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Consumption Patterns of Major Food Items in Turkey

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Demand estimates for food not only provide information bases to characterise food demand structure, but also provide a complete and consistent framework to evaluate the impacts of policy changes, since both price policies and the human capital policies related to health and nutrition are closely related to the determination of expenditure (or income) elasticities. This study attempts to produce a complete set of expenditure and price elasticities based on the estimates of food demand parameters in Turkey. The Linear Expenditure System (LES) is estimated using the last available cross-section budget survey data. The estimates throw light on certain characteristics of Turkish household behaviour that has some consequences for government policies.

1. INTRODUCTION

Demand for food rises with economic growth and highlights the importance of developing the agriculture sector in order to increase food supply. Since priorities and investment targets have to be based on demand forecasts, among other things, reliable estimates of income elasticities of different commodities are a prerequisite. Furthermore, food being a basic human requirement, its prices are a sensitive issue particularly in developing countries. Parameters describing consumers behaviour, i.e., income and price elasticities, not only help to predict future demand but are also useful to evaluate the effects of changes in income [Burney and Akmal (1991), p. 185].

This study provides parameter estimates and a set of demand elasticities for a disaggregated and complete set of food items. A systems approach is used to analyse household expenditure on food consumption and is based on cross-sectional household-level data compiled from the latest available household income and consumption expenditures survey (for the year 1994), conducted by the State Institute of Statistics (SIS) of Turkey.

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The remaining part of the paper is organised in the following way. Section 2 outlines the model and the methodology for the estimation of parameters and elasticities. Section 3 examines households' expenditure pattern of food consumption and presents the results. Finally, Section 4 summarises the major findings.

2. METHODOLOGY

2.1. The Model

Changes in food consumption patterns are of interest to agricultural policy-makers and the estimation of food consumption parameters using the complete demand system has gained increasing support. Nevertheless, the choice of the demand system is of primary importance because of the unpleasant consequences that such a choice might have for the estimated parameters [King (1979)]. In this study, the Linear Expenditure System (LES), first developed by Klein and Rubin (1947-48), is employed for estimation. The LES was derived from the maximisation of the Samuelson-Geary utility function

$$U = \sum_{i=1}^{n} \beta_i \log(q_i - \gamma_i) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

subject to the consumer's budget constraint

$$y = \sum_{i=1}^{n} p_i q_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

which can be written as

$$p_i q_i = p_i \gamma_i + \beta_i (y - \sum_{i=1}^{n} p_i \gamma_i) \quad (i = 1, \ldots, n) \quad \ldots \quad \ldots \quad (3)$$

where p_i, q_i, γ_i, and β_i are price, quantity consumed, subsistence consumption quantity, and marginal budget share of commodity i, respectively; y is total expenditure (income); and $0 < \beta_i < 1$, $\sum_{i=1}^{n} \beta_i = 1$, and $(q_i - \gamma_i) > 0$ for all i.

The parameter γ_i is sometimes called the subsistence parameter. This implies that the household first purchases γ_i units of good i at a cost of $p_i\gamma_i$, which is called committed or subsistence consumption. The total cost of subsistence is $\sum_{i=1}^{n} p_i \gamma_i$. This leaves $y - \sum_{i=1}^{n} p_i \gamma_i$ as supernumerary expenditure. Usually known as marginal expenditure shares, β_i's denote how a consumer allocates his supernumerary expenditure over different commodities. The parameter γ_i may be positive or negative. Positive γ_i implies inelastic demand and negative γ_i implies elastic demand. The subsistence quantity interpretation of the γ_i's is no longer valid

when some of them are negative, and hence it is not appropriate to regard the intercept terms as subsistence quantities unless they are assumed to be positive. If we restrict the γ_i's to being positive, then all commodities would be price inelastic, a condition that would not be a realistic assumption empirically. Therefore, we let the signs of the γ_i's be determined empirically.

The LES automatically satisfies the theoretical restrictions: adding-up, homogeneity of degree zero in prices and total expenditure, symmetry, and negative semi-definiteness of the Slutsky-Hicks substitution matrix. This is due to its functional form and the fact that it is derived from constrained maximisation of a well-behaved utility function (the Samuelson-Geary utility function).

Demand elasticities are the best available indicators of how households may respond to policies which change relative prices and the level and distribution of income. Based on the parameters estimated of the LES, it is possible to calculate all kinds of demand elasticities. Total food expenditure (income) elasticities (η_{if}) can be derived directly from the marginal and average budget shares (β_i and w_{if}, respectively). Furthermore, as a result of the theoretical restrictions imposed on the LES (additivity of the Samuelson-Geary utility), price elasticities can be obtained from the parameter values of the LES.

The relevant demand elasticites can then be computed as follows:

Total food expenditure elasticity: $\eta_{if} = \beta_i / w_{if}$ ... ... (4)

Uncompensated own price elasticity: $\varepsilon_{ii} = -1 + (1 - \beta_i)\gamma_i / q_i$ ... ... (5)

Compensated own price elasticity: $\varepsilon_{ii}^{*} = \varepsilon_{ii} + \eta_{if} w_{if}$ ... ... (6)

Uncompensated cross-price elasticity: $\varepsilon_{ij} = -\beta_i p_j \gamma_j / p_i q_i \quad (i \neq j)$ ... (7)

Compensated cross-price elasticity: $\varepsilon_{ij}^{*} = \varepsilon_{ij} + \eta_{if} w_{jf} \quad (i \neq j)$ ... (8)

Under the LES, some theoretical expectations related to the elasticities can be expressed as follows. All expenditure elasticities are positive. Compensated own price elasticities are negative. Only if γ_i is negative, can the uncompensated own price elasticity exceed one in absolute value. Further, all compensated cross-price elasticities are positive although uncompensated cross-price elasticities are negative unless γ_i is negative.

2.2. The Data

In Turkey, as in other developing countries, there is a shortage of easily accessible data that can be used in demand systems estimation. Therefore, the monthly household-level data of Household Income and Consumption Expenditure

Survey for the year 1994, the latest available survey, compiled by the State Institute of Statistics (SIS) of Turkey were used for estimation in this study. The survey was conducted from January 1 to December 31, 1994, at 236 settlements (62 urban and 174 rural) and to 26256 households (2188 households in each month by routinly) selected by means of the stratified multi-stage systematic cluster sampling method to cover all households and settlements.

Food commodities were aggregated into six groups: bread and cereals, meat, fish and poultry, milk, dairy products, fats, oils and eggs, vegetables and fruit, various processed food products, tobacco products, liquors and beverages.

No market prices were available in the survey data. Consumer price indexes for these six food groups were collected from the 1995 *Wholesale and Consumer Price Indexes Monthly Bulletin* published by the SIS.

2.3. Estimation Method

The LES is estimated under the assumption of weak separability of preferences [Alston and Chalfant (1987)] which permits budgeting in stages. In this framework, only information regarding the allocation of expenditure at each stage as well as the own set of commodity prices is required. In the first stage of the process, consumers allocate their total expenditure across broad aggregate commodity groups, while at the subsequent stages of the process only group expenditures and within-group commodity prices are considered relevant to the consumer's decision. This process can be extended provided that the results at each stage are identical to those that could be obtained from a one-time allocation with complete information [Fulponi (1989), p. 84].

In practice, it has been common to use total expenditure in place of income. One of the reasons is the belief that the total expenditure figures reflect the permanent income of the household. The other reason is that income figures are often subject to errors of measurement rendering inconsistent coefficient estimates [Tansel (1986), p. 244]. Total food expenditure, the sum expenditures on all food groups, was, therefore, used as a measure of income variables in the food demand sub-system.

Since the data is cross-sectional and may involve the heteroscedasticity problem, because high-income households show a much greater variability in their consumption behaviour than do low-income households, the Goldfeld-Quandt test Goldfeld-Quandt (1972) was carried out, assuming that the heteroscedastic variance, σ_i^2, is proportional to the square of the total food expenditure, f. The test result has confirmed the validity of heteroscedasticity. To solve this problem Model (3) was transformed by dividing all terms in the model by f [Pollak and Wales (1978), p. 352].

$$w_{if} = \frac{p_i q_i}{f} = \frac{p_i \gamma_i}{f} + \beta_i (1 - \sum_{i=1}^{n} \frac{p_i \gamma_i}{f}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Then, this model in share form was used for the purpose of estimation.

The sum of the disturbances across the six equations is zero at each observation since the expenditure shares of the six food groups always add up to one. This implies that the covariance matrix of the disturbance term will be singular. However, in order to ensure a non-singular covariance matrix, the equation related to the group of tobacco products, liquors, and beverages was dropped from the system.

The demand system has a total of 2*n* structural parameters, of which 2*n*-1 are independent parameters in view of the adding-up restriction. The independent parameters are *n*-1 β's and *n* γ's. Since these LES equations are highly interrelated, *the seemingly unrelated regression estimation (SURE)* method [Zellner (1962)] was used to estimate the parameters of the model.

3. RESULTS

Expenditure allocations of the food budget among the six food commodity groups were estimated using the expenditure form of the LES. Structural estimates of the parameters, average budget shares, total food expenditure elasticities, and total expenditure elasticities calculated based on the parameter estimates, are presented in Table 1.

Table 1

Average Food Budget Shares, Parameter Estimates, and Expenditure Elasticities Based on the LES

Food Groups	Parameter Estimates for the LES			Average Food Budget Share, %	Total Food Expenditure Elasticity	Total Expenditure Elasticity
	γ_i	β_i	R^2	(w_{if})	(η_{if})	(η_{if})
Bread and Cereals	3.476 (1.521)*	0.180 (89.048)	0.18	20.97	0.858	0.802
Meat, Fish, and Poultry	–25.569 (–12.156)	0.177 (94.910)	0.16	14.88	1.190	1.113
Milk, Dairy Products, Fats, Oils, and Eggs	–12.574 (–4.490)	0.198 (110.572)	0.02	20.47	0.967	0.904
Vegetables and Fruit	–17.334 (–5.482)	0.208 (135.508)	0.01	21.23	0.980	0.916
Various Processed Food Products	–8.532 (–4.571)	0.128 (89.859)	0.00	13.20	0.970	0.907
Tobacco Products, Liquors, and Beverages	–48.586 (–11.556)	0.109 (64.881)		9.25	1.178	1.101

Notes: 1. *t*-ratios in parentheses.

2. *Insignificant at 5 percent level.

3. The marginal budget share, β_i, related to the group of Tobacco products, liquors, and beverages was estimated as implied by the adding-up restriction.

The parameter estimates are consistent with *a priori* expectations. The estimates of the marginal budget shares (β_i) are all positive as required by the underlying Samuelson-Geary utility function, valued between zero and one, and add up to one (by restriction). All β_i values are significantly different from zero at the 5 percent significance level.

The marginal budget share estimates indicate that the largest portion of an increase in the food budget goes to vegetables and fruit. Of each additional 1000 Turkish Liras (TL) in the food budget, the households in Turkey allocated 208 TL to the vegetables and fruit group in 1994; next in the order of magnitude comes the milk, dairy products, fats, oils, and eggs group. It is followed by the first and second group of food commodities, respectively.

As for the estimated values of the γ_i parameters, not only are the *t* values for all the γ_i's, except for bread and cereals, statistically significant at 5 percent level, negative values were also encountered for all the groups, except for the first group, implying that the subsistence quantity interpretation of the γ_i's is no longer valid and the commodities are price-elastic.

The *R*-square values for the individual equations have been reported, although they are not of particular significance because the estimation procedure involves a system of equation.

The shares of every food commodity group in the food budget are also shown in Table 1. From the table, it is clear that vegetables and fruit, bread and cereals, and milk, dairy products, fats, oils, and eggs are the most important commodity groups in the food budget of the households. On the other hand, the point to note here is that the households spend proportionately less of their food budget on meat, fish, and poultry and various processed food products. The food consumption pattern of the households in Turkey may thus be marked by a diversified diet in 1994.

Total food expenditure elasticity gives the elasticity of demand for each food group with respect to total food expenditures (the food budget). From the table, the food groups that appear to be composed of commodities that are largely luxuries relative to other food items are meat, fish, and poultry, and tobacco products, liquors, and beverages. The rest of the food groups are composed largely of items that are considered necessities relative to other food commodities.

It is possible to estimate the total expenditure elasticity for any food group (elasticity with respect to the total food and non-food expenditures) from the total food expenditure elasticity for that group and the expenditure elasticity of demand for food. This elasticity is based on the expressions

$$\eta_{iy} = \eta_{if} * \eta_{fy} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

where η_{iy} is the expenditure elasticity of food group *i* with respect to total expenditure (*y*), η_{if} is the expenditure elasticity of food group *i* with respect to total

food expenditure (*f*), and η_{fy} is the expenditure elasticity for the aggregate food group with respect to total expenditure [Teklu and Johnson (1988), p. 99].

The value of η_{fy} for 1994 was estimated 0.935 by Özer (2001). Since the total food expenditure elasticities (η_{if}) are all positive, the total expenditure elasticities (η_{iy}) are all positive as well. Based on η_{iy}, meat, fish and poultry, and tobacco products, liquors, and beverages are expenditure-elastic with respect to total expenditure, whereas the rest of the food groups are expenditure-inelastic.

One of the major concerns of public policy is to make and implement plans to augment domestic production and supply of essential items so as to meet expected demand. Food being one of these items, it has been the focus for the policy-makers, particularly in the developing countries, with the objective of self-sufficiency in food and its availability to all sections of society at relatively inexpensive rates. As farm prices in general and food prices in particular are critical for developing countries, agricultural policy has come to be recognised as important [Burney and Akmal (1991), p. 193].

In the light of the expenditure elasticities estimated, it can be seen that among different food items within agriculture, the demand for the groups of meat, fish, and poultry, and tobacco products, liquors, and beverages is likely to grow at a relatively faster rate as compared to the others. Thus, when planning for the development of the agricultural sector to raise food supply, particular attention needs to be given to the development of livestock, poultry, and tobacco so as to raise the output of these sub-sectors to meet demand.

Several studies have been undertaken in the past to analyse consumption patterns of major food items in Turkey (See Table 2). These included the studies by Yurdakul (1980), Koç (1995), Ekinci (1996), Üçdoğruk (1997), Kasnakoğlu (1991), Baydemir (1998) and Şengül (2001). They have ranged from the fairly simple single-equation models, linear, semi- and double-logarithmic and logarithmic inverse, to the complex, Working-Leser, Linear Expenditure System, Almost Ideal Demand System, and Linear Approximate Almost Ideal Demand System.

On the other hand, all the studies are based on the household income and expenditure survey data. These surveys provide the single most important source of data on consumption pattern in Turkey. However, the analyses in the studies, with the exception of Koç (1995), Ekinci (1996), Üçdoğruk (1997), and Baydemir (1998), are confined to single year only. In addition, the studies differ by coverage. For example, some studies cover some provinces such as Erzurum, Ankara, İzmir, and Adana, while the others are done on the basis of rural or urban sector or overall Turkey.

Since these studies differ not only by their models, data sets, and coverage, but also by the food items studied, there is no exact conformity among them in terms of the classification of food sub-groups. Meat and milk in Yurdakul (1980), mutton in Kasnakoğlu (1991), meat products, veal, fish and beef in Koç (1995), mutton and

Table 2

A Survey on Demand for Food in Turkey

Study	Model	Data	Coverage	Food Classification		
				Inferior	Necessity	Luxury
Yurdakul (1980)	Semi-Log Double-Log Log-Inverse	1977	Adana		Dairy Products, Eggs	Meat, Milk
Kasnakoğlu (1991)	Linear Semi-Log Double-Log	1987	Ankara Erzurum	Bread	20 Food Sub-groups with the Exception of Bread and Mutton	Mutton (in Erzurum)
Koç (1995)	Working-Leser	1987	Rural		Meat, Chicken, Fish	Meat products
			Urban		Meat, Beef, Mutton, Chicken	Meat products, Veal, Fish
	AIDS LES	1976–91	Turkey		Mutton, Goat, Chicken	Beef, Veal
Ekinci (1996)	Linear Double-log LA/AIDS	1970–94	Turkey	Bread	Beef, Milk, Yogurt, Sugar, Cheese, Butter, Margarine	Mutton, Chicken
Üçdoğruk (1997)	Linear Double-log	1987 1994	İzmir		All of the 8 Food Sub-groups	
Baydemir (1998)	LA/AIDS	1995–97	Erzurum		Cereals	Meat, Milk, Vegetables, Fruit
Şengül (2001)	LA/AIDS	1994	Rural Urban Turkey		Bread and Cereals, Milk, Cheese and Eggs, Vege-tables and Fruit, Sugar	Meat and Fish, Oils and Fats (not in rural), Honey (not in urban)
This Study	LES	1994	Turkey		Bread and Cereals, Milk, Dairy Products, Fats, Oils and Eggs. Vegetables and Fruit, Various Processed Food Products	Meat, Fish and Poultry, Tobacco Products, Liquors and Beverages

chicken in Ekinci (1996), meat, milk, vegetables and fruit in Baydemir (1998), and meat and fish in Şengül (2001) are found to be luxuries, while bread was classified as an inferior item in Kasnakoğlu (1991) and Ekinci (1996).

Moreover, the uncompensated and compensated price elasticities, adjusted for change in total food expenditure, are given in Tables 3 and 4, respectively. All the uncompensated own-price elasticities for each food group provided in Table 3 are negative; that is, changes in own price indexes had inverse impacts on the quantities demanded. For most of the food groups, the estimated elasticities exceed unity in absolute value; the exception is bread and cereals because the corresponding γ_i estimate is positive. Bread and cereals is the least responsive to changed own-price. The absolute values of these elasticities tended to move closely with the total food

Table 3

Uncompensated Price Elasticities of Demand for Food Groups

Food Groups	1	2	3	4	5	6
Bread and Cereals	–0.974	0.032	0.018	0.022	0.012	0.045
Meat, Fish, and Poultry	–0.008	–1.207	0.025	0.031	0.017	0.063
Milk, Dairy Products, Fats, Oils, and Eggs	–0.006	0.036	–1.081	0.025	0.013	0.051
Vegetables and Fruit	–0.006	0.037	0.020	–1.097	0.014	0.052
Various Processed Food Products	–0.006	0.036	0.020	0.025	–1.092	0.051
Tobacco Products, Liquors, and Beverages	–0.008	0.044	0.024	0.031	0.016	–1.510

Note: 1. Bread and cereals, 2. Meat, fish, and poultry, 3. Milk, dairy products, fats, oils, and eggs, 4. Vegetables and fruit, 5. Various processed food products, 6. Tobacco products, liquors, and beverages.

Table 4

Compensated Price Elasticities of Demand for Food Groups

Food Groups	1	2	3	4	5	6
Bread and Cereals	–0.794	0.160	0.194	0.204	0.125	0.124
Meat, Fish, and Poultry	0.242	–1.030	0.269	0.284	0.174	0.173
Milk, Dairy Products, Fats, Oils, and Eggs	0.197	0.180	–0.883	0.230	0.141	0.140
Vegetables and Fruit	0.200	0.183	0.221	–0.889	0.143	0.143
Various Processed Food Products	0.197	0.180	0.219	0.231	–0.964	0.141
Tobacco Products, Liquors, and Beverages	0.239	0.219	0.265	0.281	0.171	–1.401

Note: 1. Bread and cereals, 2. Meat, fish, and poultry 3. Milk, dairy products, fats, oils, and eggs, 4. Vegetables and fruit, 5. Various processed food products, 6. Tobacco products, liquors, and beverages.

expenditure elasticities, suggesting that uncompensated own-price elasticities included substantial income effects.

Since negative signs of cross-price elasticities denote complementarity between goods, bread and cereals is gross complement as indicated by the negative signs of uncompensated cross-price elasticities. Positive signs of the compensated cross-price elasticities indicate that all food groups are net substitutes as they should be in the LES (see Table 4). Moreover, according to the results, income-compensated own-price elasticities are lower in absolute value than uncompensated elasticities as required.

Values of the estimated cross-price elasticities suggested that food demand was responsive to relative price changes. However, it can be seen that a change in the price index of any food group had less of an impact on demand for the others. Compared with own-price elasticities in absolute value, cross-price elasticities had lower values. This means that the households were more sensitive to changes in own-prices.

On the other hand, it can also be seen from the table that meat, fish, and poultry, and tobacco products, liquors, and beverages have price-elastic demand while demands for the others are price-inelastic. The relatively higher price responsiveness of meat, fish, and poultry, and tobacco products, liquors, and beverages, when compared to the others, is probably a reflection of the fact that the latter group is more essential to the Turkish diet.

4. CONCLUSION

Food consumption patterns of Turkish household have been studied in this paper. The demand system estimated for Turkey should not be viewed as conclusive but simply as adding to the information on food demand structure. Even though price variation was limited in a single cross-section, the study demonstrates that it is possible to estimate a complete set of expenditure and price elasticities based on the estimates of food demand parameters. Notwithstanding this limitation, the responses based on prices appear reasonable. Food demands are responsive to change in both income and relative prices.

Parameter estimates from the demand system comprising six food commodities are plausible and consistent with the theoretical expectations. Some major findings of the study can be summarised as follows.

The marginal budget share estimates indicate that the largest portion of an increase in the food budget goes to vegetables and fruit. Vegetables and fruit, bread and cereals, and milk, dairy products, fats, oils, and eggs are the most important commodity groups in the food budget of the households. On the other hand, the households spend proportionately less of their food budget on meat, fish, and poultry and various processed food products. The food consumption pattern of the households in Turkey may thus be marked by a diversified diet in 1994.

Total food expenditure elasticity gives the elasticity of demand for each food group with respect to total food expenditures (the food budget). The food groups that appear to be composed of commodities that are largely luxuries relative to other food items are meat, fish, and poultry, and tobacco products, liquors, and beverages. The rest of the food groups are composed largely of items that are considered necessities relative to other food commodities.

Moreover, the uncompensated and compensated price elasticities have shown that bread and cereals is the least responsive to changed own-price, and income-compensated own-price elasticities are lower in absolute value than uncompensated elasticities as required. Compared with own-price elasticities in absolute value, cross-price elasticities had lower values. This means that the households were more sensitive to changes in own-prices. Furthermore, the relatively higher price responsiveness of meat, fish, and poultry, and tobacco products, liquors, and beverages when compared to the others is probably a reflection of the fact that the latter group is more essential to the Turkish diet.

Finally, a policy reform targeted to change in price of a particular food group will have simultaneous impacts on consumption of related groups. The results suggest that policy-makers should take into account household adjustments to policy changes in their totality.

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