

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

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ABSTRACT

This paper examines sectoral private consumption expenditures in Thailand. The Perhaps Adequate Demand Systems (PADS), suggested by Almon (1996a), is used to estimate private consumption for 33 sectors during the period 1976-1998. The data reveal that the biggest consumption shares belong to food, entertainment, and transportation, respectively. These three groups account for as much as 50 percent of total expenditures. The analysis also displays factors effecting consumption demands of Thai consumers. Consumption in some certain sectors, such as telecommunications and private cars, are quite responsive to income growth. On the other hand, expenditures on house furnishing are particularly sensitive to price changes.

1. INTRODUCTION

In the past decade, private consumption in Thailand took up as much as 56 percent of the GDP. It is the largest component on the expenditure side and thus has played a major role in determining the country's economic growth. In many times, it has been used as a short-run economic stimulus. From micro-foundation, consumption is one of the variables that enter in consumer's utility function. Level of consumption is usually regarded as wellbeing of a household.

A study of aggregate consumption expenditure is useful for macroeconomic policy analysis yet inadequate to give a complete picture of the country's consumption pattern. Household's consumption basket usually consists of various types of goods. The National Accounts of Thailand lists it as many as 33 consumption categories. In fact, consumption pattern in each type of these goods could be quite different. Over a period of time, per capita consumption expenditure on food is relatively constant while expenditures on automobiles and electrical appliances tend to increase.

In addition to the diverse patterns, different goods lead to different consumption behaviors. Expenditures on dissimilar types of goods respond rather differently to an economic factor. For example, demand for food is inelastic to income changes, but a purchase of private car is income-elastic. In all, a disaggregate study of personal consumption expenditure is important.

There is rather limited study of sectoral private consumption in Thailand. Pattamasiriwat, Punyasavatsut, and Santawesuk (2000) employed the simple Linear Expenditure System (LES) to examine the private consumption expenditure in Thailand during 1957-1998. This study used both time-series and cross-sectional data from the national accounts and the Socio-economic survey (SES).

In the empirical consumption literature, the most popular demand system was suggested by Deaton and Muellbauer (1980) - the Almost Ideal Demand System (AIDS). The model was derived from a representative agent's optimization problem, which provides theoretical consistency to the microeconomic foundation. However, in practice, the model implies peculiar implication. The functional form of the budget share equations suggests that the sum of real income coefficients must be zero. Therefore, as pointed out by Almon (1996a), "increasing real income must ultimately drive the consumption of one or more goods negative, unless, of course, it has no effect at all on budget shares." Cooper and McLaren (1992) noted this problem and seem to have simply dropped the requirement that the sum of the coefficients on real income should be zero. Thereby they would seem to have lost the property that the budget shares add to 1.0 and that the equations result from optimizing behavior.

Almon (1996a) also shows that representative agent's optimization problem is neither necessary nor sufficient conditions for deriving a demand system useful for empirical analysis. He, in contrast, suggested the Perhaps Adequate Demand System (PADS), which was not derived by utility maximization. Consequently, there are no assumptions

needed on a representative agent and a specific form of the utility function. Bardazzi and Barnabani (2000) employed the PADS to examine the demand systems in Italy during 1985-1996. They found consistency between microeconomic implications and the empirical results of the model. The authors also pointed out that the model was designed to be suitable in a long-term forecasting model.

The objective of this study is to estimate 33 private consumption sectors in Thailand during 1976-1998, employing the PADS functional form. The paper consists of four main sections: The next section will be a specification of the functional form. Data sources and the estimation procedure will also be discussed in this section. Then, the results of the estimation are discussed in detail in section 3. We will pay large attention to interpret the results in order to understand consumption behaviors in Thailand. The last section will be conclusion and final remarks.

2. FUNCTIONAL FORM

Essentially, the PADS functional form suggests that private consumption per capita is a function of real income, change in income, time trend (taste change), own price, and relative prices of complementary and substitute goods.

However, the relative price variables lead to a large number of parameters to be estimated. If there are n consumption sectors, there will be $n(n-1)/2$ coefficients for these variables. Therefore, estimating 33 consumption categories leads to 528 parameters to be estimated for the relative prices. PADS suggests a way to reduce these parameters and still have the possibility of particularly strong substitution or complementarity between or among closely related commodities. This possibility is achieved by putting closely related products into groups and subgroups. Table 1 illustrates this idea as applied to the present study.

In Table 1, there is a list of private consumption sectors and the specification of groups and subgroups. The specification of the consumption group slightly differs from that of the national accounts, 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 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.

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

Transportation offers a nice illustration of the grouping idea. Three categories of consumption expenditure relate to transportation:

- 24 Personal transportation equipment
- 25 Operation of personal transportation equipment
- 26 Public transportation

All three categories are put into the Transportation group while the first two are also put into the Private transportation subgroup. We expect complementarity between the two categories in the Private transportation subgroup but substitution between that subgroup and Public transportation.

With the groups and subgroups in mind, we can now write the functional form of the PADS system:

$$x_i = (a_i + b_i(y/P) + c_i\Delta(y/P) + d_it) \cdot \left(\frac{P_i}{P}\right)^{-\lambda_i} \prod_{k=1}^n \left(\frac{P_i}{P_k}\right)^{-\lambda_k s_k} \cdot \left(\frac{P_i}{P_G}\right)^{-\mu_G} \left(\frac{P_i}{P_g}\right)^{-\nu_g} \quad [1]$$

where;

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

Equation [1] above represents the PADS functional form. The dependent variable x_i on the left-hand-side is a per capita private consumption in sector i . P_G , P_g , and P defined in equation [2] refer to the price index of group G , the price index of subgroup g , and the general price level, respectively. S_k is the expenditure share of product k of total consumption expenditure. The p_i and p_k are prices of consumption sectors i and k , respectively. Finally, t is a time trend, and y is per capita income.

The a_i , b_i , c_i , d_i , λ_i , μ_G , and ν_g are all parameters. The number of λ_i 's to be estimated equals the number of consumption sectors. In addition, there will be one μ_G for each group and one ν_g for each subgroup. The introduction of μ_G and ν_g helps to significantly reduce the number of parameters in the system. Positive (negative) μ_G implies substitution (complementary) within group G and, similarly, positive (negative) ν_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. Each of these price elasticities will be a function of λ_i , μ_G , and ν_g . For example, the own-price elasticity of the consumption in sector i is¹;

$$\varepsilon_{i,i} = -\lambda_i(1 - 2s_i) - \sum_{k=1}^n \lambda_k s_k \quad \text{if } i \notin G \text{ and } i \notin g \quad [3]$$

$$\varepsilon_{i,i} = -\lambda_i(1 - 2s_i) - \sum_{k=1}^n \lambda_k s_k - \mu_G \left(1 - \frac{s_i}{\sum_{k \in G} s_k}\right) \quad \text{if } i \in G \quad [4]$$

$$\varepsilon_{i,i} = -\lambda_i(1 - 2s_i) - \sum_{k=1}^n \lambda_k s_k - \mu_G \left(1 - \frac{s_i}{\sum_{k \in G} s_k}\right) - \nu_g \left(1 - \frac{s_i}{\sum_{k \in g} s_k}\right) \quad \text{if } i \in G \text{ and } i \in g \quad [5]$$

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 G , but not of a subgroup. Finally, equation [5] represents the price elasticity of a sector which is member of a group G and of a subgroup g .

The λ_i and s_i are specific to a category; however, μ_G and ν_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 helps us on how the undesired results can be constrained. More detail will be discussed below.

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

3. DATA SOURCE AND THE ESTIMATION PROCEDURE

Sectoral time series of the private consumption expenditures were obtained from the national accounts published by the National Economic and Social Development Board (NESDB) of Thailand. The time series for personal disposable income and population were also obtained from the same source. The estimation procedure follows a non-linear least-squares estimation, using the Marquardt algorithm to fit the non-linear system. A list of private consumption sectors and the specification of groups and subgroups has already been presented in the Table 1 above.

It is important to note that, to achieve sensible results, a number of “soft constraints” were applied. The method of soft constraints is similar to Bayesian regression but is more direct. For example, to softly constrain the coefficient on the income variable to be 0.5, an artificial observation is added that is fit exactly when 0.5 is the coefficient on the income variable. Naturally, adding such an observation moves the estimate towards 0.5. Adding another such observation shifts the estimate further towards 0.5. The more artificial observations it adds, the closer estimated coefficient it is to the desired value. The method thus arranges a compromise between closeness of fit to the data and plausibility of the estimated parameters. Further discuss about the soft-constraints method can be found in Almon (1996b) and Almon (1999).

There is no one right way to impose soft constraints. However, the value of a set of soft constraints can be judged by the reasonableness of the results of the estimation. Reasonable results should have positive income elasticities in all sectors, negative own-price elasticities in all sectors, and intuitively plausible values of estimated coefficient of *DInc*, and of μ , and ν .

In addition, a plausible relation between estimated income elasticity and a time trend coefficient for each sector should be maintained. Generally, income variables are closely correlated with the time trend since they are both normally growing through time. The regression process, therefore, often fails to identify reasonable values for the two separately. It may well produce an optimal fit with a very strong positive income effect and a negative time trend, or vice versa.

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 required, 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. Next, soft constraints were applied to sectors that are in a group that contains a subgroup. Sectors in subgroups are the last ones that were constrained. This method is particularly helpful for keeping track of how a price elasticity changes after it has been constrained because price elasticities of sectors that are in the same group are interrelated.

4. RESULTS AND DISCUSSION

4.1 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 μ and ν indicate whether goods within each group and subgroup, respectively, are either complements or substitutes. As a reminder, a positive μ_G implies substitution within group G , while its negative value implies complementarity. A similar inference also applies for the value of ν_g at subgroup level. Table 2 below presents the estimated values of μ and ν .

Table 2: Estimated values of μ 's and ν 's

Group	μ	Subgroup	ν
1. Food	0.70	i. Protein	1.02
2. Beverages	0.47		
3. Dress	-0.94		
4. Utilities	-0.44		
5. Housing furnishing	-0.19		
6. Transportation	0.97	ii. Private transportation	-1.00
7. Recreation	-0.77		

Within the Food group, the value of μ_1 is positive and equals to 0.70, which suggests that demands for food are substitutes. Interestingly, as the sectors that give similar dietary source were further added into a subgroup, namely the Protein subgroup, the estimated value of ν_1 (1.02) shows a stronger substitution effect. According to Table 3 below, the Food group has accounted for by far the largest expenditure share. Particularly, Thai people have spent 21.3% of their total consumption expenditure on food.

Table 3: Expenditure shares by group

Group	Share	Ungrouped Sectors	Share
1. Food	0.213	Tobacco	0.021
Protein	(0.057)	Personal care	0.017
2. Beverages	0.078	Health expenses	0.075
3. Dress	0.115	Communication	0.009
4. Utilities	0.085	Financial services	0.011
5. House furnishing	0.094	Other services	0.010
6. Transportation	0.127		
Private transportation	(0.082)		
7. Recreation	0.145	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, the value of μ_2 (0.47) shows less substitution. The explanation could be that some products in the Beverages group, such as alcoholic beverages and coffee, have a habit-forming property thus reduces the degree

of substitutions among goods within this group. The expenditure share in Table 3 shows that the Beverages group has accounted for the smallest share of any group.

The next group is the Dress group. The negative value of μ_3 (-0.94) shows that demands for consumption in this group are highly complements. A nice dress would go with a nice pair of shoes for Thai consumers. Price decreases in Clothing, for example, could also lead to an increase in consumption in Footwear. Thai people devote 11.5% of their total consumption spending to this group.

Demands for consumption in the Utilities group show complementarity with an estimated μ_4 of -0.44. Intuitively, this group actually consists of Rent and water, and Fuel and light. Therefore, a high rent implies more space and more luxury, which could cause a higher bill for lighting. The value of μ_5 for the House furnishing group equals -0.19, which also implies a little complementarity within group. A similar explanation also holds for this group.

The next group is the Transportation. There is also the Private transportation subgroup specified in this group. The value of μ_6 , which equals to 0.97, suggests that private transportation and public transportation are substitutes. The higher the costs of using private cars, the more likely those Thai consumers would commute by public transportation. The value of ν_2 for the Private transportation subgroup is negative and equals to -1.00, which indeed indicates strong complementarity between the cost of purchasing a car and the cost of running a car. This is a very interesting and reassuring outcome. The last group is the Recreation. The estimated μ_7 (-0.77) indicates complementarity of demands within this group.

4.2 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 carefully discussed. Table 4 below presents results of all 33 Thai private consumption sectors.

Table 4: Results of PADS Estimation by Sectors

Results by product:											
The value of lambda is 0.26											
The mu: 0.70 0.47 -0.94 -0.44 -0.19 0.97 -0.77											
The nu: 1.02 -1.00											
nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
1	Rice and Cereals	1	0	-0.53	0.056	0.10	-0.56	-0.21	-0.30	0.56	0.68
2	Meat	1	1	-0.68	0.045	0.29	-0.66	0.00	-0.41	3.40	0.66
3	Fish	1	1	-0.31	0.012	0.84	0.39	-2.80	-1.42	12.74	0.49
4	Milk, Cheese and Eggs	1	0	-0.80	0.016	1.25	-0.58	-0.32	-0.13	7.71	0.81
5	Oil and Fat	1	0	-0.63	0.009	1.22	-0.04	0.34	-0.31	3.64	0.64
6	Fruit and Vegetables	1	0	-0.53	0.048	0.62	-0.75	-0.01	-0.33	3.34	0.10
7	Sugar, Preserves and C	1	0	-0.66	0.009	1.06	-0.63	-0.15	-0.28	1.78	0.55
8	Coffee, Tea, Cocoa, et	2	0	-0.50	0.003	1.31	-0.92	-0.27	-0.22	2.92	0.61
9	Other Food	1	0	-0.71	0.018	0.55	-0.73	-0.71	-0.21	4.09	0.52
10	Non-alcoholic beverage	2	0	-0.06	0.034	1.33	-0.38	-0.05	-0.47	5.50	0.46
nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
11	Alcoholic beverages	2	0	0.63	0.041	1.37	-2.57	-0.05	-1.06	5.15	0.58
12	Tobacco	0	0	0.35	0.021	1.02	0.77	-1.65	-0.59	3.48	-0.14
13	Footwear	3	0	1.18	0.006	0.30	0.36	13.97	-0.54	3.61	0.43
14	Clothing	3	0	0.14	0.099	1.10	0.34	-0.13	-0.23	2.08	0.02
15	Other personal effects	3	0	0.96	0.010	0.85	1.30	10.50	-0.35	11.88	0.39
16	Rent and Water charges	4	0	0.26	0.066	0.89	-0.94	-0.22	-0.39	3.80	0.82
17	Fuel and Light	4	0	0.31	0.019	0.86	-0.73	0.97	-0.22	4.54	0.88
18	Furniture and Furnishi	5	0	1.63	0.021	1.14	1.35	-0.10	-1.67	6.63	0.61
19	Households Equipment	5	0	0.96	0.056	1.79	0.02	-0.04	-1.04	5.11	0.79
20	Domestic services of H	5	0	2.12	0.003	0.62	3.62	-1.48	-2.18	11.51	0.66
nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
21	Other expenditures of	5	0	0.28	0.014	1.44	-0.50	-0.52	-0.37	5.68	0.90
22	Personal care	0	0	0.71	0.017	1.08	-0.05	-0.17	-0.94	3.73	0.78
23	Health expenses	0	0	1.31	0.075	0.91	1.19	0.50	-1.38	4.74	0.71
24	Personal transportatio	6	2	0.42	0.047	1.63	3.64	-0.05	-0.82	12.50	0.65
25	Operation of personal	6	2	0.09	0.035	1.71	-0.83	-0.07	-0.47	4.63	0.84
26	Purchased transportati	6	0	-0.48	0.044	0.76	-0.02	-0.03	-0.44	3.05	0.55
27	Communication	0	0	0.09	0.009	1.27	1.59	25.68	-0.35	4.34	-0.02
28	Entertainment	7	0	0.86	0.002	0.80	-3.56	-0.48	-0.36	11.72	0.83
29	Hotels, Restaurants, a	7	0	0.47	0.103	1.01	1.16	0.01	-0.41	4.12	0.70
30	Books, Newspapers, and	7	0	0.63	0.013	1.16	0.57	-0.37	-0.17	6.24	0.71
nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
31	Other Recreation	7	0	0.93	0.027	1.49	0.26	-0.10	-0.51	3.68	0.48
32	Financial services	0	0	0.28	0.011	1.77	1.47	-0.15	-0.53	6.08	0.70
33	Other services	0	0	0.54	0.010	0.94	1.10	-0.32	-0.79	7.50	0.75

Meaning of Columns:

Columns G and S, respectively, represent numbers of groups and subgroups to which a sector belongs. The *Lamb* and *Share* columns are estimated λ_i parameter and expenditure share s_i for the consumption sector i . The *IncEl* column is the implied income elasticity; while, *DInc* column represents a ratio of the coefficient on income change to the coefficient on income variable. The value in the *Time%* column shows the percentage change in consumers' demands caused by the passage of one year, holding income and price constant. More precisely, it is the coefficient on the time trend expressed as a percent of the value of the dependent variable in the last year. The next column, labeled *PrEl* shows the estimated own price elasticity for each consumption sector. The *Err%* column shows the standard error of estimate. Finally, the *Rho* is an autocorrelation coefficient 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.

Group 1: Food

There are eight consumption sectors that were specified in the Food group. As indicated in the previous section, demands for food are substitutes. Two consumption sectors that are likely to be closely substituted due to their dietary value, namely Meat and Fish, were further grouped into the Protein subgroup. Indeed, the result shows that they are highly substitutable for each other. It should be remarked that although the Milk, cheese and eggs group also provides protein, it was not included in the Protein subgroup on purpose. The reason is simple. Milk, cheese and eggs affect consumers' choices differently. For example, when one has to make a choice during a meal, he may have to choose between Meat and Fish. However, those dishes may be cooked with eggs or cheese. Moreover, we normally have milk in the morning without concerning whether we will have Meat or Fish at dinner. Table 5 below reproduces estimated results for consumption sectors in the Food group.

Table 5: Results for Food group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
1	Rice and Cereals	1	0	-0.53	0.056	0.10	-0.56	-0.21	-0.30	0.56	0.68
2	Meat	1	1	-0.68	0.045	0.29	-0.66	0.00	-0.41	3.40	0.66
3	Fish	1	1	-0.31	0.012	0.84	0.39	-2.80	-1.42	12.74	0.49
4	Milk, Cheese and Eggs	1	0	-0.80	0.016	1.25	-0.58	-0.32	-0.13	7.71	0.81
5	Oil and Fat	1	0	-0.63	0.009	1.22	-0.04	0.34	-0.31	3.64	0.64
6	Fruit and Vegetables	1	0	-0.53	0.048	0.62	-0.75	-0.01	-0.33	3.34	0.10
7	Sugar, Preserves and C	1	0	-0.66	0.009	1.06	-0.63	-0.15	-0.28	1.78	0.55
9	Other Food	1	0	-0.71	0.018	0.55	-0.73	-0.71	-0.21	4.09	0.52

The expenditure share suggests that Thai people have spent their food budget primarily on Rice, Meat, and Fruit and vegetables. Particularly, their shares are 5.6%, 4.5%, and 4.8%, respectively. Expenditure shares of these three sectors account for more than half of the Food group.

Income elasticities also give us intuitive results. The majority of the consumption sectors in this group have income elasticity less than 1, which implies that food is necessary good. Interestingly, among all of the 33 consumption sectors, Rice has the lowest income elasticity. Price elasticities also imply sensible results. Except for Fish, all price elasticities in these sectors are less than 1 in absolute value. That is, demands for food are inelastic with respect to price changes. Finally, time trend coefficients are, in general, close to 0.

Within the Protein subgroup, although Meat and Fish provide similar dietary values, characteristics of their demands with respect to changes in income, prices, and time trend are quite different. Expenditure on Fish seems to be price elastic while Meat is not. Consumption of Fish also declined through time. Fish has positive *DInc* value, implying that, as the incomes increase, Thai consumers will increase their consumption on these sectors at the higher rate.

Group 2: Beverages

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, consumption goods in Beverages group are substitutes. The results in sectoral detail are presented in table 6 below:

Table 6: Results for Beverages group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
8	Coffee, Tea, Cocoa, et	2	0	-0.50	0.003	1.31	-0.92	-0.27	-0.22	2.92	0.61
10	Non-alcoholic beverage	2	0	-0.06	0.034	1.33	-0.38	-0.05	-0.47	5.50	0.46
11	Alcoholic beverages	2	0	0.63	0.041	1.37	-2.57	-0.05	-1.06	5.15	0.58

Thai consumers spent 7.8% of their total consumption expenditure on this three-category group, a quarter of the total spending on food and beverages. The estimation indicates that income elasticities are all greater than 1. These drinks do not include plain water and they are all considered as luxury goods, especially alcoholic beverages. Except for Alcoholic beverages, price elasticities are less than 1 in absolute terms, implying that the demands are inelastic.

Group 3: Dress

There are three consumption sectors specified in the Dress group: Footwear, Clothing, and Other personal effects. According to table 4.2, estimated μ_3 (-0.94) implies that these goods are highly complementary. Table 7 below summarizes the results of this group:

Table 7: Results for Dress group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
13	Footwear	3	0	1.18	0.006	0.30	0.36	13.97	-0.54	3.61	0.43
14	Clothing	3	0	0.14	0.099	1.10	0.34	-0.13	-0.23	2.08	0.02
15	Other personal effects	3	0	0.96	0.010	0.85	1.30	10.50	-0.35	11.88	0.39

It is important to point out that Clothing has a very large expenditure share. Actually, it is the second largest share of all sectors. About 9.9% of the total consumption expenditure has been allocated to it. Nonetheless, the income elasticity indicates that clothing remains a luxury good. Therefore, as per capita income increases, Thai people will increase expenditure on clothing more than proportionally.

On the other hand, the demands for Dress seem to be inelastic to prices change. Price elasticities are all less than 1 in absolute terms.

Group 4: Utilities

This group contains Rents and water charges, and Fuel and light. Although the Utilities group contains only two consumption sectors, this group was specified because Rents and Fuel share similar characteristic: consumers must pay these bills monthly. By grouping them together, I anticipated a significant complementarity within this group. This argument was confirmed. The estimated μ_4 equals to -0.44 , which suggests that utility bills are complements.

Table 8: Results for Utilities group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
16	Rent and Water charges	4	0	0.26	0.066	0.89	-0.94	-0.22	-0.39	3.80	0.82
17	Fuel and Light	4	0	0.31	0.019	0.86	-0.73	0.97	-0.22	4.54	0.88

The expenditure share of the Rent and water charges is about three times larger than that of the Fuel and light sector. Income elasticities and price elasticities suggest sensible values. Income elasticities are less than 1 and equal to 0.89 and 0.86, respectively. Utilities are certainly necessary goods. Price elasticities also imply that demands for these goods are inelastic to prices change. Time trend coefficient for Fuel and light also shows a positive value. This is not a surprising outcome. Thai people have been consuming more energy during the past decades.

Group 5: House Furnishing and Operation

There are four consumption sectors in this group: Furniture and furnishings, Households equipment, Domestic services, and Other expenditures. The estimated μ_5 presented in Table 2 indicates that consumption goods in this group are complements. The detail results for each sector are shown below:

Table 9: Results for House furnishing group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
18	Furniture and Furnishi	5	0	1.63	0.021	1.14	1.35	-0.10	-1.67	6.63	0.61
19	Households Equipment	5	0	0.96	0.056	1.79	0.02	-0.04	-1.04	5.11	0.79
20	Domestic services of H	5	0	2.12	0.003	0.62	3.62	-1.48	-2.18	11.51	0.66
21	Other expenditures of	5	0	0.28	0.014	1.44	-0.50	-0.52	-0.37	5.68	0.90

Within this group, Thais have a relatively large expenditure share on Household equipment. On the other hand, they apportioned the least share on Domestic service (a housemaid).

With the exception for Domestic services, income elasticities in other sectors are all greater than 1. Household equipment shows its strong luxury-goods property. All price elasticities are greater than 1 in absolute value. Only the price elasticity of the Other expenditures sector (*i.e.*, expenditure on the maintenance of house furnishing goods and equipment) shows a price inelastic demand. These results are very intuitive because the demands for purchasing furniture and equipment could be price elastic; however, once the goods are obtained, demand for maintaining them could be relatively more inelastic.

Group 6: Transportation

There are three consumption sectors in this group: Personal transportation equipment, Operation of personal transportation, and Public transportation. The Private transportation subgroup was further specified in order to differentiate expenditures on private cars, which include 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 once a consumer owns it. The more expensive a car is, the higher its running cost. In addition, high cost of operation could discourage the ownership; therefore, these categories can be complement.

On the other hand, a consumer’s expenditure on private transportation could decrease in the expenditure on a public transportation. For instance, a consumer may prefer to travel by public bus instead of driving a car if the price of gasoline is relatively high, and vice versa.

By specifying the 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 and the discussion presented in the previous have proved our argument above.

Table 10: Results for Transportation group

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
24	Personal transportatio	6	2	0.42	0.047	1.63	3.64	-0.05	-0.82	12.50	0.65
25	Operation of personal	6	2	0.09	0.035	1.71	-0.83	-0.07	-0.47	4.63	0.84
26	Purchased transportati	6	0	-0.48	0.044	0.76	-0.02	-0.03	-0.44	3.05	0.55

Thais have allocated their budget shares on Private transportation and on Public transportation for 8.2% and 4.4%, respectively. It is interesting that Thai people spent money on public transportation almost as much as that spent on the private cars (4.7%). It implies that the majority of Thai consumers still do not have their own vehicles.

Within the Private transportation subgroup, expenditure share on the costs of personal transportation is larger than the operational costs. This finding is contrast to that found in some developed countries such as the US, Italy, Spain, and France. Almon (1996a) reported that the operational costs of cars are about double the costs of purchasing cars in those countries. This is an interesting fact. The results from the current study imply that

personal cars in Thailand may be short lived or that the roads are such that the cars are not so much used as in Europe and the US.

Income elasticities also give intuitive results. Private cars are luxury goods. They can, of course, represent how well a person lives. On the other hand, Public transportation is a necessity. The income elasticities obtained from the estimation support our argument. Given that the time trend coefficients are all close to zero and the demands are price inelastic, it could be inferred that the dramatic increase in private transportation expenditures since mid 1990s may mainly come from the growing income per capita of the Thai households.

Group 7: Recreation

Four consumption sectors were placed in this group: Entertainment, Hotels and restaurants, Books and newspapers, and Other recreation. These sectors were grouped because they may represent the same type of demand. That is, purchasing of these goods may be not crucial for daily life. However, they provide extra utility for a person when they are consumed. 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	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
28	Entertainment	7	0	0.86	0.002	0.80	-3.56	-0.48	-0.36	11.72	0.83
29	Hotels, Restaurants, a	7	0	0.47	0.103	1.01	1.16	0.01	-0.41	4.12	0.70
30	Books, Newspapers, and	7	0	0.63	0.013	1.16	0.57	-0.37	-0.17	6.24	0.71
31	Other Recreation	7	0	0.93	0.027	1.49	0.26	-0.10	-0.51	3.68	0.48

Recall that demands for the goods within this group are complements. Yet, one might question how this complementarity could be explained by real life situations. The interpretation is straightforward. For instance, a consumer may go to a movie theater after dining out.

Income elasticities support the argument made earlier - recreation seems to be a luxury good, and only Entertainment sector has income elasticity less than 1. All price elasticities are less than 1 in absolute terms. It is noteworthy that Hotels and restaurants sector has the highest consumption share of any one category sectors. Entertainment, by contrast, accounts for the least expenditure of any of the 33 categories.

Ungrouped Sectors

There are six consumption sectors that remain ungrouped: Tobacco, Personal care, Health expenses, Communication, Financial services, and Other services. However, some interesting properties of these products will be discussed.

First, a relatively large expenditure share (7.5%) has been spent on Health. Income elasticity suggests that it is necessary; however, health care is elastic with respect to price. This is not surprising. There was still no systematic social health insurance available in Thailand during the estimation period. According to the time trend

coefficient, Thai people have, *ceteris paribus*, increasingly paid more attention to health care.

Table 12: Results for Ungrouped sectors

nsec	title	G	S	lamb	share	IncEl	DInc	time%	PrEl	Err%	rho
12	Tobacco	0	0	0.35	0.021	1.02	0.77	-1.65	-0.59	3.48	-0.14
22	Personal care	0	0	0.71	0.017	1.08	-0.05	-0.17	-0.94	3.73	0.78
23	Health expenses	0	0	1.31	0.075	0.91	1.19	0.50	-1.38	4.74	0.71
27	Communication	0	0	0.09	0.009	1.27	1.59	25.68	-0.35	4.34	-0.02
32	Financial services	0	0	0.28	0.011	1.77	1.47	-0.15	-0.53	6.08	0.70
33	Other services	0	0	0.54	0.010	0.94	1.10	-0.32	-0.79	7.50	0.75

It is also worth mentioning the Communication sector. This product seems to be a luxury good. Although its expenditure share is relatively small, the consumption on Communication has exponentially increased since 1990. The time trend coefficient is very high because of the special trend variable that was imposed to capture the skyrocket in communication expenditure during these periods.

5. CONCLUSION

This study gives us an understanding of the demands for private consumption in Thailand. Following Almon (1996a), the Perhaps Adequate Demand System (PADS) was used to estimate 33 consumption sectors in Thailand during 1976-1998. Results convey information about the trends of consumers' tastes, budget allocation, and their reactions against income and price changes.

The Food group has accounted for the largest consumption share over the past 23 years. However, for an individual sector, Thai people have spent the largest proportions on Hotels and restaurants, Clothing, and Health expenses. Whereas the smallest consumption sector is the Entertainment sector.

Most of the sectors have income elasticities greater than 1. On the other hand, sectors that show low income elasticities primarily are food products, rent, and utilities. The sector that is most sensitive to income changes is the Personal transportation and the Domestic services (a housemaid).

Price elasticities are less than 1 in absolute terms for most of sectors, indicating that private consumption expenditures are inelastic to price changes. Elastic price elasticities are found only in four sectors: Domestic services, Furniture, Health expenses, and Fish sectors. Sectoral comparison of the income elasticities and the price elasticities implies that income effects dominate consumption pattern of Thai consumers.

Further extensions could be made in order to gain a better 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. Poor consumers place greater emphasis with basic

necessities, while wealthy consumers spend more money on luxury items. In addition, consumers in different age groups could also unevenly allocate their expenditure shares. For instance, young consumers spend more money on education, while elder consumers spend more on their health. It is of particular interest to conduct estimations incorporating the demographic effects in the demand system.

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