THE DEMAND SYSTEM FOR PRIVATE CONSUMPTION OF THAILAND: AN EMPIRICAL ANALYSIS

- Preliminary -

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1. INTRODUCTION

The objective of this paper is to examine the demand system for the private consumption of Thailand during 1961-1998 and to build the consumption part of the Interindustry Dynamic Macroeconomic Model (INTERDYME) for Thai economy. The methodology is to apply the Perhaps Adequate Demand System (PADS) suggested by Almon (1996) to estimate 33 private consumption sectors of Thailand. The paper consists of four main sections: In the second section, there will be a specification of the functional form. Data source and the estimation procedure will also be mentioned. Next, the results of the estimation and discussions will be in section 3. The last section will be a conclusion and final remarks.

2. FUNCTIONAL FORM, DATA SOURCE, AND ESTIMATION PROCEDURE

In order to help readers to understand the results of the estimation, the functional form and the meaning of its parameters are briefly discussed as follows:

$$x_i(t) = \left(a_i(t) + b_i(y/P)\right) \cdot \left(\frac{p_i}{P}\right)^{-l_i} \prod_{k=1}^{n} \left(\frac{p_i}{p_k}\right)^{-l_k s_k} \cdot \left(\frac{p_i}{P_G}\right)^{-m_G} \left(\frac{p_i}{P_g}\right)^{-n_g} \qquad [1]$$

where;

$$P_G = \left(\prod_{k \in G} p_k^{s_k}\right)^{1/\sum_{k \in G} s_k}, \; P_g = \left(\prod_{k \in g} p_k^{s_k}\right)^{1/\sum_{k \in g} s_k} \; and \; P = \prod_{k=1}^{n} p_k^{S_k} \qquad [2]$$

Equation [1] above represents the PADS functional form. Dependent variable x_i on the left-hand-side is a private consumption in sector i. P_G, P_g, and P in equation [2] refer to the price index of group G, the price index of subgroup g, and a general price level, respectively. S_k is an expenditure share of product k on total consumption expenditure. p_i and p_k are prices of

consumption sectors i and k, respectively. Finally, t and y are time trend and per capita income.

a_i, b_i, l_i, m_G, and n_g are all parameters. The number of l_i's to be estimated equals the number of consumption sectors. Meanwhile, the numbers of m_G and n_g are estimated equal to the numbers of groups and subgroups, respectively. Positive (negative) m_G implies a substitution (complementary) within group G and, similarly, positive (negative) n_g implies a substitution (complementary) within subgroup g.

According to the PADS functional form in equation [1], one may be able to derive its properties of demand. The own-price elasticity and the cross-price elasticity can easily be derived from the functional form. Each of these price elasticities will be a function of l_i, m_G, and n_g. For example, the own-price elasticity of consumption sector i is[1];

$$e_{i,i} = -l_i(1-2s_i) - \sum_{k=1}^{n} l_k s_k \qquad \text{if } i \in G \text{ and } i \in g \quad [3]$$

$$e_{\substack{i,i \\ i\in G}} = -l_i(1-2s_i) - \sum_{k=1}^{n} l_k s_k - m_G\left(1-\frac{s_i}{\sum_{k\in G} s_k}\right) \qquad \text{if } i \in G \quad [4]$$

$$e_{\substack{i,i \\ i\in G, i\in g}} = -l_i(1-2s_i) - \sum_{k=1}^{n} l_k s_k - m_G\left(1-\frac{s_i}{\sum_{k\in G} s_k}\right) - n_g\left(1-\frac{s_i}{\sum_{k\in g} s_k}\right) \quad \text{if } i \in G \text{ and } i \in g \quad [5]$$

[1] One may derive these equations by taking log in equation [1], differentiating it with respect to $ln(p_i)$, and rearranging terms.

Equation [3] presents the price elasticity of a sector which is ungrouped. Equation [4] refers to the price elasticity of a sector which is a member of a group, but not that of a subgroup. On the other hand, equation [5] represents the price elasticity of a sector which is member of a group, and that of a subgroup.

The estimates of l_i and s_i are individual; however, m_G and n_g are common within the same group and subgroup. Thus, the last two equations of price elasticities indicate that price elasticities of grouped sectors share common parameters. This is worth mentioning because it leads to the procedure of constraining the results in this research.

2.3 DATA SOURCE AND THE ESTIMATION PROCEDURE

Sectoral time series of private consumption expenditures and sectoral time series of prices were obtained from the National Economic and Social Development Board (NESDB) of Thailand. The time series for real disposable income and population were also obtained at the same source. The estimation procedure follows the non-linear least square estimation, using the Marquardt Algorithm to fit the non-linear system. A list of private consumption sectors and the specification of groups and subgroups is presented in Table 1 below. The specification of the consumption group slightly differs from that of the National Account, which primarily specifies groups that represent 'types' of goods. Instead, in this study, groups and subgroups were specified such that they represent how goods were consumed and were related. Certainly, there is a correlation between the 'type' of goods being consumed and 'how' they were consumed; however, there is not always a correlation. Therefore, the new classification is similar to the National Account version, but they are not exact. The intuition here is that we put those sectors which tend

to be highly-related into the same group. "Highly-related" sectors refer to those whose demands are either explicitly complements or substitutes. This method helps to significantly reduce the number of parameters in the system by the introduction of parameter m_G and n_g.

Table 1: Consumption sectors and the specification of groups

[1] Food	**[5] House Furnishing**
[1.1] Protein	18 Furniture and Furnishings
2 Meat	19 Household equipment
3 Fish	20 Domestic Services
1 Rice and Cereals	21 Other expenditure
4 Milk, Cheese and Eggs	**[6] Transportation**
5 Oil and Fat	**[6.1] Private Transportation**
6 Fruits and Vegetables	24 Personal Transportation Equipment
7 Sugar, Preserves, and Confectionery	25 Operation of Personal Transportation
9 Other food	26 Public Transportation
[2] Beverages	**[7] Recreation**
8 Coffee, Tea, Cocoa, etc.	28 Entertainment
10 Non-alcoholic beverages	29 Hotels, Restaurants, and Cafes
11 Alcoholic beverages	30 Books, Newspapers and Magazines
[3] Dress	31 Other Recreation
13 Footwear	**[8] Ungrouped**
14 Clothing	12 Tobacco
15 Other personal effects	22 Personal Care
[4] Utilities	23 Health Expenses
16 Rent and Water charges	27 Communication
17 Fuel and Light	32 Financial services
	33 Other services

3. RESULTS AND DISCUSSION

This section will present the estimation results and discussions. It is important to note that, to achieve sensible results, the set of soft constraints were applied[2]. There is no final solution for the set of soft constraints. However, the desired set of soft constraints could be measured by reasonable results of the estimation. The reasonable results of the

[2] The print out of the constraints was included in the appendix.

estimation refer to positive income elasticities in all sectors, negative own-price elasticities in all sectors, and intuitive values of estimated $DInc$, m, and n.

In addition, the plausible relationship between an estimated income elasticity and a time trend coefficient for each sector should be maintained. Generally, income variables are closely related to time trend since they are normally growing through time. However, on one hand, an estimation sometimes magnifies the effect from a growing income, and undermines the effect from a time trend. This problem could be recognized by the result that gives a very high income elasticity but, at the same time, delivers a very negative time trend coefficient. On the other hand, income variables could also be undermined by a time trend. This problem is implied by the result that has a low income elasticity and a highly positive time trend coefficient[3].

In order to arrive at the results presented below, soft constraints were applied to each consumption sector, one-by-one. The constraining procedure started at sectors that seem to have the least problem and the least complicated term of price elasticity. That is, I began the process with ungrouped sectors. Soft constraints were applied, if any requires, to each of those ungrouped sectors to deliver sensible results mentioned above. Then, the process continued with sectors that are in a group which has no subgroup. Finally, soft constraints were applied to sectors that are in a group that contains a subgroup. Certainly, sectors in subgroups are the last ones that were constrained. This method is particularly

[3] See unconstrained results in the appendix. It could be noticed that in the estimation with no soft constraints, there are many sectors exhibit highly positive income elasticities and highly negative time trend coefficients at the same time.

helpful for keeping track of how price elasticity of a sector would change after it has been constrained because price elasticities of sectors that are in the same group are interrelated.

3.1 AN OVERVIEW: THE ANALYSIS AT GROUP LEVELS

The analysis begins with the relationship between demands for goods within each group. Thirty-three private consumption sectors of Thailand were grouped into seven groups and two subgroups. Six consumption sectors remained ungrouped. As implied by the PADS functional form, values of m and n indicate whether goods in the group and subgroup, respectively, are complements or substitutes. As a reminder, a positive m_G implies substitution within group G, while its negative value implies the complementarity. A similar inference also applies for the value of n_g at subgroup level. Table 2 below presents the estimated values of m and n.

Table 2: Estimated values of *m*'s and *n*'s

Group	*m*	Subgroup	*n*
1. Food	0.71	i. Protein	1.18
2. Beverages	0.27		
3. Dress	-0.10		
4. Utilities	-1.11		
5. Housing Furnishing	0.85		
6. Transportation	0.49	ii. Private Transportation	-1.10
7. Recreation	-0.23		

Within the **Food** group, the result implies that demands for food are substitutes. The value of m_1 is positive and equals to 0.71. Interestingly, as the sectors that give a similar dietary source were further added into a subgroup, namely the **Protein** subgroup, the estimated value of n_1 (1.18) shows a stronger substitution effect. According to Table 3 below, the Food group by far has accounted for the largest expenditure share.

Particularly, Thai people have spent 24.4% of the total consumption expenditure for their consumption.

Table 3: Expenditure Shares by Group

Group	Share	Ungrouped Sectors	Share
Food	0.244	Tobacco	0.022
Protein	(0.070)	Personal Care	0.019
Beverages	0.074	Health Expenses	0.074
Dress	0.111	Communication	0.008
Utilities	0.098	Financial Services	0.009
House Furnishing	0.084	Other Services	0.009
Transportation	0.111		
Private transportation	(0.062)		
Recreation	0.137	Total	1.000

The second group is **Beverages**. Similar to those in the Food group, demands for consumption in this group are also substitutes; however, m_2 (0.27) shows less substitutions. The explanation could be that some sectors in the Beverages group, such as alcoholic beverages and coffee, carry some degree of addictive property. Therefore, it could be possible that substitutions are not as high. In contrast to the Food group, the expenditure share in Table 3 shows that the Beverages group has accounted for the least share.

The next group is the **Dress** group. m_3 (-0.10) shows that demands for consumption in this group are indeed complements, implying that price decreases in Cloth, for example, could lead to an increase in consumption in Footwear. Thai people have spent 11.1% of their consumption share for this group.

Demands for consumption in the **Utilities** group, show a strong complementarity, in which estimated m_4 is equivalent to -1.11. Intuitively, this group actually consists of Rent-

and-Water sector and Fuel-and-Light sector. A high rent may imply more space and more luxury, which could cause a higher bill for lighting. Therefore, these sectors could show high complementarity.

The value of m_5 for the **House Furnishing** group equals 0.85, which implies substitution between demands for members of this group. For instance, a relatively higher price of the Domestic service (a housemaid) could make the consumers buy more Household equipment (such as electrical appliances, and etc.).

The next group is the **Transportation**. There is also a **Private Transportation** subgroup specified in this group. The value of m_6, which equals to 0.49, implies that private transportation and public transportation are substitutes. The higher the costs of using private cars, the more likely that Thai consumers would travel by public transportation. On the other hand, the value of v_2 is negative and is equivalent to -1.10, which indeed suggests a high complement between the cost of purchasing a car and the cost of running a car. The last group specified is the **Recreation** group. The estimated m_7 (-0.23) indicates a complementarity of demands within this group.

3.2 THE ANALYSIS OF 33 PRIVATE CONSUMPTION SECTORS

This section will present results of the estimation in detail. The results of all 33 private consumption sectors will be presented and will be discussed. Table 4 below presents results of all 33 Thai private consumption sectors:

Table 4: Results for 33 sectors

Table 4. Results by product:

The value of L is 0.21

The mu: 0.71 0.27 -0.10 -1.11 0.85 0.49 -0.23

The nu: 1.18 -1.10

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
1	Rice and Cereals	1	0	1	1	1	1	-0.79	0.068	0.14	-0.61	-0.14	-0.04	1.00	0.44
2	Meat	1	1	1	1	1	1	-0.63	0.052	0.38	0.47	-0.20	-0.52	3.44	0.56
3	Fish	1	1	1	1	2	1	-1.67	0.018	0.81	0.74	-11.66	-0.13	14.45	0.52
4	Milk, Cheese and Eggs	1	0	1	1	1	1	-0.86	0.017	0.93	-2.20	-0.04	-0.05	6.72	0.75
5	Oil and Fat	1	0	1	1	1	1	-0.79	0.010	1.16	-0.31	-0.05	-0.11	4.38	0.82
6	Fruit and Vegetables	1	0	1	1	1	1	-0.68	0.047	0.76	-0.54	-0.16	-0.17	2.76	0.11
7	Sugar, Preserves and C	1	0	1	1	1	1	-0.71	0.010	0.86	-0.66	-0.04	-0.20	4.17	0.86
8	Coffee, Tea, Cocoa, et	2	0	1	1	1	1	-0.31	0.003	1.21	-1.52	-0.22	-0.16	6.62	0.88
9	Other Food	1	0	1	1	1	1	-0.68	0.022	0.34	-0.41	0.02	-0.21	8.05	0.87
10	Non-alcoholic beverage	2	0	1	1	1	1	0.02	0.033	1.42	-0.73	-0.02	-0.37	3.55	0.15
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
11	Alcoholic beverages	2	0	1	1	1	1	0.45	0.038	1.34	-1.09	0.17	-0.76	3.98	0.57
12	Tobacco	0	0	1	1	1	1	0.25	0.022	0.52	-0.06	0.67	-0.45	4.16	0.58
13	Footwear	3	0	1	1	1	1	0.41	0.007	1.25	-1.99	-0.08	-0.53	5.81	0.75
14	Clothing	3	0	1	1	1	1	0.24	0.097	1.27	-0.26	-0.01	-0.40	2.30	0.39
15	Other personal effects	3	0	1	1	1	1	0.73	0.007	1.79	1.33	-0.08	-0.84	7.20	0.28
16	Rent and Water charges	4	0	1	1	1	1	0.49	0.076	0.55	-2.05	0.49	-0.38	2.28	0.49
17	Fuel and Light	4	0	1	1	1	1	0.83	0.022	0.78	-1.23	0.53	-0.15	2.58	0.65
18	Furniture and Furnishi	5	0	1	1	1	1	0.41	0.017	1.38	2.29	-0.02	-1.28	6.89	0.48
19	Households Equipment	5	0	1	1	1	1	0.93	0.048	1.79	-0.31	-0.01	-1.41	2.58	0.67
20	Domestic services of H	5	0	1	1	1	1	1.22	0.004	0.85	-0.74	0.14	-2.22	11.64	0.82
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
21	Other expenditures of	5	0	1	1	1	1	-0.15	0.015	1.32	-1.30	-0.04	-0.76	3.86	0.57
22	Personal care	0	0	1	1	1	1	0.76	0.019	0.67	-0.04	0.64	-0.94	2.07	0.60
23	Health expenses	0	0	1	1	1	1	0.77	0.074	1.06	1.00	0.01	-0.87	6.76	0.80
24	Personal transportatio	6	2	1	1	1	1	0.69	0.033	1.55	2.87	-0.04	-0.69	11.04	0.57
25	Operation of personal	6	2	1	1	1	1	0.81	0.029	1.56	-0.39	-0.05	-0.75	3.99	0.79
26	Public transportati	6	0	1	1	1	1	0.13	0.049	0.89	-0.54	-0.01	-0.60	3.86	0.46
27	Communication	0	0	1	1	1	1	1.17	0.008	2.57	-0.69	-0.03	-1.36	4.59	0.35
28	Entertainment	7	0	1	1	1	1	0.15	0.002	0.95	-3.26	0.36	-0.13	12.11	0.87
29	Hotels, Restaurants, a	7	0	1	1	1	1	0.94	0.098	1.19	0.02	-0.01	-0.90	3.34	0.64
30	Books, Newspapers, and	7	0	1	1	1	1	0.93	0.013	1.50	-1.02	-0.04	-0.90	6.52	0.74
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
31	Other Recreation	7	0	1	1	1	1	0.02	0.024	1.54	-0.68	-0.05	-0.04	2.99	0.60
32	Financial services	0	0	1	1	1	1	-0.11	0.009	2.03	-0.04	-0.13	-0.10	8.40	0.90
33	Other services	0	0	1	1	1	1	0.25	0.009	1.03	-1.45	-0.05	-0.45	3.18	0.47

***Meaning of Columns*:**

Columns *G* and *S* , respectively, represent numbers of groups and subgroups to which a sector belongs. Since the estimation allows flexibility in type of dependent variables, numbers in the *P*, *C*, and *T* columns represent types of population series, types of cstar

series (income), and types of time trend series that were used for a sector. In this case, there is only one type of series for each of population variable and cstar variable. However, there are two types of time trend variables; a normal time trend variable, which is simply a series of years, and a special time trend variable (dummy time trend) for the Fish sector[4]. Column *I* indicates the inclusion code, where code '1' refers to a situation that a sector is price sensitive and price terms were included in the system estimation. However, if a sector is price insensitive (for example, goods that are paid for by a third party such as the government), the inclusion code would be '0'.

The *Lamb* and *Share* columns are estimated l_i parameter and expenditure share s_i for the consumption sector *i*. The *IncEl* column is an implied income elasticity; while, *DInc* column represents a ratio of the coefficient on income change to the coefficient on income variable. Value in the *Time%* column shows how consumers' demands change, with respect to time (1 year passage), holding income and price constant. In other words, it simply represents changes in consumers' taste. The next column, *PrEl*, refers to an implied price elasticity for each consumption sector. The *Err%* column corresponds to a percentage of standard error with respect to the average of the last 5 actual data. Finally, the *Rho* is a autocorrelation of the residuals.

***Discussion of the Results*:**

The discussion of results will be taken in the order of groups. The analysis will begin with the Food group. Finally, some of those ungrouped sectors will be examined.

[4] See the appendix for a graph of consumption on Fish and the specification of this special time trend.

I. Food Group

There are eight consumption sectors that were specified in the Food group. Two consumption sectors that are likely to be closely substituted due to their dietary source, namely Meat and Fish, were further specified into a Protein subgroup. As indicated in section 3.1, demands for food are substitutes, where m_1 equals to 0.71. Furthermore, Meat and Fish are highly substituted for each other, as n_1 equals to 1.18. Table 5 below reproduces estimated results for consumption sectors in the Food group.

Table 5: Results for Food Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
1	Rice and Cereals	1	0	1	1	1	1	-0.79	0.068	0.14	-0.61	-0.14	-0.04	1.00	0.44
2	Meat	1	1	1	1	1	1	-0.63	0.052	0.38	0.47	-0.20	-0.52	3.44	0.56
3	Fish	1	1	1	1	2	1	-1.67	0.018	0.81	0.74	-11.66	-0.13	14.45	0.52
4	Milk, Cheese and Eggs	1	0	1	1	1	1	-0.86	0.017	0.93	-2.20	-0.04	-0.05	6.72	0.75
5	Oil and Fat	1	0	1	1	1	1	-0.79	0.010	1.16	-0.31	-0.05	-0.11	4.38	0.82
6	Fruit and Vegetables	1	0	1	1	1	1	-0.68	0.047	0.76	-0.54	-0.16	-0.17	2.76	0.11
7	Sugar, Preserves and C	1	0	1	1	1	1	-0.71	0.010	0.86	-0.66	-0.04	-0.20	4.17	0.86
9	Other Food	1	0	1	1	1	1	-0.68	0.022	0.34	-0.41	0.02	-0.21	8.05	0.87

Note: This table was reproduced from table 4 above.

The expenditure share suggests that Thai people have spent their food budget share primarily on Rice, Meat, and Fruit-and-vegetables. Particularly, their share are 0.068, 0.052, and 0.047, respectively. Expenditure shares of these three sectors account for more than half of the share that has been spent on the Food group. Income elasticities also give us intuitive results. With exception of the Oil-and-fat sector, every member of the Food group has its income elasticity less than 1, which implies that food is necessary good. Interestingly, only Meat and Fish have positive *DInc* values, which equal to 0.47 and 0.74, respectively. This means that Thai consumers would increase their consumption at higher rate on these sectors, as their incomes increase.

Price elasticities also imply sensible results - that is, all price elasticities in these sectors are less than 1 in absolute term. This property suggests that demands for food are inelastic to price changes. Finally, time trend coefficients are, in general, close to 0. However, the special time trend dummy was applied to Fish, and the estimated time trend coefficient accounts for only a sharp decrease in its consumption during 1982-1991. Therefore, the highly negative time trend coefficient of Fish is indeed unmistaken[5].

II. Beverages Group

There are three consumption sectors specified in this group, namely, Coffee-tea-cocoa, Non-alcoholic beverages, and Alcoholic beverages. As mentioned in the previous section, the estimated m_2 suggests that beverages are substitutes. The results for the Beverages group are presented in table 6 below:

Table 6: Results for Beverages Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
8	Coffee, Tea, Cocoa, et	2	0	1	1	1	1	-0.31	0.003	1.21	-1.52	-0.22	-0.16	6.62	0.88
10	Non-alcoholic beverage	2	0	1	1	1	1	0.02	0.033	1.42	-0.73	-0.02	-0.37	3.55	0.15
11	Alcoholic beverages	2	0	1	1	1	1	0.45	0.038	1.34	-1.09	0.17	-0.76	3.98	0.57

Note: This table was reproduced from table 4 above.

As discussed earlier, Thai consumers have spent only 7.4% of their total consumption expenditure on this group; however, examining the group in detail gives us a better picture. Actually, the consumers have spent the least consumption share on the Coffee-tea-cocoa sector - only 0.3% of the total consumption expenditure. However, Thai people have spent a relatively large share on alcoholic beverages. The positive time trend coefficient of this sector also suggests an increase of interest in alcoholic drinks. Income

[5] See the plot of consumption on Fish and the technical note in the appendix.

elasticities are all greater than 1. Finally, all price elasticities are less than 1 in absolute terms, implying that the demands for beverages are inelastic.

III. Dress Group

There are three consumption sectors specified in the Dress group: Footwear, Clothing, and Other personal effects. According to table 2, estimated m_3 (-0.10) implies that these goods are mild complements. Table 7 below presents the results of this group:

Table 7: Results for Dress Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
13	Footwear	3	0	1	1	1	1	0.41	0.007	1.25	-1.99	-0.08	-0.53	5.81	0.75
14	Clothing	3	0	1	1	1	1	0.24	0.097	1.27	-0.26	-0.01	-0.40	2.30	0.39
15	Other personal effects	3	0	1	1	1	1	0.73	0.007	1.79	1.33	-0.08	-0.84	7.20	0.28

Note: This table was reproduced from table 4 above.

It is important to point out that Clothing has a very large expenditure share, and actually it is the second largest share in all sectors. About 9.7% of the total consumption expenditure has been allocated to Clothing. Indeed, income elasticities indicate that Dress is a luxury good. Therefore, as per capita income increases, Thai people would proportionally increase more expenditures on dress. However, the demand for these sectors seems to be inelastic to prices change, as price elasticities are all less than 1 in absolute terms. Lastly, time trend coefficients are close to zero.

IV. Utilities Group

Although the Utilities group contains only two consumption sectors, Rents-and-water charges and Fuel-and-light, this group was specified since these two consumption sectors share a similar characteristic: consumers must pay these bills monthly. By grouping them

together, I anticipated a significant complementarity within this group. This argument was confirmed by table 2. The estimated m_4 equals to -1.11, which in fact suggests that goods in this group are strong complements.

Table 8: Results for Utilities Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
16	Rent and Water charges	4	0	1	1	1	1	0.49	0.076	0.55	-2.05	0.49	-0.38	2.28	0.49
17	Fuel and Light	4	0	1	1	1	1	0.83	0.022	0.78	-1.23	0.53	-0.15	2.58	0.65

Note: This table was reproduced from table 4 above.

The expenditure share of the Rent-and-water charges is almost four times larger than that of the Fuel-and-light sector. This is, however, not a surprising outcome. Income elasticities and price elasticities suggest sensible values. Income elasticities are less than 1 and are equivalent to 0.55 and 0.78, respectively. Therefore, these goods are certainly necessary. Price elasticities also imply that demands for these goods are inelastic to prices change. Interestingly, time trend coefficients are both positive. Hence, regardless of income effect and price effect, Thai people tend to consume more in this group.

V. House Furnishing and Operation Group

There are four consumption sectors in this group: Furniture-and-furnishings, Households equipment, Domestic services, and Other expenditures. The estimated m_5 presented in table 2 indicates that consumption goods in this group are substitutes. The detail results for each sector are shown below:

Table 9: Results for House Furnishing Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
18	Furniture and Furnishi	5	0	1	1	1	1	0.41	0.017	1.38	2.29	-0.02	-1.28	6.89	0.48
19	Households Equipment	5	0	1	1	1	1	0.93	0.048	1.79	-0.31	-0.01	-1.41	2.58	0.67
20	Domestic services of H	5	0	1	1	1	1	1.22	0.004	0.85	-0.74	0.14	-2.22	11.64	0.82
21	Other expenditures of	5	0	1	1	1	1	-0.15	0.015	1.32	-1.30	-0.04	-0.76	3.86	0.57

Note: This table was reproduced from table 4 above.

In general, with exception for the Domestic services, income elasticities in other sectors are all greater than 1. Only price elasticity of the Other expenditures sector, which, in fact, refers to expenditures on maintenance of other house furnishing goods, shows an inelastic demand. This result is very intuitive since the demand for purchasing furniture and equipment could be price elastic; however, once the goods are obtained, demand for maintaining them could be relatively more inelastic.

Within this group, Thais have made a relatively large expenditure share on Household equipment. On the other hand, they apportioned the least share to Domestic service (a housemaid), although a positive time trend coefficient implies that Thais are more interested in hiring housemaids. Ambiguously, the income elasticity suggests its necessity, although its demand is rather price elastic.

VI. Transportation Group

There are three consumption sectors in this group: Personal transportation equipment, Operation of personal transportation, and Public transportation. The subgroup of **Private Transportation** was further specified in order to differentiate expenditures on private cars, which includes the cost of a car and its operational costs, from expenditures on public transportation. The intuition is that the expenditure on operational costs of a private car could increase with the cost of a car. The more expensive a car is, the higher

its running cost. However, a consumer's expenditure on public transportation could, indeed, decrease his expenditure on a private car. For instance, a consumer may prefer to travel by public bus instead of driving a car if the price of gasoline is relatively high. On one hand, by specifying subgroup, results are expected to show a high complementarity between Personal transportation equipment and Operation of the personal transportation. On the other hand, Private transportation should be substituted for Public transportation. The results presented in table 2 and the discussion made in section 3.1 has proved our argument above.

Table 10: Results for Transportation Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
24	Personal transportatio	6	2	1	1	1	1	0.69	0.033	1.55	2.87	-0.04	-0.69	11.04	0.57
25	Operation of personal	6	2	1	1	1	1	0.81	0.029	1.56	-0.39	-0.05	-0.75	3.99	0.79
26	Public transportati	6	0	1	1	1	1	0.13	0.049	0.89	-0.54	-0.01	-0.60	3.86	0.46

Note: This table was reproduced from table 4 above.

Thais have allocated their budget shares on Private transportation and on Public transportation for 6.2% (3.3% for purchasing cost and 2.9% for operational cost) and 4.9%, respectively. Within the Private transportation subgroup, expenditures on Private transportation have accounted proportionally for more than the operational costs. This is an interesting fact, however. In some developed countries such as the US, Italy, Spain, and France, results in Almon(1996) suggested that the operational costs of owning cars by far consistently account for about double the costs of purchasing cars.

Income elasticities also give intuitive results. That is, private cars seem to be luxury goods; however, public transportation is a necessary one. Time trend coefficients are all close to zero, and price elasticities suggest inelastic demands for transportation. Given

this information, it could be inferred that a drastic increase in private transportation expenditures since mid 90s may mainly come from the growing income per capita of the Thai population.

VII. Recreation Group

Four consumption sectors were specified in this group: Entertainment, Hotels-restaurants-cafes, Books-newspapers-magazines, and Other recreation. The primary reason that these sectors were grouped because they might represent the same type of demand. That is, they represent consumers' activities which could lead to an extra utility to consumers. Thus, they should be luxury goods and they are expected to have income elasticities greater than 1.

Table 11: Results for Recreation Group

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
28	Entertainment	7	0	1	1	1	1	0.15	0.002	0.95	-3.26	0.36	-0.13	12.11	0.87
29	Hotels, Restaurants, a	7	0	1	1	1	1	0.94	0.098	1.19	0.02	-0.01	-0.90	3.34	0.64
30	Books, Newspapers, and	7	0	1	1	1	1	0.93	0.013	1.50	-1.02	-0.04	-0.90	6.52	0.74
31	Other Recreation	7	0	1	1	1	1	0.02	0.024	1.54	-0.68	-0.05	-0.04	2.99	0.60

Note: This table was reproduced from table 4 above.

Recall that demands for the goods within this group are complements, although not very strong. Yet, one might question how this complementarity could be explained by real life situations. The interpretation is straightforward. For example, one situation might be where a person goes to a movie theater after dining out. It is also worth mentioning that Hotels-restaurants-cafes has accounted for the highest consumption share in all sectors.

Income elasticities support the argument made earlier - recreation seems to be a luxury good, and only Entertainment sector has income elasticity less than 1. Moreover, the time

trend coefficient suggests that Thais have been interested more in entertainment activities. Lastly, all price elasticities are less than 1 in absolute terms.

Ungrouped Sectors

There are six consumption sectors that remain ungrouped: Tobacco, Personal care, Health expenses, Communication, Financial services, and Other services. However, only some interesting properties of these products will be discussed. First, income elasticity of Tobacco equals 0.52. Therefore, Tobacco seems to be a necessary good, as it proves its addictive property. Price elasticity also implies its inelastic demand. Sadly, the time trend coefficient is positive and equals 0.67. Thus, the taste of Thai people has shifted toward tobacco products.

Table 12: Results for Ungrouped Sectors

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
12	Tobacco	0	0	1	1	1	1	0.25	0.022	0.52	-0.06	0.67	-0.45	4.16	0.58
22	Personal care	0	0	1	1	1	1	0.76	0.019	0.67	-0.04	0.64	-0.94	2.07	0.60
23	Health expenses	0	0	1	1	1	1	0.77	0.074	1.06	1.00	0.01	-0.87	6.76	0.80
27	Communication	0	0	1	1	1	1	1.17	0.008	2.57	-0.69	-0.03	-1.36	4.59	0.35
32	Financial services	0	0	1	1	1	1	-0.11	0.009	2.03	-0.04	-0.13	-0.10	8.40	0.90
33	Other services	0	0	1	1	1	1	0.25	0.009	1.03	-1.45	-0.05	-0.45	3.18	0.47

Note: This table was reproduced from table 4 above.

Communication is also an interesting sector, although its expenditure share is relatively small. This product seems to be a luxury good as its income elasticity shows a strong positive value (2.57). The demand for communication products is also responsive to price changes. Indeed, the time trend parameter is very close to zero. In fact, these results suggest that a sharp decrease in communication prices during 1987-1990 and a growing per capita income are responsible for a major explanation of the skyrocketing expenditures on communication during past decades.

4. CONCLUSION AND FINAL REMARKS

This study gives an understanding of the demands for private consumption in Thailand during 1961-1998. It conveys information about the trends of consumers' tastes and their reactions against income and price changes. In short, the Food group has accounted for the largest consumption share over the past 38 years. However, for an individual sector, Thai people have spent the largest proportions on Hotels-restaurants-cafes, Clothing, and Rice, respectively. Whereas the smallest consumption sector, in terms of a size of the share, is the Entertainment sector.

Most of sectors have income elasticities greater than 1; however, sectors that show low income elasticities primarily are food products. The sector that is most sensitive to income changes is Communication. Generally speaking, time trend coefficients are negative and close to zero. Sadly, however, some positive time trend coefficients occur in Alcoholic beverages and Tobacco consumption sectors. This implication should lead to a revision of the government's role in a public campaign, or even on a tax policy for these consumption sectors.

Finally, further extensions could be made in order to gain more understanding of private consumption behavior in Thailand. Particularly, usage of the total income series and nation-wide consumption series could be misleading if income is not well-distributed among the Thai population. It is of particular interest to conduct estimations regarding different ranges of income classes. Certainly, availability of data would be the next major constraint for the research.

APPENDIX

Unconstrained Results:

Table 1. Results by product:

The value of L is 0.15

The mu: 0.84 -0.82 -0.67 -1.31 1.42 0.51 0.47

The nu: 1.81 -0.95

nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
1	Rice and Cereals	1	0	1	1	1	1	-0.87	0.068	0.13	-1.07	-0.09	-0.00	1.09	0.53
2	Meat	1	1	1	1	1	1	-0.77	0.052	0.51	0.30	-0.96	-0.60	3.73	0.45
3	Fish	1	1	1	1	1	1	-2.94	0.018	0.76	-1.20	-6.03	0.57	18.87	0.58
4	Milk, Cheese and Eggs	1	0	1	1	1	1	-1.98	0.017	1.70	-0.89	-2.10	0.98	5.00	0.31
5	Oil and Fat	1	0	1	1	1	1	-1.38	0.010	2.08	-0.32	-2.40	0.40	5.00	0.68
6	Fruit and Vegetables	1	0	1	1	1	1	-0.84	0.047	0.75	-0.59	-0.16	-0.07	2.89	0.21
7	Sugar, Preserves and C	1	0	1	1	1	1	-0.88	0.010	1.14	-0.63	-0.89	-0.09	3.71	0.80
8	Coffee, Tea, Cocoa, et	2	0	1	1	1	1	-0.24	0.003	2.65	-0.87	-4.58	0.87	7.81	0.76
9	Other Food	1	0	1	1	1	1	-1.41	0.022	0.28	-2.57	0.91	0.43	5.52	0.60
10	Non-alcoholic beverage	2	0	1	1	1	1	0.65	0.033	1.31	-0.17	-0.36	-0.31	3.29	0.14
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
11	Alcoholic beverages	2	0	1	1	1	1	1.20	0.038	0.79	-0.95	1.16	-0.87	3.97	0.61
12	Tobacco	0	0	1	1	1	1	0.75	0.022	0.59	-1.34	-0.09	-0.87	3.33	0.56
13	Footwear	3	0	1	1	1	1	0.44	0.007	1.94	-1.64	-2.12	0.04	6.05	0.69
14	Clothing	3	0	1	1	1	1	0.31	0.097	1.21	-0.21	-0.00	-0.32	2.17	0.28
15	Other personal effects	3	0	1	1	1	1	1.70	0.007	2.47	0.79	-3.76	-1.21	6.01	0.12
16	Rent and Water charges	4	0	1	1	1	1	0.62	0.076	0.52	-2.11	0.53	-0.39	2.45	0.50
17	Fuel and Light	4	0	1	1	1	1	1.43	0.022	0.54	-0.96	1.01	-0.51	3.03	0.70
18	Furniture and Furnishi	5	0	1	1	1	1	-1.29	0.017	2.93	0.54	-4.36	-0.04	5.81	0.28
19	Households Equipment	5	0	1	1	1	1	0.39	0.048	2.56	-0.46	-2.65	-1.12	1.52	0.25
20	Domestic services of H	5	0	1	1	1	1	-1.78	0.004	-0.43	-1.33	3.37	0.26	9.04	0.79
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
21	Other expenditures of	5	0	1	1	1	1	1.41	0.015	1.06	-1.01	0.00	-2.70	3.53	0.39
22	Personal care	0	0	1	1	1	1	-1.50	0.019	1.76	-0.54	-1.30	1.28	3.54	0.68
23	Health expenses	0	0	1	1	1	1	1.21	0.074	1.43	0.49	-0.81	-1.19	5.91	0.81
24	Personal transportatio	6	2	1	1	1	1	1.19	0.033	2.58	1.67	-4.30	-1.18	7.56	0.07
25	Operation of personal	6	2	1	1	1	1	0.72	0.029	2.09	-0.66	-1.67	-0.70	2.55	0.48
26	Purchased transportati	6	0	1	1	1	1	0.22	0.049	0.97	-0.83	-0.14	-0.64	3.57	0.56
27	Communication	0	0	1	1	1	1	0.98	0.008	4.81	-0.76	-8.49	-1.12	3.34	0.24
28	Entertainment	7	0	1	1	1	1	1.23	0.002	0.45	-3.33	-4.06	-1.83	16.78	0.82
29	Hotels, Restaurants, a	7	0	1	1	1	1	0.64	0.098	1.19	0.21	0.09	-0.80	2.66	0.60
30	Books, Newspapers, and	7	0	1	1	1	1	0.30	0.013	1.72	-0.73	-1.00	-0.87	6.15	0.71
nsec	title	G	S	P	C	T	I	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
31	Other Recreation	7	0	1	1	1	1	-0.69	0.024	1.54	-0.59	-0.44	0.12	2.22	0.33
32	Financial services	0	0	1	1	1	1	3.21	0.009	3.48	-0.04	-5.25	-3.31	4.48	0.60
33	Other services	0	0	1	1	1	1	-0.10	0.009	0.93	-0.98	-0.05	-0.05	2.79	0.53

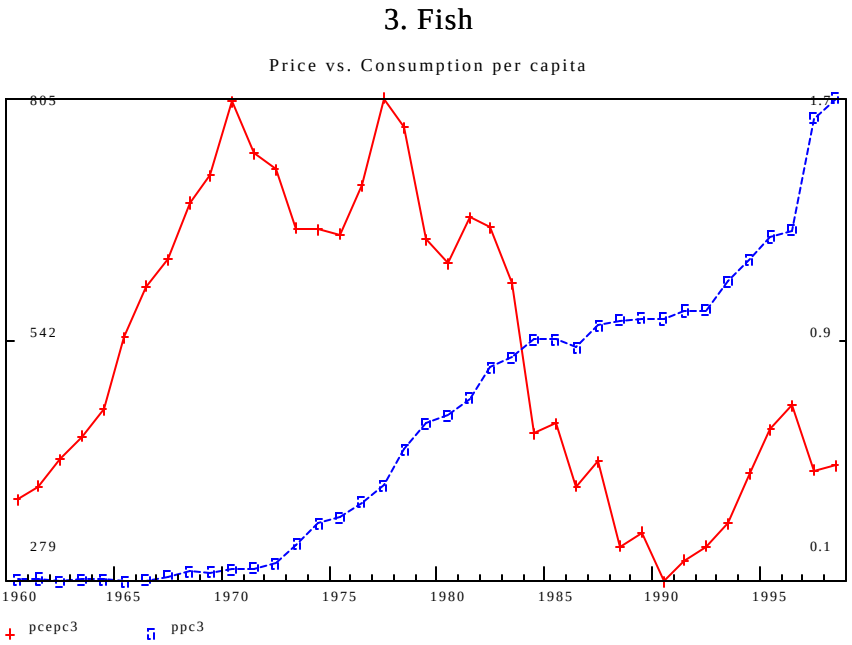
Soft constraints:

#	Title	Income		DIncome		Time		Lamda		Mu		Nu			
1	Rice and Cereals	0	0	0	0	0	0	0	0	.8	1				
2	Meat	0	0	0	0	0	0	0	0					0	0
3	Fish	.7	1	0	0	0	0	0	0						
4	Milk, Cheese and Eg	0	0	0	0	0	.5	-.5	1						
5	Oil and Fat	0	0	0	0	0	.5	.0	1						
6	Fruit and Vegetable	0	0	0	0	0	0	0	0						
7	Sugar, Preserves an	0	0	0	0	0	.5	-.1	1						
8	Coffee, Tea, Cocoa,	0	0	0	0	0	2	.5	2	.1	5				
9	Other Food	.2	1	-.1	1	0	.5	-.1	1						
10	Non alcoholic bev	0	0	0	0	0	.1	0	0						
11	Alcoholic beve	0	0	0	0	0	0	0	0						
12	Tobacco	0	0	0	0	0	0	0	0						
13	Footwear	0	0	0	0	0	.5	.5	1	0	0				
14	Clothing	0	0	0	0	0	.01	0	0						
15	Other personal eff	0	0	0	0	0	.5	0	0						
16	Rent and Water cha	0	0	0	0	0	0	0	0	0	0				
17	Fuel and Light	0	0	0	0	0	0	1	1						
18	Furniture and Furn	0	0	0	0	0	.5	.5	1	0	0				
19	Households Equipme	0	0	0	0	0	.1	0	0						
20	Domestic services	0	0	0	0	0	1	.5	1						
21	Other expenditure	0	0	0	0	0	.5	0	0						
22	Personal care	0	0	0	0	0	0	1	1						
23	Health expenses	.7	1	0	0	0	.1	0	0						
24	Personal transport	0	0	0	0	0	.1	0	0	0	0	-1	1		
25	Operation of perso	0	0	0	0	0	.1	0	0						
26	Public transport	0	0	0	0	0	.1	0	0						
27	Communication	0	0	0	0	0	1	0	0						
28	Entertainment	0	0	0	0	0	1	.5	4	0	0				
29	Hotels, Restaurant	0	0	0	0	0	.01	0	0						
30	Books, Newspapers	0	0	0	0	0	.5	0	0						
31	Other Recreation	0	0	0	0	0	.1	.1	1						
32	Financial servi	0	0	0	0	0	1	-.1	1						
33	Other services	0	0	0	0	0	.5	-.1	1						

Time trend variables:

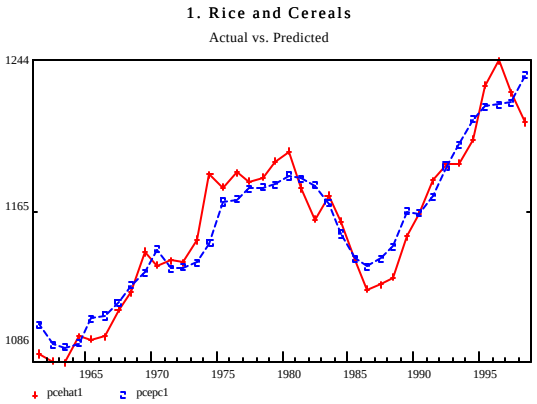
# Date	Trend(year)	Dummy for Fish
# 1960	1960	0
1961	1961	0
1962	1962	0
1963	1963	0
1964	1964	0
1965	1965	0
1966	1966	0
1967	1967	0
1968	1968	0
1969	1969	0
1970	1970	0
1971	1971	0
1972	1972	0
1973	1973	0
1974	1974	0
1975	1975	0
1976	1976	0
1977	1977	0
1978	1978	0
1979	1979	0
1980	1980	0
1981	1981	0
1982	1982	1
1983	1983	2
1984	1984	3
1985	1985	4
1986	1986	5
1987	1987	6
1988	1988	7
1989	1989	8
1990	1990	9
1991	1991	10
1992	1992	10
1993	1993	10
1994	1994	10
1995	1995	10
1996	1996	10
1997	1997	10
1998	1998	10

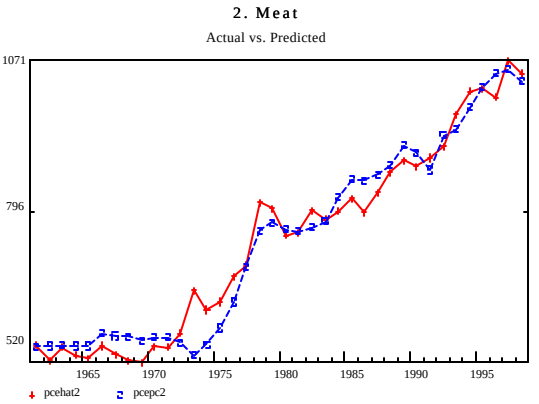
Historical plot of Fish consumption per capita and its price:

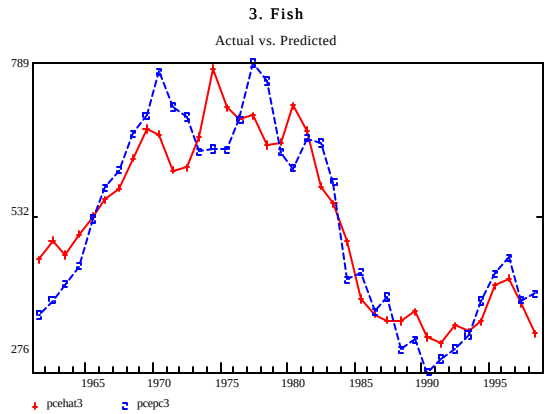


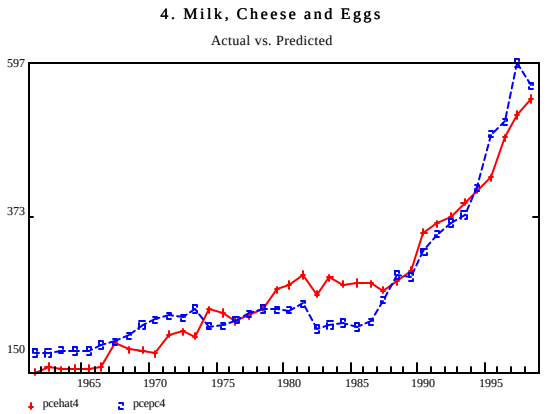
Technical note: Fish sector has been using the special time trend variable. According to the plot, it can be noticed that consumption per capita for Fish did not seem to have an explicit relationship with its price. Using a normal time trend contributed to a strong positive price elasticity. Therefore, resolve this problem, the special time trend that runs only during 1982-1991 was specified.

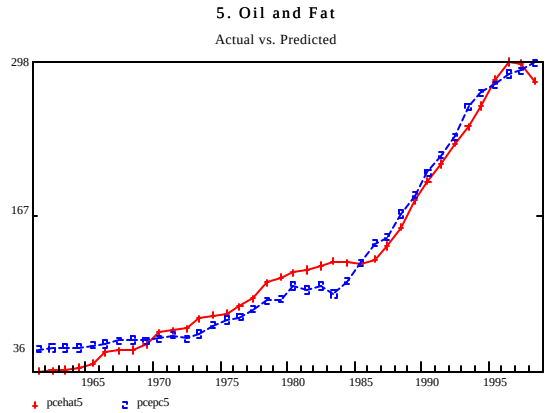
Graphs of fitted values:

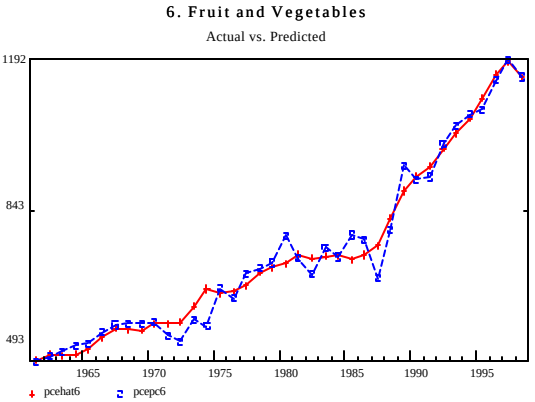






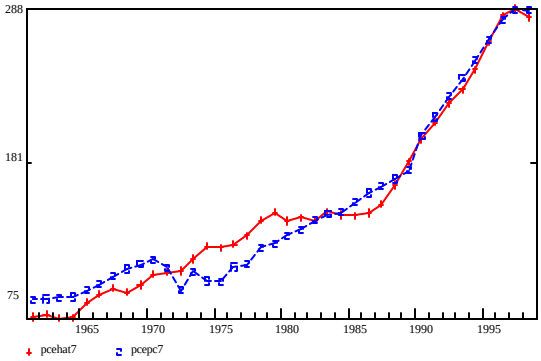






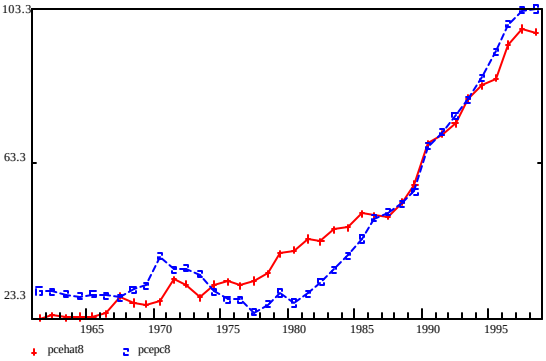
7. Sugar, Preserves and Confectionery

Actual vs. Predicted



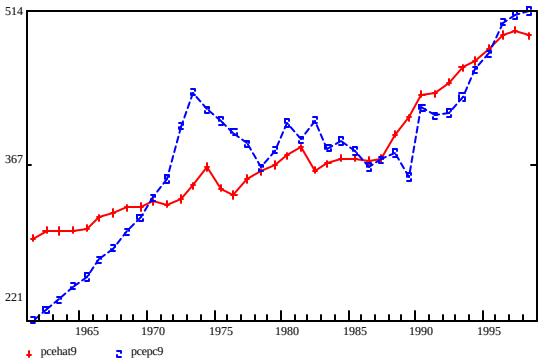
8. Coffee, Tea, Cocoa, etc.

Actual vs. Predicted



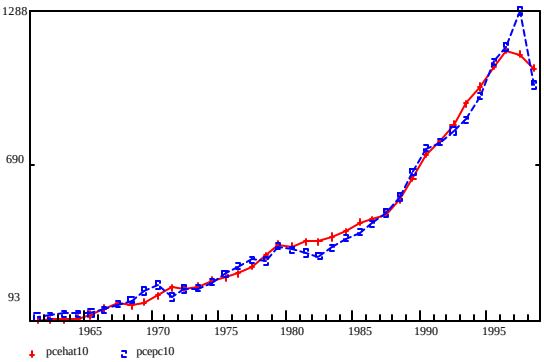
9. Other Food

Actual vs. Predicted



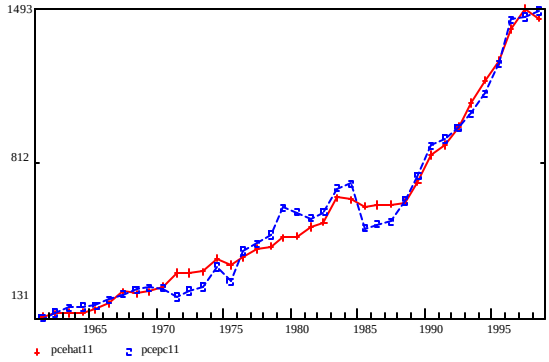
10. Non-alcoholic beverages

Actual vs. Predicted



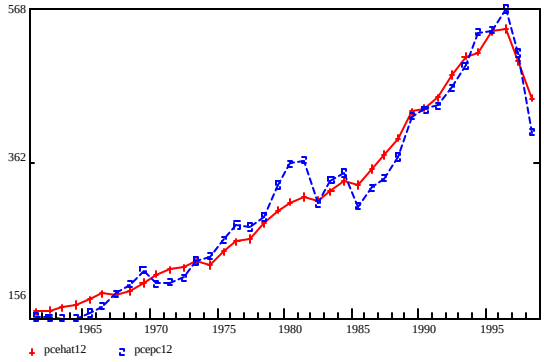
11. Alcoholic beverages

Actual vs. Predicted



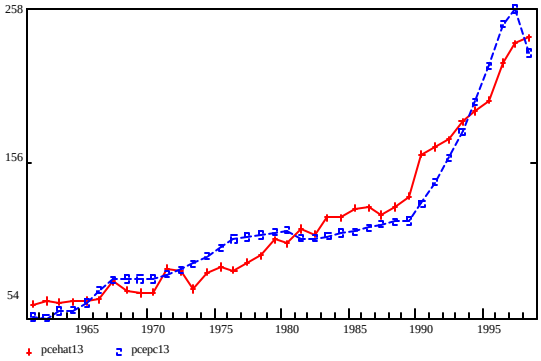
12. Tobacco

Actual vs. Predicted



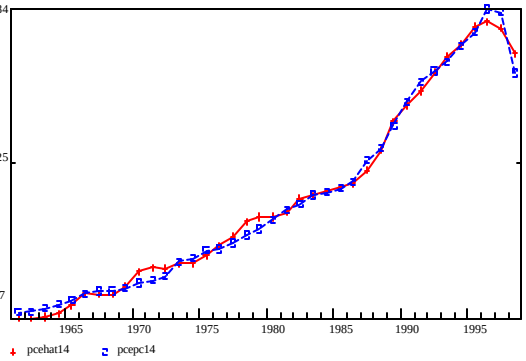
13. Footwear

Actual vs. Predicted



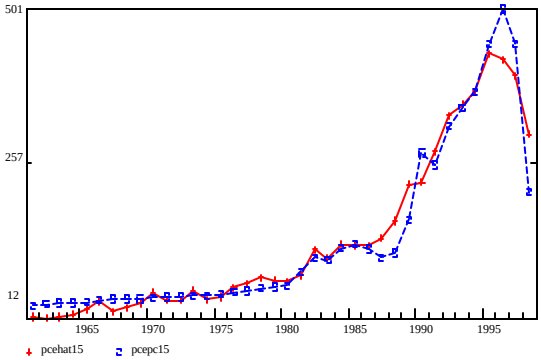
14. Clothing

Actual vs. Predicted



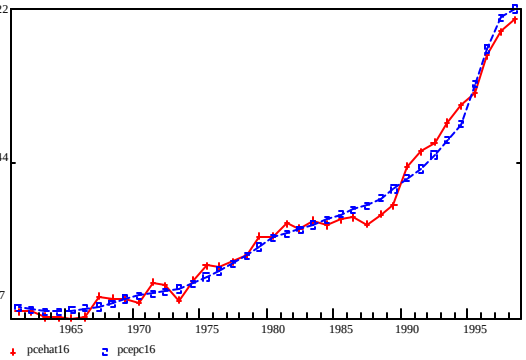
15. Other personal effects

Actual vs. Predicted



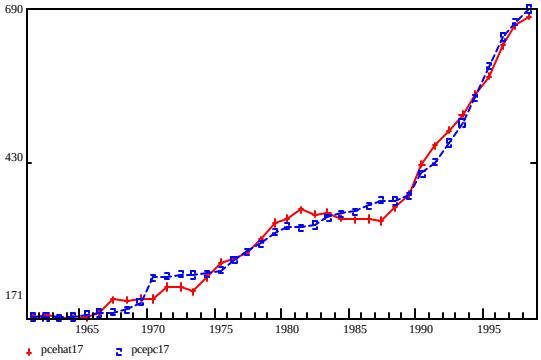
16. Rent and Water charges

Actual vs. Predicted



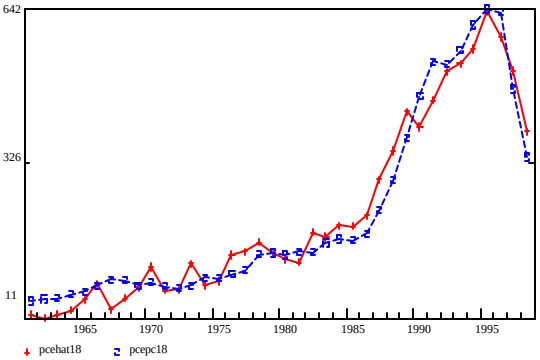
17. Fuel and Light

Actual vs. Predicted



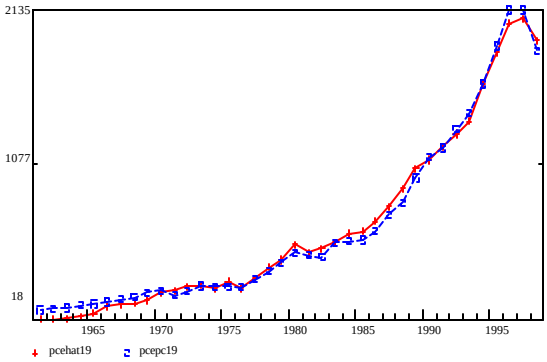
18. Furniture and Furnishings

Actual vs. Predicted



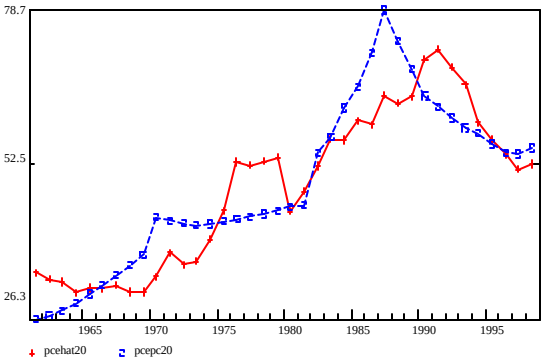
19. Households Equipment

Actual vs. Predicted



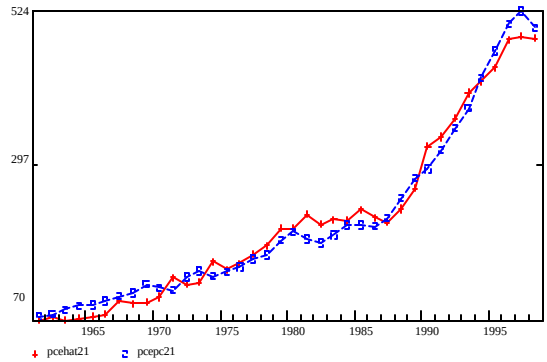
20. Domestic services of Household operation

Actual vs. Predicted



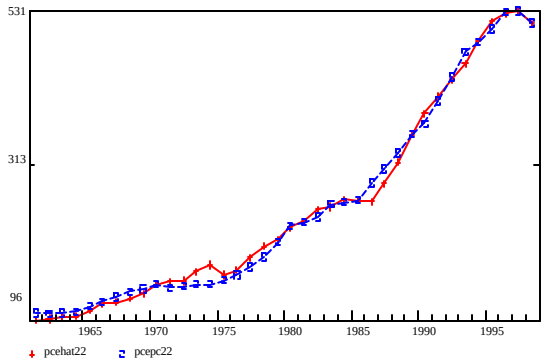
21. Other expenditures of Household operation

Actual vs. Predicted



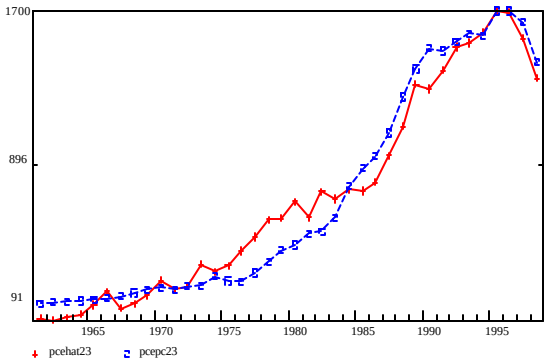
22. Personal care

Actual vs. Predicted



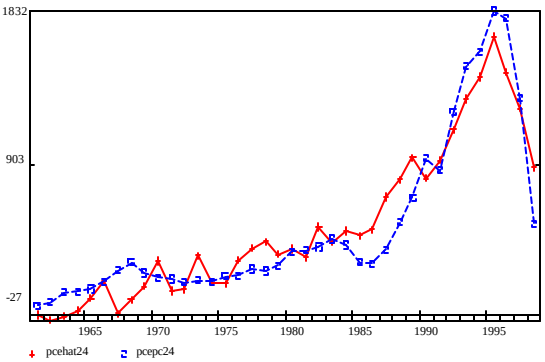
23. Health expenses

Actual vs. Predicted



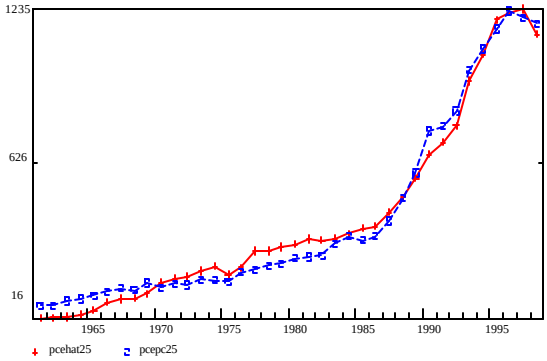
24. Personal transportation equipment

Actual vs. Predicted



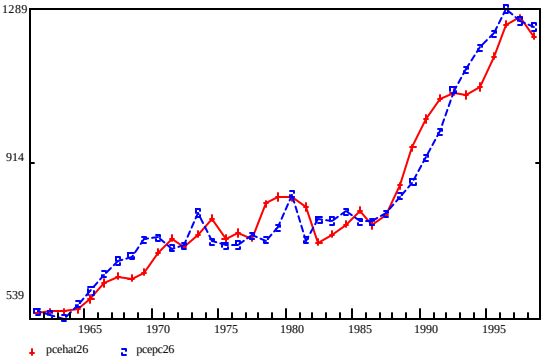
25. Operation of personal transportation equipment

Actual vs. Predicted



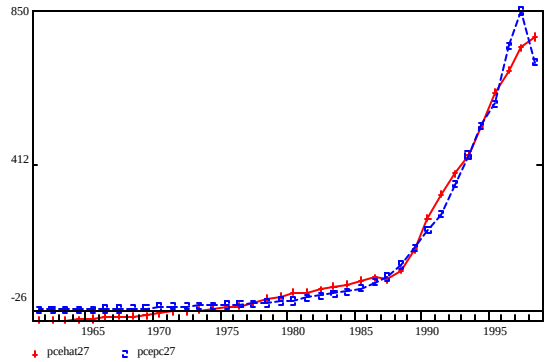
26. Public transportation

Actual vs. Predicted



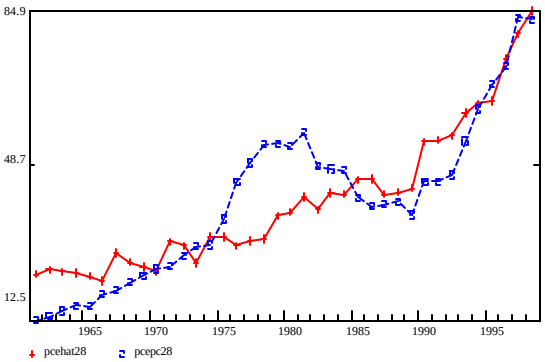
27. Communication

Actual vs. Predicted



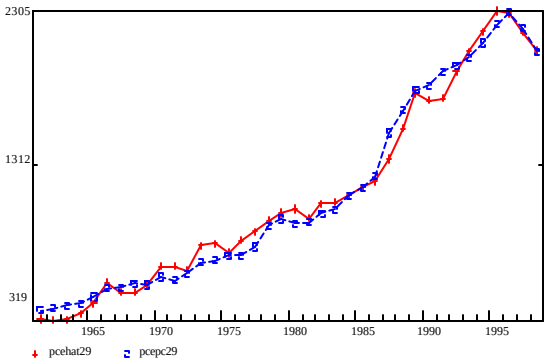
28. Entertainment

Actual vs. Predicted



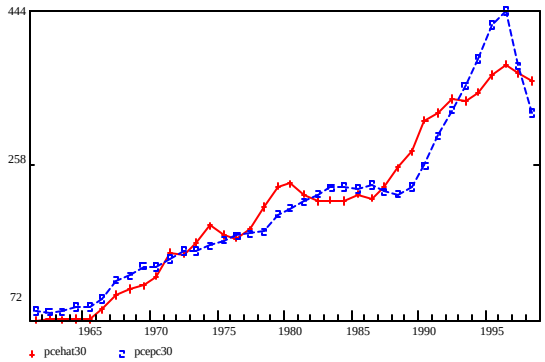
29. Hotels, Restaurants, and Cafes

Actual vs. Predicted



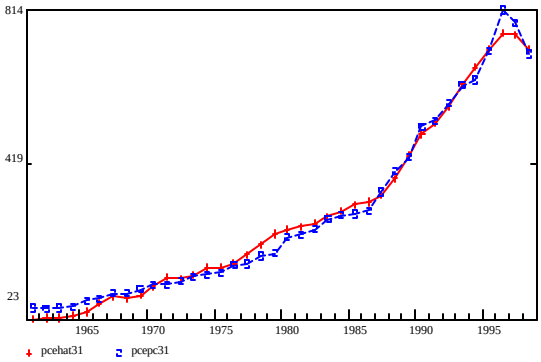
30. Books, Newspapers, and Magazines

Actual vs. Predicted



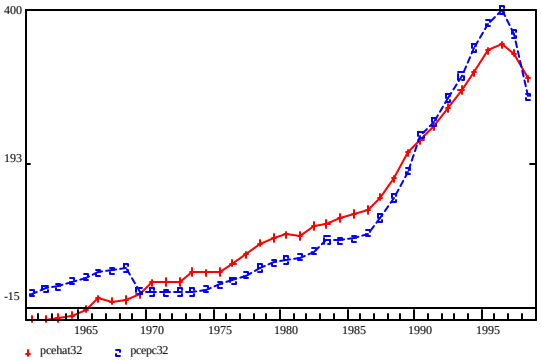
31. Other Recreation

Actual vs. Predicted



32. Financial services

Actual vs. Predicted



33. Other services

Actual vs. Predicted