-0.298	0.375	-0.035
CA(cake)	1.117	-0.611	0.318	-0.576
FR(fruit)	1.003	-1.362	0.491	-0.433
BE(beverage)	0.216	-2.540	0.768	-0.464
AL(alcohol)	0.445	-0.988	0.093	-1.257
CO(cooked food)	0.418	-0.456	0.704	-0.729
EA(eating-out)	1.443	0.410	1.068	-0.215

Notes: The expenditure and own price elasticities in <Table 3> are the elasticities calculated around the respective average values based upon the estimation in <Table 3>

increase. The age effect can be grasped from regression coefficient when age groups are measured by use of dummy variables. As mentioned before, although some of the items do not have a significant regression coefficient, observation will be made with an eye on relative changes.

<Table 3> shows the age effect in Korea. In case of dairy products/eggs and cake, the age effect goes up as the band of age moves higher up to 35-39, but tends to go down in the age group of the band beyond that. In case of alcohol and cooked food (take out box lunch, cooked bread, delicatessen), little difference is seen among age groups, and the age effect is extremely small. On the contrary, in respect to other items like cereal, fish/shellfish, vegetable/seaweed, fruit, beverage and eating-out, the age effect goes up higher as the age group moves to a higher band of age. It is noted, in particular, that the age effect for cereal, meat, vegetable/seaweed and oil/fats is remarkable. In such a great number of items, Korea is characterized by the fact that the regression coefficient, that is, expenditure, shows a more noticeable upward trend in higher age groups. The major factor for this is, as stated before, that, in Korea before the year 1985, there were more two-generation families in the higher age groups. Because of the rapid move to a core family, the age effect on expenditure by item is expected to change in the near future.

In respect to the age effect in Japan, the age effect on fish/shellfish and vegetable/seaweed rises consistently as the age group shifts to higher bands of age. In cases of cereal, meat, and oil/fats, the age effect goes up to the age group of 40-45, but it goes down in the age group of the bands beyond that. The age effect on the demand for dairy products/eggs is the highest in the age group of 25-29 and goes down thereafter to the age group of 45-49. On the contrary, the age effect on cake goes up in the age groups of that band. In case of cooked food and eating-out both are externalized food, food which is cooked outside the household, the age effects differ from each other. The age effect on eating-out goes up to the middle age group of 40-44 and goes down rapidly thereafter. In contrast, the age effect on cooked food goes up almost consistently. This seems to reflect the tendency that, while the externalization of food in the young and middle age groups is motivated by leisure related activities like going out, the higher age groups mostly composed of older family members tend to externalize food for convenience in cooking.

In this way, the age effect on food demand reflects the age composition of family members as shown in <Figure 1>. That is to say, in both Korea and Japan, the age effect on dairy products/eggs is higher in young age groups who have little children than in other age

groups, and the age effect on cake in the middle age groups, including young people, is higher than in other age groups. It is to be noted that Korea and Japan have a common tendency that the age effect on fish/shellfish and vegetable/seaweed is higher in the higher age groups. In respect to other items, trends of Korea and Japan do not converge, but become characteristics of both countries in turn.

3. Cohort Effect

Like the age effect, the cohort effect will be studied for relative changes, depending upon whether the regression coefficient is large or small. In Korea, the cohort effect goes up higher in almost all the items except alcohol as the birth cohort of householder comes from 1916 closer to the year. The cohort effect on the food demand is considered to reflect food circumstances of the growth period of the householder. If so, this means that the householder whose birth cohort is closer to the year spends a large amount on food items, and then that there exists birth cohort differences in expenditure on each item.

In order to grasp these differences in the birth cohort, the ratio of the expenditure of the cohort of the years after 1966 to that of the cohort of the years before 1915 are calculated item by item as follows: 2.3 times on cereal; 1.6 times on fish/shellfish; 9.2 times on meat; 2.0 times on dairy products/eggs: 5.4 times on vegetable/seaweed; 4.8 times on oil/facts; 6.5 times on cake; 5.4 times on fruit; 2.0 times on beverages; 0.98 times on alcohol; 76.6 times on eating-out. It should be noted that the ratios of the quantity of consumption itself are lower than these ratios because these ratios were raised due to the improvement of quantity and quality. Attention should be, however, paid to the fact that the ratios of expenditure on cereal, fish/shellfish, beverages and alcohol mostly used for the conventional cooking are far greater than those on meat, oil/fats, fruit and eating-out, mostly used for the Western-style cooking. From this information it may be said that the diet has improved in line with the rapid Westernization among consumers in the newer generation.

On the other hand, the situation in Japan can be summarized as follows: As the birth cohorts come from the years before 1915 closer to the year, the cohort effect on cereal, oil/fats and alcohol goes down while the effect on cake, eating-out and cooked food goes up conversely. On the contrary, in respect to fish/shellfish, dairy products/eggs and beverages, the effect in the birth cohorts from 1906-10 to around the 1940 group goes up, and it tends to go down in the cohorts of the years thereafter. In addition, the cohort effect on meat demand does not differ so much among the cohorts up to 1950, but it tends to go down in the cohorts from 1951 to year. It is because, in respect to the generation in the cohorts in the years after 1951, meats for the household cooking are substituted by the externalized food, as judged from the fact that the cohort effect on eating-out and cooked food is higher. In the generation in the birth cohort of the 1920 age group, the householder grew up in pre-war days when food consumption centered on cereal, and, reflecting this, the cohort effect on cereal and alcohol is outstandingly higher than in other generations. In the generation in the birth cohort of "1921-50" the cohort effect on Japanese-style food and Western-style food is high because householders experienced the Westernization of food as well as food shortage in their growth period during wartime and shortly after post-war days. In contrast, in the generation of the birth cohort of "the years after 1951", the cohort effect is greater on externalized food like eating-out and cooked food and cake, and is smaller on cereal, fish/shellfish, meat and dairy products/eggs, than in the household in the cohort of "1921-50" group, because the householders grew up in the postwar, affluent, economic growth period.

As mentioned above, in comparing the patterns of food composition between the two countries, the results show that the older generation place, in both countries, more importance on stable food while the younger generation place more importance on food consumption of livestock products, such as oil/fats and externalized food. However, the difference in the composition of food consumption among generations is extremely big in Korea, but it is relatively small in Japan. It may be said that while Westernization and externalization of the diet made rapid progress in Korea, gradual dietary progress was made in Japan in parallel with generation changes.

<Table 5> Effect of Item by Factor

(Unit: 100 Won, 100 Yen)

Items	Korea				Japan			
	R_Y	R_P	R_A	R_C	R_A	R_C	R_A	R_C
CE	18.24	6.34	49.58	47.93	2.29	0.42	4.74	23.61
FI	33.17	13.26	6.01	6.38	2.87	3.37	18.92	11.96
ME	43.12	8.05	20.23	29.08	9.18	1.52	4.22	5.25
DE	11.61	7.67	3.19	10.59	1.15	0.03	3.02	1.66
VE	26.54	6.63	18.28	27.66	2.87	3.29	20.54	12.26
OI	13.27	4.22	20.64	22.51	2.29	0.11	0.75	2.38
CA	29.85	4.79	6.95	11.60	2.87	1.28	3.14	4.74
FR	31.51	8.74	7.84	15.51	4.02	1.50	5.32	17.24
BE	24.88	2.18	1.71	5.98	5.16	1.73	3.97	5.04
AL	4.98	1.87	3.06	1.50	0.57	3.26	7.48	10.37
CO	9.95	0.54	0.48	1.05	8.03	2.67	9.48	14.97
EA	127.71	0.33	4.25	20.00	21.80	1.00	11.08	13.88

Notes: 1) This table is based upon the estimation of the demand function by the items used in <Table 3>.

2) R_Y, R_P, R_A and R_C, which are the ranges of each effect of expenditure Y, price P, age A and birth cohort C, were calculated by the following equations respectively:

$$R_p = |\alpha|(P_{MAX} - P_{MIX}), \qquad R_Y = |\beta|(Y_{MAX} - Y_{MIN}),$$
$$R_A = |\gamma_{MAX} - \gamma_{MIX}|, \qquad R_C = |\delta_{MAX} - \delta_{MIX}|.$$

However, signs of α, β, γ, δ, Y and P are the same as those of equation (2), and MAX and MIN mean maximum and minimum, respectively.

4. Comparisons of Each Effect by Factors

In the above comparisons, investigations were made on the effect of food demand on the item-by-item expenditure by the factor of food demand. Here, comparative studies will show which factor will have largest impact on food demand of the household. The factor-by-factor effects on food demand are not suitable as indicators because the regression coefficient itself is determined by the scale of the variables.

Here, the range of each effect will be calculated to avoid the effect of the scale and to compare each effect on food demand of the household by expenditure, price, age group and birth cohort. The ranges of each effect as shown in the Notes 2 of <Table 5> are estimated by the use of maximum and minimum values of the factor-by-factor effects calculated on the basis of the regression coefficient in <Table 3>. In the following parts of the report, investigations by country will be made on the effects of various factors on food demand.

In Korea, there are no items where the range exceeds 2000 won in terms of price factor, but in terms of the expenditure factor; fish/shellfish, meat, vegetable/seaweed, cake, fruit, beverages and eating-out fall into this category. On the contrary, the items where range exceeds 2000 won are only cereal, meat and oil/fats in terms of the age effect; and cereal, meat, vegetable/seaweed, oil/fats and eating-out in terms of the cohort effect. In regard to the item-wise effect of the four factors on expenditure, there are small differences of the effect among the factors for dairy products/eggs, alcohol and cooked food, but the effect of expenditure is largest on fish/shellfish, meat, cake, fruit, beverages and eating-out, followed by the cohort effect for items except for fish/shellfish. For vegetable/seaweed and oil/fats the cohort effect is largest, followed by the expenditure or age effect. Then, for cereal, the age effect is largest, followed by the cohort effect. Putting all accounts together, it may be said that among the effects on food demand the effect of expenditure is largest, followed by the cohort and age effects, the price effect being smallest.

In Japan, eating-out is the only item where the range

exceeds 1000 yen in terms of the effect of expenditure, but there are no such items in terms of the price effect. On the other hand, fish/shellfish, vegetable/seaweed and eating-out in terms of the age effect, and cereal, fish/shellfish, vegetable/seaweed, fruit, alcohol, cooked food and eating-out in terms of the cohort effect fall into the price effect from the largest to the smallest respectively. In respect to the four effects on food demand, when compared by item, there are small differences in the effect among the factors for oil/fats, cake and beverages, but the effect of expenditure is largest for meat and eating-out, followed by the cohort effect. On the contrary, cereal, fruit, alcohol and cooked food, the cohort effect is largest, followed by the age effect, while for fish/shellfish and vegetable/seaweed the age effect is largest, followed by the cohort effect. To sum up, it may therefore, be said that the cohort effect is largest, followed by the age and expenditure effects, with the price effect being the smallest.

Among the effects on the long-term change in food demand of the household, the price effect is lowest in both countries. In contrast, the effect of expenditure is on upward trend in both countries with the margin of increase being larger. In Korea, the effect is bigger than in Japan because food demand in Korea is at a growth stage and because expenditure elasticities of a large number of items are high. In Japan, the effect is smaller because consumers in Japan have reached a saturation point and because expenditure elasticities of many items have lowered. Among the effects on food demand, that of expenditure as an economic factor is bigger in Korea than those of non-economic factors of the latter two factors while the effects of non-economic factors like birth cohort and age of householder are bigger in Japan than those of economic factors like expenditure and price. So, in respect to the effects, the relative importance of the factors which determine food demand differs between the two countries, reflecting the income level of consumers.

V. Summary

This report gave analysis of food demand both in Korea and Japan through introducing the concept of cohort analysis to the conventional demand model. This research was done to clarify the factors which determine food demand of the household. The traits of the new model for demand analysis are to consider and quantify those effects on food demand not only of economic factors such as expenditure and price but also of non-economic factors such as the age and birth cohort of the householder.

The results of the analysis can be summarized as follows:

1) The comparison of the item-wise elasticities of food demand demonstrates that the expenditure elasticity is higher in Korea than in Japan and that the expenditure elasticity is -0.1 for cereal and more than 1 for eating-out in both countries. In respect to price elasticity, the absolute values of all the items except alcohol and cooked food are higher in the Korea than in Japan, and especially the price elasticities of beverages, dairy products and fruit are predominantly higher in Japan. In this way, both expenditure and price elasticities of a large number of items are higher in Korea than in Japan, which may be explained from the fact that the level of expenditure is higher in Japan than in Korea.
2) In both of Korea and Japan, as the householder grows older, the expenditure for each item increases and the composition of expenditure changes in such a way that these moves may be regarded as due to the age effect. However, there are both similarities and differences in the details of such moves between Korea and Japan. Those two countries have this trait in common that the young age groups of the householder spend more on dairy products and middle age groups spend more on cake than other age groups. In the Korea, however, there can be seen a certain trend that higher age groups spend more on a large number of items, reflecting the fact that there are more two-generation families in higher age groups. Japan differs from Korea in that expenditure in Japan is diversified, depending upon the age group. For example, in Japan, middle age groups spend more on cake, cereal, high-caloric food like meat and eating-out while older age groups spend more for Japanese-style food like fish/shellfish and vegetable/seaweed, and cooked food.
3) The effect of the birth cohort effect was also

demonstrated. The birth cohort effect was introduced under the supposition that the food circumstances under which the householder was born and brought up would determine the current expenditure. Thus, the following was made clear: older generations in both countries placed more emphasis upon stable food in their composition of food consumption; the share of livestock products, oil/fats and externalized food was higher in the food composition of younger generation; differences in food composition among generations were extremely large in Korea while they were relatively small in Japan; and Westernization and externalization of diet made rapid increases simultaneously with generation changes in Korea while they made any gradual increases in Japan during the same time period.

4) The four major factors which impact the long-term change of food demand of the household are expenditure, price, the age of the householder, and the birth cohort of the householder. Investigations were made as to which factor had the largest impact. As a result, it was found that the price effect was the smallest in both countries, and that the relative importance of the factor-by-factor effects differed among the two countries: in Korea the expenditure effect was greater than the effects of age and birth cohort while in Japan the effects of non-economic factors such as the age and birth cohort of householder were greater than those of economic factors such as expenditures.

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