

FOOD CONSUMPTION ANALYSIS USING ENGEL EQUATION IN KOREA*

CHOI JI-HYEON**

LEE KYE-IM***

key words: food consumption, Engel equation, household characteristics, cross sectional analysis

ABSTRACT

The overall objective of this study is to identify factors affecting food consumption and project the consumption for major food groups up to 2005. The data used in the empirical analysis are from the household component of 1986 and 1998 Family Income Expenditure Survey. For the estimation of food demand equation, Engel equations were estimated using OLS. Estimation results showed that household age-sex composition, types of households, and location of residence were closely related to the food expenditure at home. The expenditure elasticities were relatively elastic in food away from home (FAFH), fruits, and fish and shellfish compared to grains, vegetables, and oils.

1. INTRODUCTION

Food consumption patterns in Korea have changed considerably in recent years. Numerous factors are responsible for these including demographic and lifestyle changes, diet, health, and

* The authors are grateful to the unanimous referees for their valuable comments.

** Senior Fellow

*** Research Fellow

food safety concerns. New product development, new varieties, and advertizing campaigns have also contributed to shifts in consumption.

The changes are mainly characterized by an increased demand for meat, fast food and food away from home (FAFH) while demand for cereal products such as rice and barley have decreased. The proportion of expenditures on meat and FAFH expenditures of urban households have been increasing over time. In 1998, meat and FAFH accounted for 10 percent and 36 percent of food expenditure, respectively.

In the U.S, numerous studies related to food demand using household budget data have been performed (Gould, Cox, and Perali(1991), Hein & Pompelli(1988), Popkin, Guilkey, and Haines(1989)) while few research in Korea. Recently, Choi & Lee(1996a, 1996b, 1997) performed food consumption analysis using household budget data. These studies contributed to understanding consumption patterns in Korea. However, these studies did not deal with projection of food consumption.

The purpose of this study is to identify factors affecting food consumption and project the consumption for major food groups up to 2005. Identifying characteristics of household is focused on analysing economic factors and socio-demographic factors such as age-sex category variables, education level, occupation and employment status.

The data used in the empirical analysis are from the household component of 1986 and 1998 Family Income and Expenditure Survey conducted by National Statistical Office. Two cross sectional data sets are used to examine the changes on food consumption across two different time period.

II. Changes in Food Consumption

1. Expenditure by Food Item

During 1982~99, food and beverages expenditure per household had increased 8.6 percent annually while consumption expenditure had increased 11.1 percent (Table 1). The annual increasing rate

for expenditure of the FAFH was 20.7 percent in the period. Fruits, fish & shellfish, meat, and dairy products had increased over 8 percent on average. Cereals & breads such as rice, and barley had increased 2.9 percent due to the change in nutrient intake sources from cereals to meat.

The share of the FAFH increased from 5.9 percent in 1982 to 35.5 percent in 1999 while the share of cereals & breads decreased from 34.5 percent to 13.7 percent between the same period. In 1999, expenditures on meat, fish & shellfish, vegetables & seaweeds, and fruits accounted for 10.3 percent, 7.6 percent, 9.0 percent, and 6.2 percent, respectively.

2. Expenditure by Income Group

Food expenditure for most food items increased as household income increased (Table 2). The magnitude of increases significantly varied across the food items. The households spent more on FAFH, beef, fruits, and fish & shellfish compared to increases in income while they spent less on rice, pork, and dairy products. The high income households relatively spent less on pork than low income households.

The household whose head was a wage earner spent more on beef, fish & shellfish, oils, vegetables & seaweeds while spent less on dairy products, pork, and bread & confectioneries compared to the household whose head was a non-wage earner.

TABLE 1. Monthly Food Expenditure Per Household

Unit: thousand won, %

	Consumption Expenditures	Food and Beverages	Cereals & Breads	Meat	Dairy Products	Fish & Shellfish	Vegetables & Seaweeds	Fruits	Condimental Foods	Bread, Confectioneries	Tea, Soft Drinks & Alcoholic Beverages	Other Food and Beverages	Food away from Home
1982	248.9	101.6 (100)	35.1 (34.5)	11.5 (11.3)	4.5 (4.4)	8.0 (7.9)	12.2 (12.0)	6.5 (6.4)	8.3 (8.2)	4.2 (4.1)	4.5 (4.4)	0.3 (0.3)	6.0 (5.9)
1985	317.0	118.8 (100)	34.6 (29.1)	14.8 (12.5)	6.0 (5.1)	10.2 (8.6)	15.2 (12.8)	7.4 (6.2)	10.5 (8.8)	5.2 (4.4)	5.2 (4.4)	0.2 (0.2)	8.8 (7.4)
1990	685.6	220.8 (100)	44.8 (20.3)	26.1 (11.8)	12.0 (5.4)	21.0 (9.5)	24.8 (11.2)	15.6 (7.1)	11.7 (5.3)	8.2 (3.7)	8.2 (3.7)	2.6 (1.2)	44.8 (20.3)
1993	1020.9	301.6 (100)	45.2 (15.0)	36.0 (11.9)	15.3 (5.1)	28.2 (9.4)	30.9 (10.2)	22.3 (7.4)	15.5 (5.1)	11.2 (3.7)	11.2 (3.7)	5.1 (1.7)	79.6 (26.4)
1996	1426.8	409.5 (100)	54.4 (13.3)	44.3 (10.8)	17.6 (4.3)	36.1 (8.8)	37.6 (9.2)	30.5 (7.4)	16.5 (4.0)	14.8 (3.6)	14.8 (3.6)	5.7 (1.4)	136.5 33.3
1997	1489.5	427.4 (100)	53.5 (12.5)	43.7 (10.2)	17.9 (4.2)	35.0 (8.2)	38.8 (9.1)	30.8 (7.2)	15.8 (3.7)	15.5 (3.6)	15.5 (3.6)	5.1 (1.2)	155.0 (36.3)
1998	1316.2	365.9 (100)	48.4 (13.2)	38.6 (10.5)	19.2 (5.2)	29.1 (8.0)	35.0 (9.6)	22.3 (6.1)	16.2 (4.4)	15.8 (4.3)	14.1 (3.9)	4.5 (1.2)	122.8 (33.6)
1999	1478.9	412.1 (100)	56.6 (13.7)	42.6 (10.3)	19.2 (4.7)	31.3 (7.6)	37.0 (9.0)	25.6 (6.2)	15.8 (3.8)	17.4 (4.2)	15.6 (3.8)	4.6 (1.1)	146.4 (35.5)
82-99	11.1	8.6	2.9	8.0	8.9	8.4	6.7	8.4	3.9	8.7	7.6	17.4	20.7

Source : National Statistical Office, *Annual Report on the Family Income and Expenditure Survey*, 2000

TABLE 2. Monthly Food Expenditure by Income Group, 1998
Unit: won, %

	Wage Earner Group by Income Level								Non-Wage Earner Group (27,380)	
	~50% (6,611)		50~75% (8,806)		75~125% (12,832)		125%~ (8,806)			
Food & Beverages	230,789	62.6	302,566	82.1	368,707	100	493,794	133.9	376,268	102.1
Cereals	30,140	88.3	31,021	90.9	34,131	100	37,587	110.1	37,404	109.6
Rice	28,048	89.1	28,744	91.3	31,476	100	33,750	107.2	33,976	107.9
Meat	24,375	63.1	31,487	81.4	38,659	100	48,772	126.2	40,985	106.0
Beef	6,366	54.7	8,301	71.3	11,636	100	18,101	155.6	14,047	120.7
Pork	7,899	75.5	9,286	88.8	10,462	100	10,369	99.1	10,084	96.4
Chicken	1,910	86.2	2,110	95.2	2,217	100	2,458	110.9	2,349	106.0
Dairy Products	14,625	68.7	19,642	92.3	21,290	100	23,215	109.0	17,951	84.3
Fish & Shellfish	18,487	66.2	23,106	82.7	27,940	100	36,357	130.1	31,861	114.0
Vege. & Seaweeds	26,959	79.1	30,467	89.4	34,074	100	38,651	113.4	37,613	110.4
Fruits	13,159	60.1	18,201	83.1	21,894	100	29,161	133.2	22,570	103.1
Oils	1,997	80.5	2,175	87.7	2,481	100	2,979	120.1	2,984	120.3
Bread & Confectioneries	11,403	63.8	15,008	83.9	17,882	100	19,365	108.3	15,019	84.0
Tea, Soft Drink	6,764	67.2	8,905	88.4	10,068	100	11,278	112.0	9,279	92.2
Alcoholic Beverages	3,551	71.6	4,366	88.0	4,961	100	5,430	109.5	4,650	93.7
FAFH	56,006	45.0	90,305	72.6	124,429	100	202,569	162.8	122,968	98.8

Note : () are numbers of households.

3. Nutrition Intake

Nutrients intake has varied as food consumption has changed over time. Per capita energy and carbohydrate intakes had decreased while fat, iron and vitamin C had increased since 1980. In 1998, nutrient intakes were 1,985 kcal for energy, 325g for carbohydrate, 74.2g for protein, 41.5g for fat, 12.5g for iron, and 123.1mg for vitamin C (Table 3).

TABLE 3. Nutrient Intakes Per Capita Per Day, 1980–1998

	Energy (kcal)	Protein (g)	Fat (g)	Carbo- hydrate (g)	Calcium (mg)	Iron (mg)	VitaminA (IU/R.E. ¹)	Thiamin (mg)	Ribo- flavin (mg)	Niacin (mg)	VitaminC (mg)
1980	2,052	67.2	21.8	396	598	13.5	1,688	1.13	1.08	19.1	87.9
1985	1,936	74.5	29.5	342	569	15.6	1,846	1.34	1.21	25.7	64.7
1990	1,868	78.9	28.9	316	517	22.7	1,662	1.15	1.27	21.6	81.2
1991	1,930	73.0	35.6	325	518	23.0	550 ¹	1.27	1.24	17.5	92.2
1992	1,875	74.2	34.5	313	538	22.9	535 ¹	1.22	1.22	17.4	102.5
1993	1,848	72.6	36.9	301	523	22.4	440 ¹	1.37	1.11	16.5	92.6
1994	1,770	71.9	35.9	286	556	22.0	411 ¹	1.12	1.19	16.6	93.5
1995	1,839	73.3	38.5	295	531	21.9	443 ¹	1.16	1.20	16.7	98.3
1998	1,985	74.2	41.5	325	511	12.5	625 ¹	1.35	1.09	15.7	123.1

Note: 1 are VitaminA intakes measured by R.E basis.

Source: Ministry of Health & Welfare, *Report on 1998 National Health and Nutrition Survey*.

The proportion of vitamin A and calcium intake to RDA (Recommended Dietary Allowance) were 96 percent and 73 percent, implying that these were less taken compared to the RDA's, while protein, thiamin and vitamin C were over-taken. Total energy intake was 95percent to the RDA (Table 4).

85 percent of energy came from plant foods and 63 percent of plant foods consisted of cereals and grain products. It implies that the energy intake highly depends upon cereals such as rice and wheat. The share of animal foods accounted for 15 percent of total energy intakes. This was 8 percent point increase from the early 1980. In 1998, the 66 percent of energy intakes came from carbohydrate, and 19 percent and 15 percent came from fat and protein, respectively. The carbohydrate share decreased from 81 percent to 66 percent between 1970 and 1998, while the protein share increased from 12 percent to 15 percent during the same period.

TABLE 4. Intake Ratio to the RDA's by Nutrients

	Energy	Protein	Calcium	Iron	VitaminA	Thiamin	Ribo-flavin	Niacin	VitaminC
1980	93.5	94.6	81.9	96.4	90.2	128.4	89.3	131.7	176.9
1985	91.1	110.4	93.0	112.0	81.2	122.9	93.8	182.1	125.0
1990	90.0	127.8	82.0	173.3	76.5	109.9	101.4	156.2	154.9
1991	93.1	118.1	82.3	177.3	84.3	120.7	98.9	126.7	175.8
1992	90.0	118.8	85.1	175.1	81.5	114.9	96.0	124.5	194.2
1993	90.0	117.9	84.0	176.0	67.7	140.1	97.3	120.6	175.6
1994	85.0	121.8	91.8	192.0	62.0	109.0	100.2	122.8	176.9
1995	88.6	116.7	75.4	159.5	67.2	108.8	96.0	119.8	185.4
1998	94.5	117.8	72.8	91.9	95.6	126.3	86.2	110.8	234.0

Source: Ministry of Health & Welfare, *Report on 1998 National Health and Nutrition Survey*.

TABLE 5. The Nutrient Shares for Energy Intakes

Unit: %

	Carbohydrate	Protein	Fat
1970	80.8	12.0	7.2
1998	66.0	15.0	19.0

Source: Ministry of Health & Welfare, *Report on 1998 National Health and Nutrition Survey*.

III. Analysis of Consumer's Preference by Food Group

Food consumption patterns were examined by estimating Engel equations. For the analysis, food groups were aggregated into 10 groups : cereals, meat, dairy products, fish & shellfish, vegetables, fruits, bread & confectioneries, and food away from home. It is important to examine the impact of socio-demographic variables as well as prices and expenditures on food consumption. It is expected that households with different socio-demographic characteristics have different attitude towards food consumption.

The household characteristic variables included in the Engel equation are : the presence of female household head (FHEAD), occupation of household head (if household head was employed in a blue collar job then BCOLLAR=1), age of household head (HEADAGE), education of household head (if household head's education was below high school then EDBH=1 and if household head's education was beyond college, then EDGC=1), the employment status of man and wife (WJSTY), month dummy (M2,..., M12), region dummy (SEOUL) and tenancy dummy (TENANCY).

Series of household composition variables were constructed to measure the number of individuals in various age-sex categories in the household. The categories were: (1) children under 6 years (C05); children 6 to 13 years (C613); male youth 14 to 19 years (M1419); female youth 14 to 19 years (F1419); male adult 20 to 49 years (M2049); female adult 20 to 49 years (F2049); male adult over 50 years (MO50); female adult over 50 years (FO50).

The Engel equation incorporating the socio-demographic can be written as :

$$(1) \quad w_i = \alpha_1 + \beta_1 \log y + \sum_1^n \delta_1 D_i + \varepsilon_i$$

where w_i is food expenditure for the i th food item, y is household expenditure as the proxy of income and D_i is socio-demographic variables. The ε_i are error terms which are assumed to be normal with mean zero and the unit variance.

The semi-log form was applied for the estimation because food expenditure increases at the decreasing rate as the income increases. The equations were estimated by OLS because zero consumption problem was not serious with high degree of aggregation. Most of estimated coefficients were significant and the signs of coefficient generally met the expectation. The estimation results of Engel equations are presented in Table 6

and 7. Estimation results are as follows.

1. Cereals

Generally, there was no significant difference across socio-demographic effects on cereals between 1986 and 1998. It implies that consumers' preferences for cereals had no changes across different

TABLE 6. Estimation Results for Engel Equation by Food Group, 1998

	Cereals	Meats	Dairy Products	Fish & Shellfish	Vegetables	Fruits	Oils	Bread & Confectioneries	Alcoholic Beverages	FAPH
Const	-44053*	-120596*	-14622*	-98225*	-42175*	-85908*	-3078.63*	-22761*	-10572*	-794269*
Log (EXP)	2617.65*	10260*	1903.47*	8061.6*	2913.86*	7293.85*	276.46*	2078.03*	1220.74*	56568*
Bcolor	453.56	-2712.6*	543.51*	-2504.12*	-1241.92*	-1612.27*	-168.9*	145.41	31.89	-17379*
Fhead	-1560.06*	-2182.38*	-2047.88*	-2564.72*	-1729.72*	-1311.25*	-66.99	342.34*	-1260.7*	4846.56*
Headage	213.15*	276.25*	-53.27*	289.13*	214.35*	135.43*	30.42*	-16.16*	-42.23*	319.66*
Seoul	-1245.92*	4726.69*	1603.03*	-3623.13*	3511.69*	1965.95*	129.43*	436.02*	-338.66*	21917*
EDGC	-2454.72*	1208.77*	2686.54*	154.93	-561.33*	2497.75*	31.98	1542.67*	-400.91*	11236*
EDBH	3178.56*	-3803.72*	-2479.81*	-2520.36*	-433.98*	-1793.39*	-174.99*	-1189.34*	757.05*	-8403.75*
WJSTY	-821.52*	-2083.83*	-1794.8*	-3496.29*	-2630.84*	-2170.5*	-247.72*	-255.04*	-237.42*	5195.92*
C05	2709.81*	3841.48*	6921.48*	2029.12*	1329.98*	2716.35*	134.5*	4836.33*	72.7	4512.43*
C613	6615.93*	8064.57*	789.07*	3557.72*	3127.4*	3510.06*	373.83*	3935.13*	128.41*	13205*
M1419	10779*	9269.06*	922*	5084.86*	4217.57*	2155.27*	476.28*	1693.32*	303.49*	20676*
F1419	7297.59*	5817.56*	826.36*	5134.36*	3825.76*	4127.84*	478.75*	1918.17*	-5.69	15868*
M2049	7028.93*	5030.18*	1456.58*	3761.25*	3694.85*	1636.21*	294.92*	401.85*	123.27	54484*
F2049	5597.87*	4996.31*	1469.9*	4134.89*	3566.49*	2989.6*	342.91*	1314.57*	201.46*	32228*
MO50	10837*	4826.62*	-604.63*	5787.7*	4198.26*	2423.91*	155.52*	-31.95	1024.78*	39154*
FO50	9378.76*	5155.71*	-259.18	6147.39*	3854.32*	3243.88*	252.41*	19.27	-132.88	25810*
M2	-4057.24*	-16300*	-752.85*	-11446*	-124.32	-11583*	-1123.77*	-1461.24*	-1344.61*	2429.83
M3	-2655.78*	-9268.57*	1631.88*	-6488.93*	5913.66*	-8939.92*	-846.13*	85.75	-1076.3*	16806*
M4	-1756.36*	-10632*	1127.25*	-7684.79*	8818.62*	-8810.37*	-715.57*	245.94	-1046.48*	17315*
M5	34.96	-8250.57*	1126.5*	-8532.11*	8136.19*	-5390.2*	-602.87*	1034.04*	-430.16*	19788*
M6	423.83	-10619*	534.01	-10659*	5784.32*	-4337.35*	-566*	153.86	-631.98*	10379*
M7	1571.15	-7534.46*	1109.83*	-10733*	3616.88*	-2468.97*	-571.81*	829.17*	-667.71*	12327*
M8	3800.23*	-6782.05*	871.6*	-9481.89*	5559.26*	-1010.72*	-595.35*	758.86*	-453.19*	13044*
M9	2753.58*	-9068.92*	1985.15*	-5450.64*	8241.9*	-638.87	-289.89*	-326.45	-605.01*	13937*
M10	9598.27*	-933.57	777.81*	-185.77	6735.46*	6030.3*	-118.84	-157.12	732.64*	18894*
M11	22385*	-9653.57*	331.85	-2523.71*	8399.3*	-4049.69*	-1255.71*	-138.61	-1215.89*	25604*
M12	16172*	-5104.82*	939.66*	-2631.29*	4398.36*	-2467.94*	-1082.16*	1692.68*	-797.12*	30067*
TENANCY	-57.35	-3430.64*	-1056.18*	-2277.67*	-1271.31*	-2656.83*	-26.87	-620.18*	-21.11	5702.85*

* represents significance at the 5% level.

TABLE 7. Estimation Results for Engel Equation by Food Group, 1986

	Cereals	Meats	Dairy Products	Fish & Shellfish	Vegetables	Fruits	Oils	Bread & Confectioneries	Alcoholic Beverages	FAFH
Const	-130622*	-163645*	-48900*	-135363*	-83418*	-129738*	-12170*	-58098*	-18720*	-314810*
Log (EXP)	10293*	13374*	4023.7*	10832*	6679.91*	10969*	1067.69*	5139.72*	1707.5*	25822*
Bcolor	380.2	-4422.57*	-1438.19*	-3855.97*	-3712.78*	-4319.25*	-392.67*	-1601.31*	240.68*	-3464.48*
Fhead	657.8	-3397.12*	-426.89*	-2808.3*	-2335.04*	-1356.8*	-166.26	-3.36	-1064.12*	-1675.98
Headage	122.95*	182.38*	54.8*	239.2*	154.83*	110.21*	24.4*	20.72*	-24.61*	9.96
Seoul	-5111.73*	5100.19*	1601.93*	-1773.82*	4360.33*	1354.9*	419.77*	1760.64*	-269.31*	-1770.26*
EDGC	-6817.31*	3459.29*	2472.99*	4123.06*	129.12	3949.02*	204.36*	1465.17*	-581.47*	8659.55*
EDBH	2823.87*	-1304.09*	-1900.56*	-1912.74*	-1383.61*	-1410.45*	-299.66*	-1003.28*	728.69*	-1752.81*
WJSTY	-999.98	-4552.76*	-732.34*	-3477.94*	-3307.93*	-3286.88*	-346.07*	-1430.35*	-361.17*	2145.87
C05	7841.68*	4156.56*	4565.5*	3881.7*	2973.25*	3188.14*	299.09*	4615.29*	416.01*	3357.03*
C613	12640*	5107.25*	2084.25*	4941.21*	5292.09*	4159.76*	626.67*	3576.58*	385.61*	4847.52*
M1419	17010*	4456.58*	2070.9*	5611.35*	6103.16*	2736.4*	639.53*	1315.01*	229.37*	3722.56*
F1419	13733*	2073.11*	1427.17*	3633.8*	5176.98*	3050.56*	389.49*	1517.67*	95.49	3595.3*
M2049	13694*	5304.16*	1177.76*	5072.76*	6708.08*	2294.98*	585.75*	581.88*	423.54*	7540.85*
F2049	10391*	4466.41*	1540.53*	4329.49*	6523.81*	4480.07*	737.99*	1542.65*	317.46*	3545.83*
MO50	17265*	3968.51*	26.82	3739.2*	5018.87*	971.94*	609.94*	-231.42	1081.53*	5805.44*
FO50	14061*	6417.14*	1124.02*	5967.54*	6083.51*	4355.15*	813.83*	1061.05*	585.34*	5819.2*
M2	-4424.52*	1430.52*	-679.04*	570.74	67.21	2908.9*	-540.54*	-1097.43*	750.52*	-591.46
M3	-2873.8*	-3710.28*	1395.25*	-992.88	5565.81*	-3833.52*	-858.21*	-2837.3*	-482.6*	2972.08
M4	-4043.88*	-2046.67*	2170.32*	670.93	12649*	-1054.01*	-539.78*	-1502.89*	-585.63*	4031.11*
M5	-3426.4*	-993.39	1975.13*	1279.24*	14171*	-3502.18*	-510.69*	-1409.22*	-424.55*	5578.86*
M6	-3906.18*	-2173.26*	1351.82*	-323.42	7375.52*	-1392.76*	-555.01*	-2398*	-136.71	1834.12
M7	-3918.37*	-251.92	1273.76*	374.28	3721.03*	4819.06*	-616.48*	-1497.6*	-466.44*	2749.38
M8	-3676.87*	686.62	1355.17*	1522.03*	5464.36*	9653.28*	-625.41*	-2015.66*	109.92	2726.81
M9	-3063.2*	4120.16*	2002.71*	7780.05*	7404.52*	10445*	265.97*	-2549.67*	879.79*	-1765.65
M10	2111.87	-1728.18*	2101.1*	4470.95*	4739.36*	2469.24*	-1042.34*	-1428.12*	-588.83*	4505.12*
M11	17415*	-2685.28*	1097*	9027.17*	14055*	1399.44*	-1048.36*	-2160.13*	-884.36*	2477.5
M12	12710*	428.42	1361.34*	2301.62*	1585.62*	1625.67*	840.26*	710.14*	-57.06	4461.25*
TENANCY	1135.85*	-3725.79*	-889.02*	-3001.63*	-1728.46*	-3548.16*	-440.32*	-991.85*	92.23	527

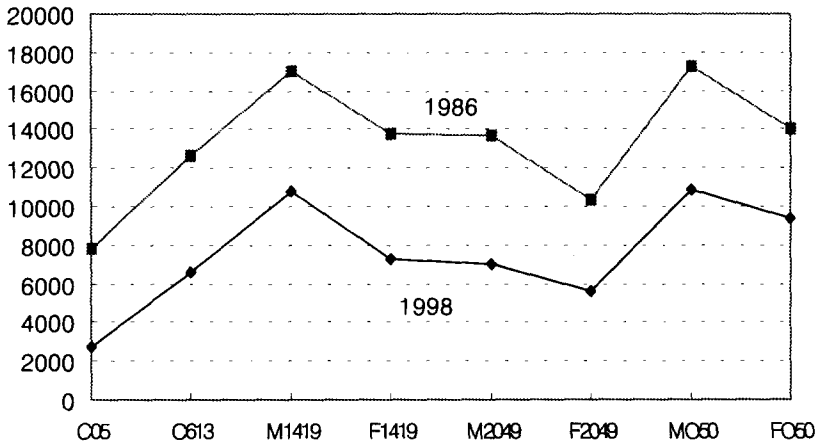
* represents significance at the 5% level.

age-sex groups in the same period. The estimation results for 1998 showed that region of residence and education background of the household head had impacts on cereals consumption

patterns. Households residing in Seoul(SEOUL) spent less on cereals than households in other cities by 1,246 won per month. And households whose head had a college education or more spent less on cereals than household whose head had a high school education or less. The coefficients associated with M10~M12 variables showed a positive signs on cereal consumption. This implies that most households purchase more cereals to store after October in harvest season.

Cereal consumption patterns between 1986 and 1998 were very similar along the age-sex composition of households. Households with male 14 to 19(M1419) and over 50 years old(MO50) spent more on cereals compared to other households.

FIGURE 1. Preference for Cereals by Age-Sex Composition, 1998



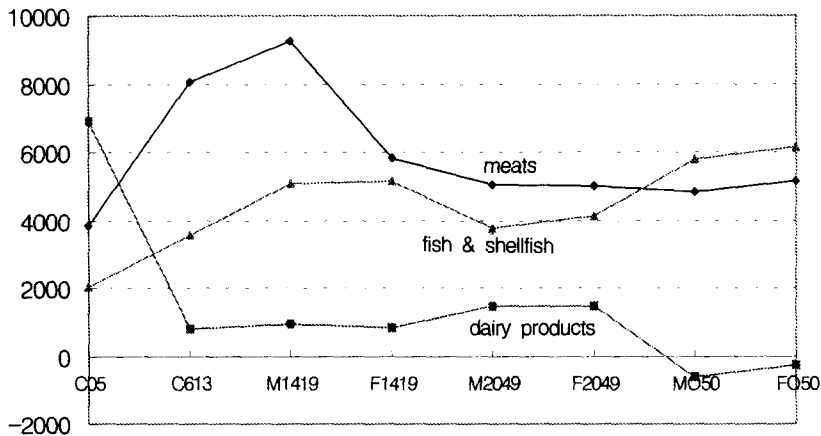
2. Meats, and Fish & Shellfish

In 1998, blue collar households consumed less meats compared to white collar households, and households whose head had a college education or more consumed more meat compared to households whose head had a high school education or less.

Households whose head had a high school education or less also consumed less fish & shellfish compared to others. In 1986, white collar households consumed more eggs compared to blue collar households, however, in 1998, they consumed less. Households whose head had a college education or had a blue collar job consumed less fish & shellfish.

Meat and fish & shellfish consumption was closely related to household age-sex composition. For most of age-sex categories, meats were preferred in 1986 and 1998. The result showed that households who have kids between six and thirteen years old, and male youth between 14 and 16 years old consumed more meats. Households who had adults over 50 years old and kids below 5 years old consumed more fish & shellfish and eggs, respectively.

FIGURE 2. Preference for Meats, Fish & Shellfish, Milk and Eggs by Age-Sex Composition, 1998



3. Dairy Products

In 1998, household residing in Seoul(SEOUL) consumed more dairy products compared to household residing in other cities and

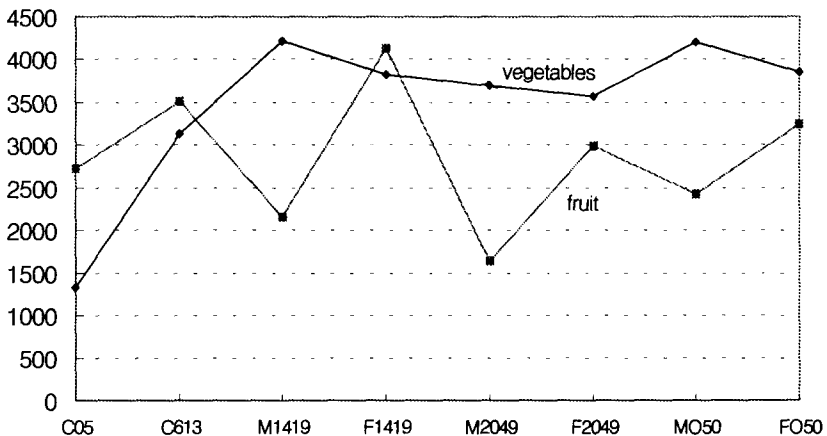
households whose head had a college education or more consumed more dairy products compared to households whose head had a high school education or less. The estimation results showed that dairy products were strongly preferred for children under 6 years(C05) in 1998 and children 6 to 13 years(C613) in 1986, respectively while less preferred to adults over 50 years old(MO50, FO50).

4. Fruit and Vegetables

Housesholds residing in Seoul or households whose head were elder consume more fruit and vegetables while blue collar households consumed less.

Households who had kids below 14 years old consumed less vegetables while households who had household members over 14 years old consumed more. For those households with members over 14 years old, there were not much differences across the specific age-sex groups. In 1998, consumer preferences for fruit became indifferences compared to in 1986. However, females' high preference for fruit still existed since 1980's. Fruit was much more preferred by girls between 14 to 19 years old.

FIGURE 3. Preference for Fruit and Vegetables by Age-Sex Composition, 1998



5. Oils, Breads & Confectioneries, Alcoholics and Food Away From Home (FAFH)

Consumption for oils such as soybean oils, sesame oil, and margarine was less in blue collar households compared to white collar households. Female headed households consumed more bread & confectioneries. Consumption for bread & confectioneries was least in households with the aged household head.

Households residing in Seoul or households whose head had college education or more consumed less alcoholic beverages.

Households residing in Seoul or households whose head had college education or more, and white collar households spent more on food away from home (FAFH). Especially, households where both husband and wife had a job (WJSTY) spent more on FAFH compared to other households while they spent less on other foods. It implies that expenditure on FAFH increases as the women have lots of chance to get a job.

Age-sex composition of the households had a significant impact on bread & confectioneries consumption and FAFH expenditure pattern. The young age group much more preferred bread & confectioneries than old age group. In 1998, household consisting of male between 20 to 49 years old significantly spent more on FAFH. Households with male over 50 years old had significantly higher preference for alcoholic beverages. Preference of adult over 20 years old for oils decreased in 1998 compared to in 1986.

FIGURE 4. Preference for Oils, Breads & Confectioneries and Alcohols by Age -Sex Composition, 1998

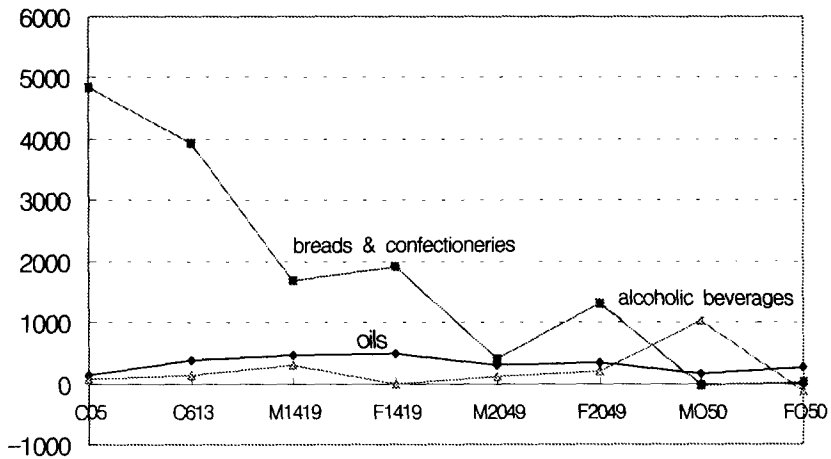
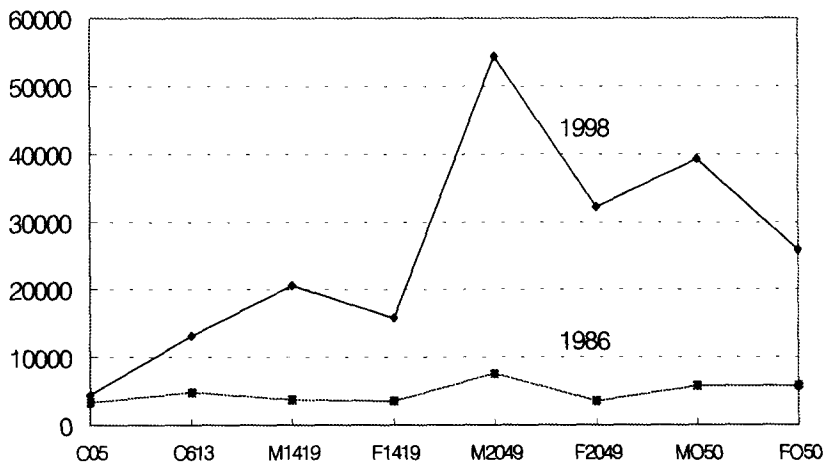


FIGURE 5. Preference for Food Away From Home (FAFH) by Age -Sex Composition, 1998



6. Income Effect on Food

Expenditure effects on food consumption can be measured by expenditure elasticities. Expenditure elasticities of major food groups are calculated from the estimated coefficient and are evaluated at sample mean. The results show that the expenditure elasticities of foods are getting more inelastic since 1984 (Table 8). It implies that expenditure on food increases at the decreasing rate as income increases. Elasticities of FAFH and meats were 1.15 and 0.83 in 1984 while 0.56 and 0.28, respectively in 1998. Elasticities of FAFH and fish & shellfish more elastic than other food. It implies that expenditures on FAFH and fish & shellfish increased more as income increased compared to other foods. Elasticities for cereals are 0.09 in 1998 and 0.11 in 1984, indicating cereals consumption were more inelastic as income increased. Generally, income elasticities of cereals such as rice are found to be negative based on time series data analysis. The elasticities from cross-section analysis is likely to be positive because there exist quality differences in the rices paid by households(Choi & Lee, 1997).

TABLE 8. Expenditure Elasticities for Food Group, 1984-98

	1984 ¹⁾	1986 ²⁾	1993 ¹⁾	1996 ²⁾	1998
Cereals	0.11	0.19	0.15	0.07	0.09
Meat	0.83	0.58	0.54	0.30	0.28
Dairy Products	0.68	0.48	0.31	0.20	0.13
Fish & Shellfish	0.59	0.50	0.52	0.35	0.32
Vegetables	0.40	0.26	0.31	0.12	0.12
Fruits	0.75	0.57	0.56	0.30	0.34
Oils	0.46	0.31	0.30	0.15	0.13
Food Away From Home	1.15	0.99	0.75	0.54	0.56

1) Choi & Lee (1995), 2) Choi & Lee (1997).

Note: Elasticities were evaluated at sample means.

IV. Projection of Food Consumption

Food expenditure at home in 2005 was projected by using the estimation results from Engel equations for food groups. It is known that prediction power is low when projection is done by using results for cross-section data analysis. In this study, the projection was only focused on knowing the direction and trend of food consumption.

Changes in demographic profile of household were projected based on the projection results of Korea Institute for Health and Social Affairs. The projected food expenditure is based on the consumption rate of private sector projected by KDI(Korea Development Institute). Projection of food expenditure per household(in 1995 constant price) in 2005 by food groups are in Table 9.

The projected food expenditures show that most food expenditure except cereals and eggs will increase up to the year 2005, while cereals and eggs will decrease by 1 percent and 4 percent, respectively, relative to the year 1998. Especially, it is

TABLE 9. Projection of Food Consumption at Home in 2005

Food Group	Food Expenditure per Household(1998=100)	Rate of Increase in Per Capita Consumption(%)
Cereals	99.1	-1.2
Meats	111.1	2.8
Milk	106.2	2.2
Eggs	96.4	-0.8
Fish & Shellfish	114.4	3.3
Vegetables	102.7	1.7
Fruits	115.0	3.3
Oils	103.9	1.9
Bread & Confectioneries	105.0	2.0
Tea & Soft Drink	105.6	2.1
Alcoholic Beverages	110.3	2.7
Food Away From Home	121.0	4.1

projected that food away from home (FAFH) will rapidly increase by 21 percent.

Fruit, fish & shellfish and meats will increase 15 percent, 14 percent, and 11 percent, respectively. The increasing rate of per capita consumption is 4 percent for FAFH and 3 percent for fruit and fish & shellfish, respectively.

V . Conclusions

The empirical results showed that household characteristics variables significantly affected food consumption patterns between 1980's and 1990's. Especially, household age-sex composition, type of households and location of residence were closely related to the food expenditure at home. And the expenditure elasticities varied across food groups and were relatively elastic in FAFH, fruit and fish & shellfish compared to grains, vegetables and oils.

It is expected that women will have more job opportunities. And the number of single headed household, the aged household and the young household will increase. These changes will affect food consumption patterns. For example, the increase in meat consumption for households who have children below 20 years old implies potentiality in increase of demand for meat. The estimation result implies that 20 to 30 years old groups will play a leading role for FAFH consumption. Food consumption will be affected by increases in number of fast food restaurants and changes in food marketing circumstances such as the entry of foreign food retailers and wholesalers as well as changes in household characteristics.

REFERENCES

- Braschler, C. 1983, "The Changing Demand Structure for Pork and Beef in the 1970s: Implications for the 1980s." *S. J. Agr. Econ.* 15, December
- Choi, J.H., 1993 "Estimation of A Vegetable Demand System: A Censored Regression Approach." Ph.D. Dissertation Dept. of Ag. Econ. Washington State Univ., Pullman
- Choi, J.H., and K.I. Lee. 1995. *Changes in Food Consumption Patterns in Korea: Cross-Sectional Data Analysis*, Korea Rural Economic Institute, Annual report R335
- Choi, J.H., and K.I. Lee. 1996a. "Food Consumption Analysis in Korea," *Korea Rural Economic Review*, KREI, Vol. 19. No.1
- Choi, J.H., and K.I. Lee. 1996b. "Income and Socio-demographic Impacts on Household Food Expenditure Away from Home," *Journal of Rural Development*, Vol. 19 : 37-51. KREI
- Choi, J.H., and K.I. Lee. 1997. "An Analysis of Food Consumer Characteristics in Korea," *Journal of Rural Development*, Vol. 20. 245-260, KREI
- Deaton, A., and J. Muellbauer. 1980, *Economics and Consumer Behavior*, Cambridge University Press
- Gould, B.W., T.L. Cox, and F. Perali, 1991. "Demand for Food Fats and Oils: The Role of Demographic Variables and Government Donations." *Amer. J. of Ag. Econ.* 73.
- Heien, D., and G. Pompelli. 1988, "The Demand for Beef Products: Cross-section Estimation of Demographic and Economic Effects." *Western J. of Ag. Econ.* 13
- Lee, K.I, J.H. Choi, and J.K. Park. 1998. *An Analysis of Consumer Behavior in Selected Fruit in Korea*, KREI, Annual Report R391
- Lee, K.I, J.H. Choi, and B.I. Ahn. 1999. *Consumer Demand for Meats in Korea*, KREI, Annual Report R401
- Philips, L. 1990, *Applied Consumption Analysis*, North-Holland.
- Popkin, B.M., D.K. Guilkey, P.A. Haines, 1989, "Food Consumption Changes of Adult Women between 1977 and 1985", *Amer. J. of Ag. Econ.* 71.
- Senauer, B. and J. Kinsey, 1991, *Food Trends and the Changing Consumer*, Eagan press.