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Pooling surveys in the estimation of income and price elasticities: An application to Tunisian households*

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Abstract. This paper presents a methodological extension of Deaton's (1990) model for estimating price elasticities, by pooling Tunisian data from several surveys to improve the inter-cluster variability of unit values which is one of the key elements used in the derivation of these elasticities. Since the surveys cover a relatively long period, possible structural changes in consumption behaviour occurring over time are accounted for by postulating that certain response coefficients of the basic model vary from one survey to the other. The own price and cross price elasticities calculated using appropriate estimates of the extended model are satisfactory both from the economic point of view of their sign and the statistical point of view of their significance and superior to those obtained using a single survey.

Key words: pooling cross-sections, consumer demand system, unit value, price elasticity.

JEL classification code: D12

1. Introduction

A typical demand equation explains the quantity of a good consumed by a household (or the corresponding budget share) in terms of the household income/total expenditure, a vector of prices of all goods and other socio-demographic factors relating to the household. Data on all theses variables are generally collected by means of surveys except for prices which are obtained from other sources. In situations where observations on prices are not

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available or are not reliable, Deaton (1986, 1987, 1988, 1990) proposed a new methodology to estimate price elasticities using spatial variation of prices in survey data via unit values[1].

Ever since this pioneering work by Deaton, several studies have applied the methodology to household consumption survey data available in many countries. See for instance Laraki (1988), Case (1988), Deaton (1990), Deaton and Grimard (1991). Let us briefly recall Deaton's model and method. The sample of households is divided into different clusters[2] within which prices remain constant and homogeneity of behaviour is assumed. The model consists of two equations: the first one is a semi-logarithmic demand function of the AIDS type (cf. Deaton and Muellbauer (1980)) explaining the budget share of a good in terms of the variables mentioned above and a cluster specific effect; the second equation is a unit value one which relates the unit value to prices, quality effects (reflected by income and socio-demographic characteristics) and measurement errors. First, both these equations are transformed by taking deviations from cluster means (known as the within transformation in the terminology of panel data models, see e.g. Baltagi (1995), Matyas and Sevestre (1996), Hsiao (1986) for further discussion of fixed effects models). This transformation eliminates the unobservable prices and cluster effects thus enabling estimation of the coefficients of income and other exogenous variables as well as the variance-covariance parameters of the residuals. In the next stage, estimates of price elasticities are derived using the empirical intra-cluster variation of budget shares and unit values corrected for quality effects and its relationship with the variance covariance matrix of the errors, which involves the required parameters. Restrictions of homogeneity and symmetry are imposed in the estimation and hence in the calculation of elasticities.

Ayadi *et al.* (1994) recently applied this method to the 1990 household survey data concerning Tunisian households and obtained satisfactory results as far as the income and certain own price elasticities were concerned. However, most of the cross-price elasticities were not significant and were of the wrong sign. All attempts at deriving price elasticities by applying Deaton's method using a single survey suffered from the same drawbacks. However, now that Tunisia has conducted several surveys, it seemed interesting to explore the idea of combining the spatial and time dimensions, thus using all the available information to improve the quality of results. This pooling technique is known to be efficient in presence of specific effects when we have repeated observations over the same households. Therefore Tunisian data collected from four different surveys using similar sampling techniques provide us with a rich source of information to model and test various assumptions regarding the evolution of consumer behaviour over time. Though the same households are not observed in the different surveys, nevertheless Deaton's method can be extended to take into account the additional variability and changes in behaviour introduced by the time dimension (see Section 3 for a detailed presentation of our model).

[1] The unit value of a good *i* is obtained by dividing the total expenditure on the good *i* by the quantity consumed of the same good.

[2] A cluster is a group of households (10 to 12 in the Tunisian case) that are geographically close (i.e. same village or same area) and surveyed around the same time. The technique of cluster sampling is adopted in order to minimise the transport cost of the investigator and hence minimise the cost of collecting the data.

As a first step, *time* effects are introduced in the demand equations to account for shifts in these functions over time. Secondly, the response coefficients are allowed to vary over time. Since the four surveys cover a period of 15 years, it is very difficult to assume *a priori* that all the coefficients have remained the same over all the years. We devised several tests for verifying this intuitive statement and their results will be discussed in detail later on. In particular, the assumption of constancy of all coefficients was clearly rejected. The results obtained with the retained assumptions regarding the response coefficients are compared with those obtained using other assumptions, both statistically and economically, in order to evaluate *a posteriori* the empirical validity of our assumptions. Once again the results seem to confirm the practical relevance of our approach.

The paper will be organised as follows. In Section 2, we attempt to describe the economic context of the study and argue that consumption patterns have changed over time by means of an exploratory analysis. In the following section these changes are specified more formally by introducing variable coefficients in the system of equations and tested statistically against uniformity restrictions on the parameters of the model. The results of these tests are analysed and incorporated into the original model. The extended model is then estimated using data from all the four surveys and the resulting income and price elasticities interpreted in Section 4. Section 5 ends the paper with some conclusions.

2. The tunisian context

Tunisia has undergone major structural changes during the past three decades especially with respect to consumer behaviour. The substantial increase in the standard of living and the extension of subsidies in basic food products have been the causes of changes in consumption patterns during our period of study 1975–1990. These changes that have taken place over time constitute the main justification of the inclusion of the time dimension in our model. Note that our study uses data from four household surveys conducted by the "Institut National de la Statistique" (INS) for the years 1975, 1980, 1985 and 1990. Each survey concerns a representative sample of households selected using clustered sampling techniques. The reader may find some useful information on the number and distribution of households across surveys in Table A1, Appendix A.

Standard of living

Consistent economic growth since 1970 has resulted in a considerable increase in the mean and median real per capita expenditure over time as can be seen from Table A2, Appendix A. Further, one can observe that (a) the distribution of income is more spread out on the right with greater dispersion in higher incomes as the mean is bigger that the median; and (b) the difference between the two has decreased over time indicating a tendency towards a more symmetrical distribution and perhaps lesser inequality. Let us add that the relative difference is smaller in the rural area than in the urban one.

Subsidisation policy and administered prices

Tunisian Government created the "Caisse Générale de Compensation" in 1970 with a view to improve the quality of life of the poor by ensuring a minimum food consumption for them through administered prices. However, very soon the increase in burden of the subsidies due to their rapid growth could not be borne by the State. In fact, the compensation amount grew at 24% per year on average, which represents three times the growth rate of GDP or government revenue. During 1986–1988, the total amount of these subsidies reached an average of about 3% of GDP, 14% of government revenue and 80% of budget deficit. Hence, in order to balance the budget, the Government decided to drastically raise the level of administered prices from 12 August 1989 and around 15 to 20% increases in nominal prices were recorded, which was never the case earlier though these prices have been raised before. Similar jumps were made in 1990. Table A3, Appendix A reports the price changes in nominal and real terms for selected items. One can note that in spite of big increases in nominal prices between 1981 and 1988, the real prices in fact decreased over the same period.

It should be noted that in the case of administered prices there is no variation across regions and this might seem to pose an identification problem. However, the commodities with such fixed prices represent only three out of the twelve categories considered, namely Bread, Pasta and Sugar, and the extent of subsidisation varies across the different components within each category. As can be seen from the list given below, among the nine remaining items, Milk, Oil and Meat have one component each with administered price and the rest free. Hence the majority of prices do have significant variability across regions in our study. In addition, when different surveys are combined, there is variation over time in all prices. When prices are fixed by the government, one can in fact use available data on these prices instead of unit values, provided the shares of the different components within each category are known[3].

The classification of items used in our study is as follows (components listed in italics are subject to administered pricing):

Pasta	*pasta, semolina and couscous*
Bread	*flour and bread*
Cereals	other cereal products
Sugar	*sugar*
Milk	*milk* and milk derivatives
Oil	*mixed oil* and olive oil
Meat	mutton, *beef* and other red meat and slaughter
Chicken	fresh fish, poultry and eggs
Can	canned food
Veg	dry and fresh vegetables
Fruit	fruits
Misc	meat and beverages taken outside, tea, coffee and other food products

[3] This is a possibility that can be envisaged in the future and the authors are thankful to an anonymous referee for pointing it out.

Table 1. Budget shares (urban)

	1975		1980	1985	1990	
Cereals	10.4		8.9	6.8	6.7	
Milk and derivatives	2.3		3.3	3.8	4.0	
Fish and chicken	3.0	12.1	3.4	4.2	4.9	15.8
Vegetables	6.8		7.1	7.4	6.9	

Table 2. Unit values (urban) (in 1985 Tunisian Dinars/Kg)

	1975	1980	1985	1990
Cereals				
Pasta, semolina and couscous	0.210	0.230	0.163	0.174
Bread	0.149	0.154	0.122	0.136
Milk and derivatives	0.246	0.309	0.382	0.426
Fish and chicken	0.948	0.809	0.991	0.967
Vegetables	0.204	0.236	0.267	0.298

Changes in consumption patterns

In addition to the changes in standard of living and in subsidisation policies, profound changes have also occurred in consumption patterns over time. Tables 1 and 2 show the evolution of budget shares and unit values respectively, of a few important categories namely cereal-based products (pasta, bread and other cereals) and products rich in proteins and vitamins (milk, chicken, fish and vegetables), both of which form together half of an average Tunisian's consumption basket. Comparing the figures for different periods, we see that the consumer has decreased the share of cereals in his/her expenditure (their share has gone down from 10.4% in 1975 to 6.7% in 1990) even if the real price (unit values) of the same product has decreased during this period as seen in Table 2. At the same time, though the real price of the other categories mentioned above has increased over time, their share in the total consumption has also increased from 12.1 to 15.8. In particular, milk prices have gone up by at least 73% and its share has almost doubled.

The above observations indicate two major structural changes: (a) the significant improvement in the standard of living of the average consumer, implied by a substantial increase in real income, has resulted in a greater share of products whose price increases have been relatively high implying that he/she can now afford to buy more expensive products to satisfy his/her nutritional requirements; (b) a change in habits and tastes of the Tunisian household, induced by the long term decrease in real price of cereals through administered pricing, has caused a shift from an essentially cereal-based meal to a more diversified one including fish, meat and vegetables. This fundamental change in consumption behaviour over time needs to be taken into account explicitly and we propose to do it by introducing time variation in the response coefficients.

3. Specification of the model

The basic model is the two equation system proposed by Deaton (1990) for the use of survey data. The first equation of this system expresses the budget share of a good or a category as a function of the total expenditure and certain socio-demographic characteristics of the household as well as prices of all goods and has a functional form similar to that of AIDS (cf. Deaton and Muellbauer (1980)). Since prices are not observed and instead unit values are available, a second equation is added relating unit values to prices and quality choices reflected by the level of income and other relevant characteristics of the household. This two equation model can be written as:

$$W_{ic}^{h} = \alpha_i^0 + \beta_i^0(\ln X_c^h) + (Z_c^h)'\gamma_i^0 + (\ln p_c)'\theta_i + f_{ic} + U_{ic}^{0h} \tag{1}$$

$$\ln(UV)_{ic}^{h} = \alpha_i^1 + \beta_i^1(\ln X_c^h) + (Z_c^h)'\gamma_i^1 + (\ln p_c)'\psi_i + U_{ic}^{1h} \tag{2}$$

where W_{ic}^h and UV_{ic}^h are respectively the budget share and the unit value of the i-th good consumed by the h-th household belonging to cluster c, X_c^h is the total expenditure of the h-th household, Z_c^h a vector of socio-demographic variables concerning the h-th household: size of the household, age of the head of the family, number of active women and number of active men[4]. $\ln p_c$ is the vector comprising log of prices of all the n goods prevalent in cluster c, f_{ic} is a cluster specific fixed effect for good i and U_{ic}^{0h} and U_{ic}^{1h} are random error terms.

There are three steps involved to arrive at price elasticities: first, consistent estimation of the coefficient vectors $\beta_i^k,\ \gamma_i^k,\ k = 0, 1,\ i = 1, \ldots, n$ using the within transformation on the system; second, consistent estimation of the between cluster variance-covariance matrices of the two endogenous variables corrected for quality effects and finally derivation of a consistent estimator of price elasticities after extracting the measurement error variance from the between-cluster variance and applying the method of moments[5].

The derivation of the price elasticities E is based on the following idea. Since prices are not observable, θ and ψ cannot be directly estimated. However there is a way (method of moments) to estimate $B = (\psi')^{-1}\theta'$ and this estimation of B is used to derive θ and E using the "quality" model. Thus in order to understand how price elasticities are obtained, one has to first briefly describe the quality model and then present the method of moments procedure. The reader is referred to Appendix B for a short description of the quality model involving the theoretical derivation of price elasticities. We continue here with the method of moment stage of Deaton's procedure.

Using the within estimates of the parameters of equations (1) and (2), the budget shares and the unit values are "corrected" for quality effects as follows:

$$y_{ic}^{0h} = W_{ic}^h - \hat{\beta}_i^0 \ln X_c^h - \hat{\gamma}_i^{0\prime} Z_c^h \tag{3}$$

[4] Note that in the case of the two variables X^h and Z^h the index c is added just to identify the cluster to which the household belongs.

[5] As explained in Deaton (1990), zero expenditures are included in the estimation of the budget share equation whereas households with zero expenditures (and hence no recorded unit values) are not taken into account for the unit value equation.

$$y_{ic}^{1h} = \ln UV_{ic}^{h} - \hat{\beta}_i^1 \ln X_c^h - \hat{\gamma}_i^{1\prime} Z_c^h \tag{4}$$

with the respective cluster means denoted as $\bar{y}_{ic}^0$ and $\bar{y}_{ic}^1$. Then the empirical variance-covariance of these means and those of the within residuals are evaluated as

$$\hat{S}_{ij} = Cov(\bar{y}_{ic}^1, \bar{y}_{jc}^1)$$

$$\hat{R}_{ij} = Cov(\bar{y}_{ic}^0, \bar{y}_{jc}^1)$$

$$\hat{\Omega}_{ij} = Cov(\hat{U}_{ic}^{1h}, \hat{U}_{jc}^{1h})$$

$$\hat{\Gamma}_{ij} = Cov(\hat{U}_{ic}^{1h}, \hat{U}_{jc}^{0h})$$

giving the respective matrices $\hat{S}$, $\hat{R}$, $\hat{\Omega}$ and $\hat{\Gamma}$. Let us add that correction for cluster design has been incorporated in the above calculations.

It can be seen that using equations (1) and (2) the theoretical moments of the corrected values (3) and (4) can be expressed as

$$S = \Psi M \Psi' + N_+^{-1} \Omega \tag{5}$$

$$R = \Psi M \Theta' + N^{-1} \Gamma \tag{6}$$

where M is the variance covariance matrix of the logarithm of (non-observable) prices and N_+ and N are normalisation factors corrected for differences in sample sizes of the estimation of S, R and Ω, Γ (cf. Deaton (1987)). Combining (5) and (6) and defining $B = (\Psi')^{-1}\Theta' = (\Psi M \Psi')^{-1} \Psi M \Theta'$, B can be consistently estimated as

$$\hat{B} = (\hat{S} - N_+^{-1}\hat{\Omega})^{-1}(\hat{R} - N^{-1}\hat{\Gamma})$$

since $\operatorname{plim} \hat{R} = R$, $\operatorname{plim} \hat{S} = S$, $\operatorname{plim} \hat{\Omega} = \Omega$ and $\operatorname{plim} \hat{\Gamma} = \Gamma$.

This estimate of B enables us to compute the estimators of Θ and E according to equations (B7) and (B8), Appendix B.

Homogeneity and symmetry restrictions are imposed and estimates for the asymptotic variance-covariance of the estimated price elasticities are also derived by applying the delta method (cf. Deaton (1990) and Deaton and Grimard (1991)). In what follows, we present our proposed extension and its consequences for the estimation procedure.

Let us go back to our model formed by equations (1) and (2) and see how it can be modified to take account of changes in tastes and habits over time. We propose to extend the specification at two levels. First we add a time dummy specific to the survey in the demand equations. Next we allow for the response coefficients β_i^0, γ_i^0, β_i^1 and γ_i^1 to vary from one survey to the other. Thus the model is reformulated as follows:

$$W_{ict}^h = \alpha_i^0 + \beta_{it}^0(\ln X_{ct}^h) + (Z_{ct}^h)'\gamma_{it}^0 + (\ln p_{ct})'\theta_{it} + f_{ic} + k_{it} + U_{ict}^{0h} \tag{7}$$

$$\ln(UV)_{ict}^h = \alpha_{it}^1 + \beta_{it}^1(\ln X_{ct}^h) + (Z_{ct}^h)'\gamma_{it}^1 + (\ln p_{ct})'\psi_{it} + U_{ict}^{1h} \tag{8}$$

where t stands for the survey period (75, 80, 85, 90) and all the other parameters have the same interpretations as before, the only new element being the time effect denoted as k_{it}. This time effect results in the intercept term of the equation changing from one period to the other.

The type of specific effects introduced in this model is related to the nature of data source. As often is the case, the combination of observations from different surveys does not constitute a balanced panel as the households selected are different from one survey to the other (cf. Deaton (1985), Blundell *et al.* (1993)). In fact even within a given cluster the identity of households changes from one survey to another. However clusters are chosen in such a way that uniformity of behaviour can be reasonably assumed within a cluster at any time. Hence combination of different time periods is in fact equivalent to addition of new observations to the initial sample, hence increasing the variability, provided structural changes over time present in the additional observations are adequately taken care of. This is where the time specific effects and the time variability of the response coefficients that we introduce in our model become appropriate. Recall that the variations across clusters are modelled using cluster specific effects. Thus we have two fixed specific effects in our equations: f_{ic} and k_{it} , the first one denoting a cluster specific effect (already in Deaton's model) and the second a time specific effect (a new element introduced in our model of pooled surveys).

It can be verified that the transformation that eliminates all the non-observables namely price terms, cluster effects *and time effects* is still the within transformation which consists in taking deviations with respect to cluster means of each period. This means that the two sets of transformed equations (budget share and unit value) can be estimated as before, by applying OLS separately for each good (as the explanatory variables are the same for all goods). There are two modifications in the method of moments stage. First, the within residuals of each time period are calculated using the coefficient estimates of the corresponding period, when time variation is assumed. Secondly, the variance-covariance matrices $\hat{S}$ and $\hat{R}$ are calculated using the cluster means for all clusters in the four surveys. However, the time variation of β and γ coefficients have certain implications for the calculation of price elasticities.

As shown in Appendix B, the price coefficients are derived using the relationship (B6) which involves β_i^1. In order to derive constant price elasticities over time, a single value (meaning independent of time) has to be plugged in for β_i^1 in (B6). Thus in the case in which the β's are supposed to be different for different periods (with the θ_i and ψ_i remaining time-invariant), we replace β_i^1 in the above mentioned equation by a weighted mean of the $\hat{\beta}_i^1$'s obtained in the first stage i.e. $\hat{\beta}_{it}^1$, $t = 75, 80, 85, 90$. By using weights given by the inverse of the respective estimated standard errors we have an efficient estimation of β_i^1 (see Gourieroux, Monfort and Trognon (1985) or Gourieroux and Monfort (1989) for instance).

We also conducted some tests in order to evaluate the empirical validity of our assumptions about the variability over time of the different parameters in the Tunisian context. To this effect, three sets of alternate hypotheses were tested regarding the response coefficients.

Hypothesis A: $\beta_{it}^k = \beta_i^k$, $\gamma_{it}^k = \gamma_i^k \ \forall t$;
Hypothesis B: $\gamma_{it}^k = \gamma_i^k \ \forall t$ (*β's different for different t*);

Table 3. Statistics for tests of different hypotheses (urban)

Item	Test 1	Test 2	Test 3
	Individual tests		
	$F(6, 25260)$	$F(30, 25236)$	$F(24, 25236)$
Pasta	3.13*	1.71**	1.36**
Bread	8.67*	4.06*	2.90*
Cereals	84.10*	18.32*	1.85*
Sugar	6.96*	2.49*	1.38
Milk	8.23*	3.00*	1.70**
Oil	5.33*	4.46*	4.24*
Meat	20.66*	5.73*	1.99*
Chicken	33.60*	9.20*	3.08*
Can	2.88*	1.34	0.95
Veg	28.69*	7.32*	1.96*
Fruit	16.68*	3.75*	0.52
Misc	7.70*	2.50*	1.20
	Global tests		
	$F(72, 303120)$ or $\chi^2_{72}/72$	$F(360, 302832)$ or $\chi^2_{360}/360$	$F(288, 302832)$ or $\chi^2_{288}/288$
	37.73*	7.55*	1.54*

* Null hypothesis rejected at the significance level of 1% (and 5%)
** Null hypothesis rejected at the significance level of 5% (but not at 1%)

Hypothesis C: *β's and γ's different for different t;*
$t = 75, 80, 85, 90 \quad i = 1, \ldots\ldots\ldots, n \; k = 0, 1.$

The above hypotheses basically modify the first stage of the estimation procedure and hence can be tested using the residuals of the within estimation of the constrained and unconstrained model.

The first test (Test 1) was to choose between Hypothesis B and Hypothesis A i.e. different β's but same γ's (H_a) versus constancy of all coefficients (H_0). The number of restrictions in H_0 is 6 for each good. Based on these tests, we reject constancy of all coefficients (see Table 3).

The next test (Test 2) was to choose between Hypothesis C (H_a) and Hypothesis A (H_0). In this case also we reject the constancy of all coefficients, the test statistics exceeding the F critical value.

The third test (Test 3) was to choose between Hypothesis C and Hypothesis B i.e. all β's and γ's vary (H_a) versus H_0: only β's vary (γ's remaining the same). Comparing our test statistics with the F critical values, we reject H_0 in favour of H_a implying that the β's and the γ's vary over time[6]. Table 3 gives the relevant values for the different tests.

[6] It can be noted that hypothesis B would be retained on the basis of the Schwarz (1973) criterion (which some authors consider to be more appropriate for large samples such as ours, see Deaton (1990)); however we will see later that the results of H_B and H_C are so similar that their interpretations remain the same across the two hypotheses.

Table 4. Income elasticities (urban)*

	Individual				Pooled		
	1975	1980	1985	1990	same β's and γ's	different β's and same γ's	different β's and γ's
Pasta	0.898	0.304	0.362	0.306	0.365	0.317	0.359
Bread	0.954	0.283	0.313	0.282	0.338	0.321	0.333
Cereals	0.842	0.601	0.611	0.993	0.820	0.771	0.839
Sugar	0.918	0.382	0.396	0.382	0.425	0.411	0.421
Milk	1.000	0.712	0.638	0.706	0.700	0.711	0.698
Oil	0.921	0.441	0.538	0.639	0.636	0.532	0.638
Meat	0.928	0.861	0.798	0.947	0.875	0.867	0.881
Chicken	0.916	0.645	0.620	0.655	0.667	0.633	0.674
Can	0.987	0.574	0.457	0.448	0.476	0.488	0.467
Veg	0.863	0.459	0.441	0.497	0.499	0.503	0.499
Fruit	0.883	0.914	0.733	0.950	0.873	0.891	0.878
Misc	0.989	0.911	0.935	0.943	0.892	0.884	0.887
Nonfood	0.918	1.24	1.19	1.13	1.16	1.16	1.15

* All estimates are statistically significant with t-values greater than 4 even after correcting for cluster design.

4. Results

Income elasticities

Table 4 reports the income elasticities of quantities for the urban area. All estimates are statistically significant even after taking into account the effect of cluster design on the standard deviations. Indeed Kloek (1981) showed that when observations are collected using clustered sampling techniques, the variance covariance matrix of OLS estimators is underestimated and needs a correction given by the following formula:

$$V(\hat{\beta}) = \sigma^2(X'X)^{-1}[1 + (m-1)\rho]$$

where m is the number of households in each cluster and ρ is the intracluster correlation coefficient (assuming equicorrelation within each cluster). In our study, ρ was estimated to be 0.09 using the formula given in Deaton (1997):

$$\hat{\rho} = \frac{\sum_{c=1}^{n}\sum_{j=1}^{m}\sum_{k\neq j}^{m}\hat{\varepsilon}_{jc}\hat{\varepsilon}_{kc}}{nm(m-1)s^2}$$

where $\hat{\varepsilon}$ is the vector of within residuals and n the number of clusters. This means that with $m = 12$, our standard deviations would be increased by about 40%. Still our t-statistics are all bigger than 4. This relatively low loss of efficiency is due the small number of observations per cluster, as shown by Scott and Holt (1982) and Pfefferman and Smith (1985). In a situation where this number is large as in the case reported by Moulton (1990) where there were nearly 400 observations per cluster, the standard errors would be substantially greater after the correction.

Now turning to the values of elasticities, let us first note that there is not much variation in them among the different assumptions of the pooled case and also not much difference compared to the values obtained from individual surveys, except for 1975[7]. This can be explained by the fact there is already adequate variability in income in the individual surveys resulting in a 'good' estimation of income elasticities and combining them only brings about a marginal improvement, if any. In fact we find that the majority of the differences between individual survey values taken two by two are statistically insignificant when we compare 80 values to 85/90 and 85 to 90; however many differences are significant between 75 and 80/85/90. The same remark holds in the case of rural households[8] whose consumption patterns differ in general from those of the urban households due to differences in the standard of living and in the type of markets where the households make their purchases in the two regions.

Comparing the evolution over time for different goods, the following observations can be made: (i) there is a substantial decrease for the subsidised goods (Pasta, Bread, Sugar), for canned food and for chicken, whose consumption has become more and more regular, the goods becoming more and more "essential" so to speak; (ii) there is an increase for the category Cereals in 1990 which is due to a change in the composition of this category with rice and biscuits rising in proportion compared to cereals in the form of grain.

The income elasticity of the item Can (canned food) has reduced mainly because of its high proportion of tomato cans whose price is fixed by the government in addition to the product being subsidised at the production end. Chicken and eggs were also subsidised until 1985.

A finer classification into 23 products (see Table C1, Appendix C) makes the interpretation of income elasticities even more interesting. For instance, income elasticity of milk has decreased whereas that of milk derivatives has increased. Similarly, if we split Oil into its two main components, olive oil and mixed oil, the latter has a very low elasticity value while the elasticity of the former is close to one. Finally, Table C1 shows a certain order in the different sub-groups of red meat (Meat): ovine meat, followed by bovine meat and then the other types of meat.

Price elasticities

In most of the earlier works using Deaton's methodology on Tunisian consumption data, for instance the one by Ayadi *et al.* (1994), estimations of many price elasticities did not always conform to theoretical expectations. One may account for this by observing that these elasticities are derived by making use of the spatial variation in prices in a single survey and not by following the households over time. In this work, adding a time dimension by means of different surveys is seen to produce much better results with all the own price elasticities becoming significant with the correct signs and readily

[7] The products Pasta, Bread, Sugar, Oil and Can were subsidised by the "Caisse Générale de Compensation" from early 70's but they found their place in the household consumption only by the late 70's. In 1975 they still have high income elasticities.

[8] All results concerning rural households are available with the authors upon request.

Table 5. Own price elasticities (urban)

	Individual				Pooled		
	1975	1980	1985	1990	same β's and γ's	different β's and same γ's	different β's and γ's
Pasta	−.491	−0.896	−1.59*	−.820*	−.836*	−.121	.201
Bread	−1.06*	−0.425	−.351*	−.197	−.969*	−.379*	−.083
Cereals	−1.59*	−1.17*	−.861*	−.876*	−1.22*	−.758*	−.898*
Sugar	−1.37*	−0.794	−1.34*	−.183	−.232*	.141	.033
Milk	−1.28*	−1.64	−.696*	−.930*	−.867*	−.440*	−.265*
Oil	−.353	−0.382	.115*	1.25*	−.334*	−1.63*	−2.05*
Meat	−1.16*	−0.395*	−1.05*	−.0002	−.627*	−1.17*	−1.39*
Chicken	−1.20*	−1.10*	−1.10*	−.727*	−.961*	−.616*	−.673*
Can	−.883*	−0.900*	−.610*	−.101	−.795*	−.903*	−.617*
Veg	−.630*	−0.853*	−.788*	−.830*	−.837*	−.698*	−.593*
Fruit	−.753*	−1.47*	−1.07*	−1.27*	−1.17*	−1.26*	−1.26*
Misc	−.635*	−1.17*	−1.43*	−1.38*	−1.30*	.318*	.474*
Nonfood	−.435*	−0.819*	−1.11*	−.437*	−.858*	−.414*	−.484*

* indicates statistically significant estimates.

interpretable values. Moreover, more than three quarters of the cross price elasticities are significant and of the correct order and have the expected signs based on economic theory.

Table 5 shows the compensated price elasticities obtained under various hypotheses. Columns 2–5 report the values obtained assuming different price coefficients for different surveys which leads to using each survey separately. Since a good number of these values are insignificant, of the wrong sign or hard to interpret in economic terms, their changes over time are even more difficult to explain. For instance, price elasticities of cereals and milk are high compared to those of oil and meat (when the latter are of the right sign)[9].

Going to the next three columns of Table 5, which report results of pooled estimation under hypotheses A, B and C respectively, it can be seen that hypotheses B and C (variable coefficients) seem to offer a better performance than hypothesis A (constant coefficients), with the results of B and C being very close to each other. Let us recall that hypothesis A was clearly rejected against B and C (Tests 1 and 2, Table 3) and hence it is expected that its results would be poorer than those of B and/or C. If we examine the plausibility of their values, we have for instance an elasticity less than 1 for an essential item like Cereals and greater than one for olive oil and red meat which can be considered as "luxury" or non-essential goods and hence price elastic. Though a few positive own price elasticities are obtained under these assumptions, they are not statistically significant. The only positive and significant value is for Misc which is a mixture of all the goods not included in the other categories with a composite price index and hence its demand reaction is unpredictable. Let us add that Sugar, Pasta and Bread are perfectly homogeneous products (with no quality effect) and their prices, arbitrarily fixed by the gov-

[9] Similar results were reported by Deaton (1990) who found the value of own price elasticity of rice greater than 1 in Indonesia where it is an essential commodity.

ernment, are much less than their cost prices[10], which may explain their non-significant own price elasticities and/or the price-inelasticity when it is significant.

Among the different types of meat, we observe that red meat (ovine and bovine, (Meat)) is more elastic than white meat (chicken and fish, (Chicken)) with respect to their own prices. We may recall that the former was also more income elastic than the latter. Similarly between fruits and vegetables, fruits are more own-price-elastic and income-elastic than vegetables.

Now we go on to analyse and interpret the results concerning the two groups Oil and Milk which are formed of homogenous sub-groups but of different quality. The category Milk is composed of milk on the one hand, which is subsidised at the production level and whose price is fixed by the government, and milk derivatives on the other hand, whose prices are fixed by the producer subject to approval by the Ministry. These are much higher than those of milk (about four times). The relatively low values of the price elasticities of this group, in spite of a high income elasticity reflect the dominance of the product "milk" within the group. The item Oil comprises two types of oils. The first one, a mixed oil, was introduced by the "Caisse Générale de Compensation" in the early 70's and its price is arbitrarily fixed by the State. The second component is olive oil whose price fluctuates from season to season depending on the production and availability of the product. Unlike the milk group, Oil group as a whole has a high own price elasticity as the consumption of olive oil accounts for a large part in the total consumption of the group; in fact it was entirely only olive oil in 1975.

Results obtained using rural data lead to the same conclusions as those from urban data with the exception that strangely enough, the items Pasta and Bread have own-price elasticities greater than one.

The most interesting empirical results, in our opinion, concern the cross-price elasticities presented in Table C2, Appendix C and summarised in Tables 6 and 7. Two important features of these results are the following: (i) a high percentage of significant coefficients and (ii) a high degree of conformity of their signs to theoretical and intuitive expectations.

Regarding the first point, we note that (see Table 6) introducing the time dimension has resulted in more than 60% of the values becoming significant whatever be the assumption concerning the variability of coefficients over time; this figure never exceeded 40% while using individual surveys. Further, Hypotheses B and C yield even greater and similar values (79% and 82% respectively). The same trend is observed for rural households.

Coming to the expected signs of cross price elasticities, though there is always a subjective element involved in the discussion, we decided to choose certain key products for which the nature of inter-relations can be predicted without much ambiguity and confront our intuitive expectations with the results obtained.

In particular, one can reasonably postulate the following pairs (or groups) of foods to be substitutes: (a) cereal based products Pasta, Bread, Cereals, (b) the two types of meat Meat and Chicken, (c) fresh vegetables (Vegetables)

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[10] In 1990, the selling price of sugar was 0.3 dinar per kilogram whereas its factor cost price was greater than 1 dinar (see Lahouel and Rejeb (1990)).

Table 6. Number of significant cross-price elasticities (urban)

	individual				pooled		
	1975	1980	1985	1990	same β's and γ's	different β's and same γ's	different β's and γ's
Pasta	5	3	3	5	5	8	7
Bread	3	2	3	4	9	10	9
Cereals	8	2	2	5	7	12	12
Sugar	3	0	0	1	5	10	10
Milk	5	2	7	3	11	10	11
Oil	4	2	4	2	7	10	7
Meat	0	7	5	10	10	10	9
Chicken	3	2	8	6	7	9	10
Can	2	1	3	5	4	6	10
Veg	2	3	4	5	8	9	10
Fruit	2	4	4	7	8	7	10
Misc	1	1	4	4	7	12	12
Nonfood	3	1	2	10	8	10	11
Total	41 (26%)	30 (19%)	49 (31%)	64 (41%)	96 (61%)	123 (79%)	128 (82%)

Table 7. Expected and actual signs of cross-price elasticities (urban)*

	predicted signs	individual				pooled		
		1975	1980	1985	1990	same β's and γ's	different β's and same γ's	different β's and γ's
Cereals-Pasta	+	−				−	+	+
Cereals-Bread	+	+	+		+	−	+	+
Pasta-Bread	+					+	+	+
Meat-Chicken	+		+	+	+	+	+	+
Can-Vegetables	+					+		+
Can-Chicken	+	+		+	+		+	+
Cereals-Meat	−		+			+	−	−
Pasta-Meat	−		−	+	+		+	
Bread-Meat	−			−	−	−	−	
Cereals-Chicken	−						−	−
Pasta-Chicken	−	+		+				
Bread-Chicken	−						−	−
Cereals-Vegetables	−			+	+		−	−
Pasta-Vegetables	−	+		−	−	−	−	−
Bread-Vegetables	−					−	−	−

* The signs reported in columns 3 to 9 are those of significant elasticities, blanks indicating non significant ones.

and canned vegetables (Can) and (d) fish (Chicken) and canned fish (Can). Similarly the following foods may be complements: (i) cereals and meats, (ii) cereals and vegetables.

We represent in the second column of Table 7 the expected signs of cross-

Table 8. Unit value equation results*

	H_A	H_B				H_C			
	β^1	β^1_{75}	β^1_{80}	β^1_{85}	β^1_{90}	β^1_{75}	β^1_{80}	β^1_{85}	β^1_{90}
Pasta	.007	.038	−.009	.007	−.002	.039	−.008	.008	−.004
	(2.8)	(6.9)	(−1.7)	(1.6)	(−0.6)	(6.7)	(−1.3)	(1.6)	(−1.0)
Bread	.020	.024	.015	.025	.015	.018	.014	.028	.012
	(11.4)	(6.7)	(4.5)	(8.5)	(4.8)	(4.7)	(3.7)	(8.8)	(3.7)
Cereals	.054	.056	−.130	.296	.016	.027	−.119	.280	.015
	(3.8)	(1.8)	(−5.7)	(12.2)	(0.6)	(0.8)	(−4.8)	(10.7)	(0.5)
Sugar	.018	.025	.019	.022	.011	.026	.019	.024	.010
	(8.7)	(5.9)	(4.6)	(6.3)	(3.1)	(5.9)	(4.2)	(6.3)	(2.9)
Milk	.048	.049	.049	.083	.022	.044	.056	.080	.015
	(6.7)	(3.1)	(3.3)	(7.0)	(1.8)	(2.6)	(3.5)	(6.2)	(1.1)
Oil	.037	.030	.053	.019	.054	.027	.050	.032	.049
	(5.5)	(2.2)	(3.9)	(1.6)	(4.9)	(1.9)	(3.3)	(2.6)	(4.1)
Meat	.029	.050	.044	.034	.009	−.001	.047	.034	.014
	(6.7)	(5.3)	(4.9)	(4.9)	(1.3)	(−0.1)	(4.8)	(4.5)	(1.8)
Chicken	.108	.125	.094	.123	.095	.116	.095	.124	.094
	(26.8)	(14.3)	(11.7)	(18.1)	(13.9)	(12.6)	(10.7)	(16.9)	(12.7)
Can	.010	−.009	−.017	.017	.010	.019	−.016	.015	.010
	(2.2)	(−0.9)	(−1.8)	(2.1)	(1.2)	(1.8)	(−1.5)	(1.7)	(1.2)
Veg	.077	.084	.072	.093	.059	.076	.073	.096	.059
	(16.9)	(8.9)	(7.8)	(12.1)	(7.5)	(7.6)	(7.2)	(11.5)	(6.9)
Fruit	.126	.122	.125	.170	.105	.103	.124	.179	.102
	(12.5)	(5.5)	(5.8)	(10.8)	(6.0)	(4.4)	(5.3)	(10.4)	(5.5)
Misc	−.023	.034	−.055	−.058	−.011	.041	−.043	−.068	−.008
	(−3.5)	(2.5)	(−4.2)	(−5.2)	(−1.0)	(2.9)	(−2.9)	(−5.6)	(−0.7)

* Figures inside brackets indicate *t*-values.

price elasticities for the products mentioned above[11] and in the remaining columns of the same table the actual signs obtained in the various estimations. Comparing each of columns 3 to 9 to the second one, we note that the models based on Hypotheses B and C seem to outperform A once again, and between B and C there is not much difference in the conclusions. Thus combining the observation that calculating different price elasticities for different surveys results in many of the values being not significant and/or of the wrong order of magnitude, with the observation that better estimates are obtained with pooled estimation taking into account the time variation in certain coefficients, we can say that the latter alternative seems to be more suitable to our study.

Unit value equations (quality effects)

Finally, a brief look at the quality effects estimated by our model. Observing Table 8 below, we note that homogeneous products like Bread, Sugar and Pasta have a very small quality effect less than 0.025. Other products like Milk,

[11] These are just a few possible combinations chosen to illustrate our point; other interesting observations may have a certain appeal, for instance chicken and fish (Chicken) are found to be substitutes for vegetables or fruits and vegetables are substitutes of each other and so on.

Vegetables, Chicken and Fruit have values that are three to six times the previous one. Looking at their evolution over time we can say that they increased until 1985 and there is a general decrease in 1990.

5. Conclusion

This paper presents a methodological extension of Deaton's model for estimating price elasticities by combining Tunisian data from several surveys to improve the inter-cluster variability of unit values which is one of the key elements used in the derivation of these elasticities. Since these surveys cover a period of 15 years, we have allowed for structural changes in consumption patterns that may have occurred over time. This is done by postulating that certain response coefficients of the basic model vary from one survey to the other, which is confirmed by the conclusions of various tests designed for this purpose. Above all, the own price and cross price elasticities calculated using appropriate estimates of the extended model are satisfactory both from the economic and statistical points of view. Thus they represent reliable information that can be used by economic policy makers.

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Appendix A

Table A1. Distribution of households and clusters by survey

year of survey	total population	number of households participating in the survey			number of clusters in the survey		
		urban	rural	total	urban	rural	total
1975	5,560,000	2578	2384	5962	249	230	479
1980	6,380,000	2658	3286	5944	238	280	518
1985	7,195,000	4171	3283	7454	368	279	647
1990	8,120,000	4477	3257	7734	390	276	666
total		13884	12210	26094	1245	1065	2310

Table A2. Real per capita expenditure (in Dinars)

	Mean	Index	Median	Index	% difference mean-median
Urban Area					
1975	445.5	100	290.8	100	53
1980	486.8	109.3	346.7	119.2	40
1985	573.2	128.7	395.6	136	45
1990	576.6	129.7	437.9	150.6	32
Rural Area					
1975	234.1	100	168.0	100	39
1980	242.6	103.1	172.8	102.9	40
1985	263.6	112.6	202.0	120.2	30
1990	313.1	133.8	249.1	148.3	26

Table A3. Evolution over time of the main administered prices

	Average Growth Rate between 1981 and 1988 (in %)		Average Growth Rate between 1988 and 1989 (in %)		Average Growth Rate between 1989 and 1990 (in %)	
	nominal	real	nominal	real	nominal	real
Bread						
Big Bread	7.5	−2.1	20.0	11.4	20.0	12.7
Thin bread	8.5	−1.5	14.3	6.1	8.5	1.9
Semolina	2.4	−4.9	12.9	4.8	2.4	−3.9
Pasta	4.9	−3.5	18.9	10.4	4.9	−1.5
Couscous	4.8	−3.6	18.5	10.0	4.8	−1.6
Mixed oil	3.0	−4.6	6.3	−1.3	5.9	−0.6
Sugar	3.7	−4.2	16.7	8.3	3.7	−2.6
Milk						
Sterilised in Carton	–*		18.8	10.3	15.8	8.7
Sterilised in Bottle	6.5	−2.6	17.9	9.5	15.2	8.1
Pasteurised in Brick	3.6	−4.2	19.2	10.7	19.4	12.1

* Carton milk was not used until 1988.

Appendix B: A brief description of Deaton's quality model

The unit value of a category i, UV_i, defined as the expenditure x_i on the item divided by the quantity consumed q_i, can be written as a product of two components: the price p_i and the quality v_i. Thus we have

$$\ln UV_i = \ln p_i + \ln v_i \tag{B1}$$

$$\ln x_i = \ln q_i + \ln UV_i = \ln q_i + \ln p_i + \ln v_i \tag{B2}$$

Following Deaton's (1987) definition of quality and assuming weak separability of preferences among different groups, one derives

$$\frac{\partial \ln v_i}{\partial \ln p_j} = \frac{\partial \ln v_i}{\partial \ln x_i}\left(\frac{\partial \ln x_i}{\partial \ln p_j} - \delta_{ij}\right) \tag{B3}$$

where δ_{ij} denotes the Kronecker delta. Deriving equation (B2) with respect to $\ln p_j$ yields:

$$\frac{\partial \ln x_i}{\partial \ln p_j} = \frac{\partial \ln q_i}{\partial \ln p_j} + \delta_{ij} + \frac{\partial \ln v_i}{\partial \ln p_j} \equiv \varepsilon_{ij} + \delta_{ij} + \frac{\partial \ln v_i}{\partial \ln p_j} \tag{B4}$$

Using the fact that[12]

[12] Note that $\frac{\partial \ln UV_i}{\partial \ln x} = \frac{\partial \ln v_i}{\partial \ln x}$ as $\frac{\partial \ln p_i}{\partial \ln x} = 0$ and under the separability assumption a change in x acts only through its effect on x_i.

$$\frac{\partial \ln v_i}{\partial \ln x} = \frac{\partial \ln v_i}{\partial \ln x_i}\frac{\partial \ln x_i}{\partial \ln x} = \frac{\partial \ln v_i}{\partial \ln x_i}\left(\frac{\partial \ln q_i}{\partial \ln x} + \frac{\partial \ln v_i}{\partial \ln x}\right)$$

or in the notation of our model (1) and (2)

$$\beta_i^1 = \frac{\partial \ln v_i}{\partial \ln x_i}(\varepsilon_i + \beta_i^1)$$

one obtains

$$\frac{\partial \ln v_i}{\partial \ln x_i} = \frac{\beta_i^1}{\varepsilon_i + \beta_i^1} \tag{B5}$$

where ε_i denotes the income elasticity.

Substituting (B4) and (B5) in (B3) and simplifying, we get

$$\frac{\partial \ln v_i}{\partial \ln p_j} = \frac{\beta_i^1}{\varepsilon_i}\varepsilon_{ij}$$

Therefore

$$\frac{\partial \ln UV_i}{\partial \ln p_j} = \frac{\partial \ln p_i}{\partial \ln p_j} + \frac{\partial \ln v_i}{\partial \ln p_j}$$

or in the notation of equation (2) of our model

$$\psi_{ij} = \delta_{ij} + \frac{\beta_i^1}{\varepsilon_i}\varepsilon_{ij} \tag{B6}$$

The income and price elasticities of our model are given by

$$\varepsilon_i = (1 - \beta_i^1) + \frac{\beta_i^0}{W_i}$$

$$\varepsilon_{ij} = -\psi_{ij} + \frac{\theta_{ij}}{W_i}$$

Substituting the above in equation (B6) one finally obtains

$$\psi_{ij} = \delta_{ij} + \frac{\beta_i^1 W_i\left(\dfrac{\theta_{ij}}{W_i} - \psi_{ij}\right)}{(1-\beta_i^1)W_i + \beta_i^0} = \delta_{ij} + \eta_i(\theta_{ij} - W_i\psi_{ij})$$

with obvious notation for η_i.

Writing the above equation in matrix form and rearranging, one obtains

$$\Theta = B'[I - D(\eta)B' + D(\eta)D(W)]^{-1} \tag{B7}$$

and the matrix of price elasticities

$$E = D(W)^{-1}\Theta - \Psi \tag{B8}$$

where in general $D(v)$ denotes a diagonal matrix having the elements of vector v as the diagonal.

Appendix C

Table C1. Income elasticities (23 products classification) (urban)

item	1975	1980	1985	1990
pasta	0.423	0.261	0.306	0.246
semolina and flour	0.614	0.358	0.444	0.441
couscous and m'hammas	0.346	0.269	0.156	0.160
great bread	0.483	0.293	0.233	0.208
other forms of wheat and barley	0.743	0.248	0.534	0.744
other cereal products	1.03	1.17	0.678	0.781
sugar	0.539	0.379	0.394	0.375
milk	0.775	0.878	0.706	0.678
milk derivatives	0.966	0.960	0.916	1.01
mixed oil	2.07	0.063	0.145	0.126
olive oil	0.918	1.07	0.853	0.921
mutton	0.916	0.877	0.794	0.910
beef	0.928	0.718	0.681	0.787
other red meat and slaughter	0.822	0.582	0.669	0.601
fresh fish	0.709	0.656	0.614	0.694
poultry and eggs	0.978	0.749	0.666	0.635
canned food	0.620	0.399	0.457	0.448
dry vegetables	0.664	0.638	0.440	0.647
fresh vegetables	0.642	0.475	0.475	0.491
fruits	1.01	1.23	0.800	1.05
meals & beverages taken outside	1.03	0.937	0.969	1.07
tea and coffee	0.564	0.437	0.446	0.498
other food products	0.710	0.878	0.824	0.770
non foods	1.08	1.23	1.19	1.12

Table C2. Own and Cross price elasticities matrix (Hypothesis C) (urban area)*

	Pasta	Bread	Cereals	Sugar	Milk	Oil	Meat	Chicken	Can	Veg	Fruit	Misc	Nonfood
Pasta	0.201	1.32	0.644	0.387	−0.034	0.185	0.033	−0.025	0.090	−0.298	−0.094	1.01	−3.78
	(0.88)	(10.1)	(41.0)	(4.96)	(−0.50)	(1.92)	(0.20)	(−0.25)	(1.11)	(−2.79)	(−2.07)	(11.4)	(−12.1)
Bread	1.07	−0.083	0.507	0.501	−0.599	0.112	−0.064	−0.683	−0.197	−0.303	0.053	0.981	−1.62
	(10.2)	(−0.71)	(49.1)	(10.3)	(−13.1)	(1.82)	(−0.58)	(−9.57)	(−3.83)	(−4.91)	(1.75)	(16.5)	(−7.98)
Cereals	1.72	1.67	−0.898	0.678	−0.873	0.675	−1.18	−0.503	−0.367	−0.410	−0.251	0.540	−1.63
	(40.6)	(48.5)	(−71.0)	(32.4)	(−31.0)	(18.0)	(−22.5)	(−14.1)	(−17.0)	(−11.5)	(−14.0)	(15.3)	(−13.6)
Sugar	0.835	1.34	0.550	0.033	−0.716	0.403	0.233	−0.493	−0.172	−0.448	0.064	0.976	−3.03
	(4.94)	(10.2)	(32.8)	(0.16)	(−12.3)	(5.39)	(1.61)	(−5.38)	(−2.20)	(−5.05)	(1.77)	(12.6)	(−10.7)
Milk	−0.032	−0.647	−0.276	−0.286	−0.265	−0.140	−1.02	0.894	0.231	0.591	−0.113	−0.816	1.18
	(−0.53)	(−13.0)	(−30.2)	(−12.2)	(−5.69)	(−2.91)	(−13.2)	(17.6)	(7.73)	(13.4)	(−4.72)	(−19.0)	(7.85)
Oil	0.192	0.140	0.272	0.198	−0.183	−2.05	−0.283	−0.464	−0.028	−0.017	−0.260	1.99	−0.157
	(1.85)	(1.71)	(18.1)	(5.33)	(−3.10)	(−16.0)	(−2.20)	(−5.58)	(−0.53)	(−0.20)	(−5.80)	(24.8)	(−0.47)
Meat	0.004	−0.041	−0.162	0.038	−0.450	−0.098	−1.39	0.168	−0.137	−0.274	−0.090	0.185	1.38
	(0.06)	(−0.80)	(−22.3)	(1.52)	(−13.9)	(−2.20)	(−13.3)	(3.52)	(−4.51)	(−6.79)	(−4.10)	(4.03)	(9.67)
Chicken	−0.024	−0.635	−0.135	−0.170	0.760	−0.317	0.346	−0.673	0.463	0.362	−0.138	−0.337	−0.171
	(−0.31)	(−9.56)	(−13.7)	(−5.37)	(17.5)	(−5.50)	(3.59)	(−8.18)	(11.7)	(6.84)	(−4.68)	(−6.34)	(−0.98)
Can	0.098	−0.264	−0.142	−0.084	0.295	−0.019	−0.362	0.686	−0.617	0.297	−0.109	0.308	−0.553
	(1.12)	(−3.81)	(−16.3)	(−2.15)	(7.95)	(−0.35)	(−4.06)	(12.0)	(−10.3)	(5.51)	(−4.29)	(6.29)	(−3.34)
Veg	−0.129	−0.164	−0.061	−0.089	0.295	−0.0002	−0.293	0.217	0.115	−0.593	−0.125	0.376	−0.041
	(−2.79)	(4.93)	(−10.7)	(−4.97)	(13.6)	(−0.01)	(−6.20)	(7.07)	(5.36)	(−15.1)	(−8.04)	(13.5)	(−0.39)
Fruit	−0.122	0.065	−0.109	0.032	−0.170	−0.288	−0.292	−0.228	−0.133	−0.368	−1.26	−0.314	2.30
	(−2.24)	(1.46)	(−13.7)	(1.61)	(−5.21)	(−5.79)	(−4.17)	(−4.88)	(−4.76)	(−8.54)	(−38.1)	(−7.35)	(16.0)
Misc	0.520	0.626	0.106	0.233	−0.515	0.971	0.244	−0.251	0.134	0.429	−0.142	0.474	−3.72
	(11.2)	(16.2)	(15.5)	(12.5)	(−20.0)	(24.9)	(3.76)	(−6.78)	(5.65)	(12.6)	(−7.57)	(10.1)	(−27.3)
Nonfood	−0.225	−0.131	−0.034	−0.083	0.050	−0.014	0.180	−0.030	−0.050	−0.045	0.103	−0.394	−0.484
	(−12.3)	(−8.76)	(−12.9)	(−10.8)	(4.93)	(−0.77)	(7.94)	(−2.17)	(−5.50)	(−3.12)	(14.5)	(−25.6)	(−7.56)

* Figures inside brackets indicate *t*-values.