Lithuania's Food Demand During Economic Transition

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Abstract

The linear approximate version of the AIDS model is estimated using data from the Lithuanian household budget survey covering the period from July 1992 to December 1994. Price and real expenditure elasticities for twelve food groups were estimated based on the estimated coefficients of the model. Very little or nothing is known about the demand parameters of Lithuania and other former socialist countries, so the results are of intrinsic interest. Estimated expenditure elasticities were positive and statistically significant for all food groups while all own-price elasticities were negative and statistically significant, except for that of eggs which was insignificant. Results suggest that Lithuanian household consumption did respond to price and real income changes during their transition to a market-oriented economy.

Keywords: transition economies, food demand, LA-AIDS, fixed effects model.

LITHUANIA’S FOOD DEMAND DURING ECONOMIC TRANSITION

Introduction

Since gaining their independence from the former Soviet Union, Lithuania and other former Soviet Republics, as well as other eastern European countries, are experiencing major economic reforms. These reforms include privatization of property, liberalization of prices, and withdrawal of government subsidies for inputs and outputs. The market-oriented reform measures have resulted in rapid increases in prices, severe erosion of real income and purchasing power, and major reallocation of resources within these societies. Although the transition policies have had effects specific to each country, the general experience has been that, for the vast majority of the population in these countries, the reforms have brought severe hardship through higher prices, lower real income, and lower real wages.

Lithuania was one of the early adopters of market-oriented economic reforms and its experience makes evidence from this country useful for on going evaluation of reforms for both Lithuania and other emerging market economies. In addition, Lithuania is one of the transition economies for which relatively detailed household surveys are available that provide information on income sources, demographics, and consumption patterns of households. To date, very little is known about the consumption patterns of Lithuanian households and how households have adjusted to the economic reform measures. The household data provide a unique opportunity to obtain estimates of demand parameters that are important for other economic analyses.

Lithuania was among the most developed and industrialized economies of the former Soviet Union, with per capita gross domestic product (GDP) in the 1990s about 50 percent higher than that of Russia (OECD, 1996). Following the adoption of price liberalization, however, GDP fell significantly after 1990 before showing signs of growth in 1994. Prices increased sharply during 1991 and 1992. The official annual inflation rate soared to 383 percent in 1991 and 1,163 percent in 1992 before moderating to 45 percent in 1994 and 36 percent in 1995 (OECD 1996). Real wages in the public sector fell dramatically through 1993 and since then have improved slightly (OECD, 1996). Initially, increases in wages and social benefit payments partly compensated for the price increases. But, budgetary pressure made it increasingly difficult for the government to increase social benefit payments in line with price increases.

The average level of food consumption in Lithuania during the late 1980s was quite high, especially relative to per capita income. Consumption of milk and milk products was particularly high. The high per capita consumption reflected both abundance of supply and a high consumer subsidy that resulted in low prices at retail levels. Following the liberalization of prices, however, as output of livestock products fell, prices rose sharply and consumption dropped dramatically. Between 1990 and 1996, per capita consumption of beef, pork, and eggs fell by more than 40 percent, milk consumption fell by about 36 percent, whereas that of potatoes declined by about 13 percent, as shown in Table 1. On the other hand, per capita consumption of grain-based products increased. Per capita consumption data thus suggest that as relative prices changed and real income fell, consumption of relatively expensive products declined. Specifically, grains, fruits, and vegetables were substituted for more expensive food items.

This paper reports the results of an analysis of consumption expenditures of Lithuanian households during the economic transition period of the 1990s. Demand system parameters are estimated using a panel structure of the household budget survey data and linear approximation version of the almost ideal demand system (AIDS) model of Deaton and Muellbauer (1980). The plan of the paper is as follows: Section 2 describes the data and panel consruction; Section 3 outlines model specification and estimation methods; and Section 4 presents empirical results, followed by a concluding section.

Data

Data used in the study came from the Lithuanian Household Budget Survey (HBS). Introduced in 1992, the HBS was designed to be nationally representative of Lithuanian households (Òniukstiene, Vanagaite, and Binkauskiene, 1996) and replace the traditional Soviet Family Budget Survey (Atkinson and Micklewright, 1992). The design included monthly surveys of households where households were included in the survey for 13 months. This allowed for a sample rotation with 1 of every 13 households replaced each month. The stratified survey design included samples from urban (Vilnius and other urban areas) and rural areas and from different income levels. The income levels were set by ad hoc intervals in 1992 and 1993, and by deciles in 1994 (Cornelius, 1995). Although the HBS marked a significant improvement over the earlier survey, in practice the implementation suffered from certain weaknesses associated with the sample not being fully random as well as from nonresponse because not all households completed the full 13-month period of inclusion in the survey design. In total, about 1,500 households were surveyed in each month. Despite the problems, the 1992–94 HBS provides current and complete consumption and expenditure data for the period of interest. Review of the data with other, aggregated consumption data did indicate the data to be a good measure of consumption trends and representative of the national population.

Panel Data Construction

As mentioned earlier, all households did not complete the full 13-month period of inclusion in the survey. The procedure for household replacement (replacement of a household dropping out of the survey by another household of similar type) was not tightly controlled or properly recorded during the survey. Consequently, the survey design does not allow for uniquely identifying households from month to month for construction of a panel of data at the household level. Alternatively, for this analysis, monthly household data for the period July 1992 through December 1994 were used to create panel data for 40 representative household groups, defined by household size, level of total (per capita) expenditures, and location (rural/urban).

The panel of the 40 representative household groups was constructed as follows. First, households were classified into five quintiles on the basis of per capita total household expenditures. Second, within each per capita expenditure quintile, households were classified into rural and urban households. This two-level classification (quintiles and rural/urban) yielded 10 household groups (5x2). Third, each group of households was then further classified according to household size. This third-level classification took into account the distribution of household sizes in the whole sample and yielded a reasonably balanced distribution of observations in different cells in the three-level classification. Once the classes were selected, the means of different variables in each of the cells were used as representative values of the corresponding variables in the data set. This procedure generated 40 observations for each of the 30 months of data, for a total of 1,200 observations.

Prices and Expenditures

The survey instrument was used to collect detailed information on household expenditures for various food and nonfood commodities and services, as well as demographic and income data. Information was collected on more than 65 food items for each month, during which households reported their weekly expenditures and corresponding quantities on each of the food items. The nominal expenditure was divided by quantity data to obtain a unit-value. The unit-values of different food items were used as prices. However, because observed variations in unit-values across households could be due to quality differences as well as actual differences in price distributions, the average (mean) unit-value of a commodity was used as the price that all households faced. Separate prices were computed for rural and urban households to allow for price variation across the two regions (rural/urban). It was implicitly assumed that all households within the same region (rural/urban) and at any particular time faced the same set of prices.

Expenditure on each food item included purchased food plus the value of nonpurchased food items. In addition to providing data on purchased quantities and monetary values, the survey provided information on the quantities of food that were not purchased (such as food from home production, gifts, free food, and so forth). The nonpurchased quantities were assigned monetary values by evaluating them at (mean) unit-values and these values were then added to expenditures on purchased food items. The nonpurchased quantities were evaluated separately for rural and urban households by using appropriate unit-values. Nonpurchased food represented about 30 percent of total food expenditure for rural households and a slightly lower share for urban households.

For estimation purposes, expenditures on various food commodities were aggregated into 12 categories: grains, fruits and vegetables, beef, pork, poultry, eggs, other meat products (including processed meat), fluid milk, butter and cheese, other dairy products, sugar and confectionery items, and *other food* (which includes fats, fish, spices, nonalcoholic beverages, and other minor items). Expenditure shares on fat and fish were found to be small; consequently, a decision was made to relegate them to the other food category.

Model and Empirical Specification

The conceptual framework and empirical specification of the demand system took advantage of the panel structure of the data to account for variation across households and over time. Ideally, in order to be able to make unconditional inferences about the population from which the sample of households were drawn, one should use a random effects model. However, estimation of the random effects model requires cross-sectional variation in all explanatory variables. In addition, a random effects model is appropriate if the individual effects are uncorrelated with other regressors in the model. In the data set used in this study, there is no cross-sectional variation in prices; only household expenditures vary across cross-sectional units. The fact that only one regressor (i.e., expenditure) has cross-sectional variation suggests that several key household-specific variables have been omitted, and their effects are combined into the household-specific intercept terms, the *individual effects*. This in turn makes it more likely that these individual effects are correlated with the one regressor that does vary across households. In addition, as discussed earlier, the survey design used to collect household data resulted in the sample being not fully random.

Because of these factors, a decision was made to estimate the fixed effects model (otherwise known as the Least Squares Dummy Variables model [LSDV]). In this framework, the effects of cross-sectional variation (effects of variables that vary across households but remain fixed over time) and time-specific effects (effects of variables that are the same across households but change over time) were captured by allowing the intercept terms of the demand equations to vary across cross-section and across time.

The linear approximate version of the almost ideal demand system (LA-AIDS) of Deaton and Muellbauer (1980), that uses Stone's (expenditure) share-weighted price index instead of the non-linear general price index of the full AIDS model, is used to estimate the demand system. The LA-AIDS model is augmented to incorporate the effects of cross-sectional variation and time-specific effects. The cross-sectional (henceforth household effect) and the time-specific effects (henceforth time effect) are assumed to be fixed in the LSDV version of the LA-AIDS model. Apart from its aggregation properties that allow interpretation of the demand parameters estimated from household data to be equivalent to those estimated from aggregate data, the LA-AIDS model is popular in empirical analysis because of the model's linearity in terms of its parameters.

The AIDS model is derived from an expenditure function and can be expressed as

$$w_i = \alpha_i^* + \sum_{j=1}^{K} \gamma_{ij}^* \ln p_j + \beta_i^* \ln\left(\frac{x}{P}\right) + \eta_i \ , \qquad (1)$$

where w_i is the expenditure share of the i^th^ good, p_j is the price of the j^th^ good, x is the total (nominal) expenditure on food, h_i is the error term, and lnP is the general price index which, in the case of the LA-AIDS model, is approximated by the Stone's price index as

$$\ln P = \sum_{j=1}^{K} w_j \ln p_j \ . \qquad (2)$$

Denoting *real expenditure,* $\left(\frac{x}{P}\right)$, by y, and augmenting Equation (1) to incorporate the household and time effects, the LSDV version of the LA-AIDS model can be expressed as

$$w_{iht} = \alpha_i + \mu_{ih} + \lambda_{it} + \sum_{j=1}^{K} \gamma_{ij} \ln p_{jt} + \beta_i \ln y_{ht} + u_{iht}, \ \ h = 1, 2, ¼, H, \ t = 1, 2, ¼, T. \qquad (3)$$

where w_{iht} is the expenditure share of the i^{th} food group for household h specific to time period t, α_i is the average intercept term (for the i^{th} good), m_{ih} represents the difference between α_i and the intercept term corresponding to i^{th} good and h^{th} household, and l_{it} is the difference between α_i and the intercept term for the i^{th} good and t^{th} time period. At any given time period, the parameter m_{ih} captures the influence (on the demand for the i^{th} good) of the variables that vary across households but remain constant over time. The parameter l_{it} reflects the influence (on the demand for i^{th} good) of those factors that are common to all households and change over time. The household effects (m_{ih}) and time effects (l_{it}) are assumed to be fixed. There are H number of cross-sectional units (households) and T time periods. It assumed that vector of disturbances corresponding to the ith good and hth household, u_{ih}, has the property that $E[u_{ih}] = 0$, $E[u_{ih}u'_{ih}] = \sigma_i^2 I$ (σ_i^2 is the variance corresponding to ith equation), and $E[u_{ih}u'_{ij}] = 0$ for h ¹ j. To satisfy the properties of homogeneity, adding-up, and Slutsky symmetry, the parameters of Equation (1) are constrained by $\sum_i a_i = 1$, $\sum_i \beta_i = 0$, $\sum_i \gamma_{ij} = \sum_j \gamma_{ji} = 0$, and $\gamma_{ij} = \gamma_{ij}$. Further, to avoid the dummy variable trap in the LSDV model, the above model is estimated with restrictions $S_h m_{ih} = 0$ and $S_t l_{it} = 0$.

The demand system is estimated under the implicit assumption that households treat market prices as predetermined. Although the study covers a period when there were supply disruptions and significant price increases, we assume that individual households acted as if their individual purchase decisions did have an effect on market prices. Under this assumption, consumption demand was modeled with prices taken as predetermined.

The LA-AIDS formulation is not derived from any well-defined preferences system, and is only an approximation to the nonlinear AIDS model. Moschini (1995) demonstrates that the Stone's price index is not independent of the choice of any arbitrary unit of measurement for prices. Consequently, the estimated parameters from the LA-AIDS model based on Stone's price index may contain undesirable properties. To avoid such potential problems, we follow Moschini's (1995) suggestion to define the price indices for each commodity group in units of the mean of the price series (i.e., $p_j^* = (p_j / \mu_{p_j})$, where p_j is the price index of commodity group j, and μ_{p_j} is the mean of p_j).

Model Estimation

The demand system model (Equation 3) is estimated with the data set described in Section 2. Under with the restrictions of the AIDS model, one equation is deleted in the estimation process. The model is estimated with dummy variable restrictions along with the homogeneity and Slutsky symmetry restrictions (i.e.,$S_j g_{ij} = 0$, and $g_{ij} = g_{ji}$) as a maintained hypotheses. Since the observations of the panel data used to estimate the above system are group averages, the use of these averages directly in the estimation would lead to heteroscedasticity unless all group sizes are equal. In order to correct for this problem, each of the variables in the data set is transformed as

$$z_g^* = \sqrt{n_g} \cdot z_g \tag{4}$$

where the subscript g refers to the group g, and n_g is the number of households in group g . The transformed variables are then used to estimate the coefficients of the demand model.

Empirical Results

The demand system specified by Equation (3) was estimated for 12 food groups (i=1, 2, ¼, 12);

- i = 1 is expenditure on grains,
- i = 2 is fruits and vegetables,
- i = 3 is beef,
- i = 4 is pork,
- i = 5 is poultry,
- i = 6 is eggs,
- i = 7 is other meat products (including processed meat),
- i = 8 is fluid milk,
- i = 9 is butter and cheese,
- i = 10 is other dairy products,
- i = 11 is sugar and confectionery items, and
- i = 12 stands for other food items.

This last group was the omitted group in the estimation of the system. The model was estimated using the statistical package TSP (1995). Visual inspection as well as statistical tests did not show evidence of heteroscedasticity and serial correlation.

The estimated coefficients of the demand system along with the t-ratios are reported in Table 2. Other coefficients of the system, including those of the deleted equation, can be recovered from the restrictions imposed in the estimation process. As shown in Table 2, most of the estimated coefficients are statistically significant at the 5 percent level. Also, it can be noted from the last column of Table 2 that the coefficients of real expenditure are statistically significant for all commodity groups. Similarly, all of the own-price effects are statistically significant, as shown along the diagonal of Table 2. But, economic theory does not imply any particular sign for any of the coefficients as these coefficients are associated with the logarithm of prices rather than levels of prices.

The elasticities of demand (price and expenditure elasticities) were estimated by the methodology suggested by Green and Alston (1990, 1991). The Marshallian (uncompensated) elasticities for the LA/AIDS model are derived as:

$$\eta_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}(w_j + \sum_{k=1}^{K} w_k \ln p_k)(1 + \sum_{k=1}^{K} \beta_k \ln p_k)^{-1}, \text{ and}$$

$$\eta_E = 1 + \frac{\beta_i}{w_i}(1 - \sum_{j=1}^{K} w_j \ln p_j)$$

where d_{ij} = 1 for i = j, and d_{ij} = 0 for i ¹ j.

The estimated uncompensated (Marshallian) elasticities along with their t-ratios are presented in Table 3. The t-ratios were estimated using bootstrapping methods at mean levels of prices and expenditures. Based on the model specification, these elasticities should be interpreted as conditional elasticities where it is assumed that the relative price changes within the food groups do not affect the real expenditure on food. Also, it is implicitly assumed that short-run dynamics in the adjustment of food expenditure patterns have been fully incorporated within the time period.

Discussion

The estimated price and expenditure elasticities seem to be reasonable: all own-price elasticities are negative and statistically significant except for that of eggs. Most of the cross-price elasticities are statistically significant and many of them are positive. All expenditure elasticities are positive and statistically significant. It may be noted that expenditure elasticities for grains, eggs, fluid milk, butter and cheese, and other dairy products are less than unity indicating that consumers treat these commodities as essentials. On the other hand, expenditure elasticities for beef, pork, poultry, sugar and confectionery items, and other food items are higher than unity, whereas those for fruits and vegetables and other meat (including processed meat) are slightly above unity. This suggests that, as real income of the consumers fell, major consumption reductions came in the meat (except processed meat products, identified as other meat), sugar and confectionery items, and other food items. Expenditure reductions on fruits and vegetables and other meat were almost proportional to the income decline. On the other hand, expenditure on grains, eggs, and various dairy products fell less than proportionately as real income was eroded by inflation. This is not surprising given the economic hardship experienced by the people of Lithuania during the period under consideration. The estimated expenditure elasticities are relatively high compared to those found in most developed countries, and they are comparable to those found for less developed societies. In that sense, the relatively high expenditure elasticities are reflective of the economic condition of Lithuanian households during the transition period.

Estimated (uncompensated) price elasticities show that all of the own-price elasticities are negative, which is consistent with economic theory. Most of the own-price elasticities are less than unity as is expected for food commodities. These elasticities are expected to be *low* for essential commodities and relatively high for commodities that are not *essential* items. This is reflected by the low estimated own-price elasticities for grains (-0.44), other dairy (-0.51), fluid milk (-0.59), and relatively high elasticities for pork (-1.92), other food

(-1.35), butter and cheese (-1.49), and other meat (-1.12). Estimated cross-price elasticities suggest that consumption of grains did not respond to changes in dairy product prices; demand for various meat categories was insensitive to changes in the price of poultry (which account for about 10 percent of total meat consumption); and consumption of fruits and vegetables was unaffected by changes in the prices of meat and dairy products. Other cross-price elasticities seem to be reasonable both in terms of their magnitudes as well as their signs.

Although the parameter estimates and estimated price and expenditure elasticities seem reasonable based on other studies on consumption, it is difficult to compare these estimates with others because few studies on the consumption patterns of the formerly socialist societies exist. Also, the period under consideration is one during which the society as a whole underwent significant economic and political change with supply disruptions and price increases. Also, it should be noted that the parameters and elasticities are estimated under the assumption that the food consumption depends on the amount of (real) income devoted to food commodities (i.e., the utility function is at least weakly separable). Therefore, the estimates are essentially conditional estimates. Other estimates by the authors found the expenditure elasticity for food estimated in a total demand system to be 0.98.

Other Tests

The empirical results presented previously are based on the model specified in Equation (3), which assumes that cross-section household units and time variation have important effects on household food expenditure patterns. This assumption can be verified by testing with a standard F-test, the null hypothesis that all m_{ih} and l_{it} coefficients are simultaneously equal to zero. The test yielded an estimated value of the test statistic equal to 23.85, which exceeds the 95 percent critical value of the F-distribution (with appropriate degrees of freedom). Hence, the null hypothesis of no cross-section and time effects is rejected at a conventional significance level.

The estimated demand system incorporates the zero-degree homogeneity and symmetry restrictions as implied by economic theory. The a priori imposition of the zero-degree homogeneity restriction presupposes that the consumers do not suffer from *money illusion*. The fact that the data for this study cover a period during which Lithuania experienced large absolute and relative price changes makes formal testing of the assumption all the more interesting. Accordingly, we tested for the validity of the assumption of the (zero-degree) homogeneity of the demand system. The formal test uses the likelihood ratio test for the system as a whole and the F-test for individual equations. The likelihood ratio test yielded an estimated test statistic of 395.6, which exceeds the 95 percent critical value of the Chi-square distribution (with appropriate degree of freedom), implying that the system as a whole did not satisfy the zero-degree homogeneity restriction. The results from the F-test for individual equations revealed that only three commodity groups (namely poultry, sugar and confectionery items, and other food) satisfied the restriction at a 5 percent level while the restriction could not be rejected at the 1 percent level for fruits and vegetables, beef, and other meat. Test results for all other groups contradicted the validity of the zero-degree homogeneity restriction and suggest the presence of money illusion for many of the food groups. Finally, the likelihood ratio test of homogeneity and (Slutsky) symmetry restrictions yielded a test statistic of 769.2, which exceeded the 95 percent critical value of the Chi-square distribution (with appropriate degrees of freedom). This indicates that the data reject the homogeneity and symmetry restriction as implied by economic theory.

Conclusion

Economic reforms in the 1990s in Lithuania have brought significant changes in terms of prices and real income of households. Faced with rising prices and falling purchasing power, consumers had to make major adjustments in their consumption patterns. Consumption of expensive food items such as meat and meat products, and dairy products fell substantially as consumers substituted less expensive grain-based items, as well as fruits and vegetables.

Household consumption data reveal that during the transition period examined here, households were responsive to changes in prices and household purchasing power. Estimated expenditure elasticities were positive and statistically significant for all food groups as is expected. The magnitudes of the estimated elasticities, however, are higher than those estimated for developed countries. These magnitudes are consistent with those found in relatively low-income countries and reflect the economic hardship faced by Lithuanian households. The estimates suggest that expenditures on commodities such as beef, pork, and sugar and confectionery items fell rather significantly while those for grains, eggs, and miscellaneous dairy products fell less than proportionately. Price elasticities for the major food groups are also relatively high compared to those found in developed countries despite allowances for home production of food. This finding indicates that demand for food commodities in Lithuania is quite price sensitive. Estimated cross-price elasticities suggest that as relative prices changed, households adjusted their food consumption patterns through substitution among competing food items.

Table 1. Annual consumption of main food products, kg/capita

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Bread	110	110	111	104	108	138	134.0	114.5	125.7	133.9	143.9
Potatoes	138	139	143	145	146	128	95	122	100.0	127.1	133.1
Fruits & Vegetables	143	128	133	137.5	112	134	94	122.7	104.1	98.8	133.1
Meat (total)	83.6	84.9	87.3	83.4	88.9	65.5	70.3	57.9	53.8	57.7	55.1
Pork	37.8	39.9	39.3	39.1	39.9	28.5	28.6	20.8	22.3	23.3	23.2
Poultry	7.5	7.6	8.7	9.2	9.6	6.4	8.1	5.5	6.1	6.8	8.0
Beef	37.5	36.6	38.5	34.8	39.1	30.6	33.1	31.0	24.8	26.9	23.3
Milk[a]	431	438	441	447	480	315	334	319	291	238	213
Eggs[b]	305	317	319	319	305	293	216	148	175	180	173
Sugar[a]	44	47	50	47	43	31	27.4	24.8	21.9	31.0	36.3

Source: Data for 1986–91 period come from OECD (1996) and those for the 1992–96 period from FAO data, FAOSTAT. The data come from the Food Balance Sheet for Lithuania at *http://apps.fao.org.*

[a] FAO data for milk represent fluid milk whereas OECD figures for milk represent fluid milk plus milk equivalent of other dairy products. For consistency, milk consumption data for 1992–96 period were obtained from the Department of Statistics, Lithuanian Ministry of Agriculture through personal contact.

[b] Consumption of eggs is measured in number/capita.

Table 2. Estimated coefficients and t-ratios: Major food groups[a,b]

	Grains	Fruits & Veg.	Beef	Pork	Poultry	Eggs	Other Meat	Milk	Butter & Cheese	Other Dairy	Sugar & Confec.	Real Expenditure
Grains	0.051*	0.14*	0.039*	0.030	-0.035*	-0.008	-0.072*	0.005	-0.014	-0.007	-0.036*	-0.032*
	(6.20)	(4.07)	(4.87)	(1.81)	(-4.38)	-(1.16)	(-4.42)	(1.15)	(-1.87)	(-0.63)	(-2.32)	(-37.75)
Fruits & Veg.		0.025*	-0.007*	-0.0003	0.012*	-0.008*	-0.022*	0.017*	-0.004	-0.002	-0.017*	0.014*
		(8.02)	(-3.02)	(-0.06)	(5.41)	(-4.44)	(-3.89)	(8.89)	(-1.42)	(-0.40)	(-3.32)	(10.09)
Beef			0.010*	0.102*	-0.009	-0.018*	-0.011	-0.016*	-0.060*	-0.036*	-0.029*	0.010*
			(2.28)	(9.62)	(-1.66)	(-3.80)	(-0.91)	(-5.94)	(-11.53)	(-5.72)	(-2.83)	(2.79)
Pork				-0.143*	-0.001	0.054*	-0.019	-0.014*	0.106*	0.001	-0.017	0.026*
				(-4.91)	(0.06)	(5.91)	(-0.89)	(-2.85)	(10.77)	(0.05)	(-0.86)	(36.26)
Poultry					0.054*	-0.004	0.059*	-0.006*	-0.050*	0.007	0.027*	0.004*
					(2.60)	(-0.85)	(5.29)	(-2.52)	(-9.50)	(1.16)	(2.75)	(10.86)
Eggs						0.002	0.003	-0.004*	-0.023*	-0.006	0.016	-0.013*
						(0.38)	(0.34)	(-2.24)	(-4.72)	(-1.39)	(2.05)	(-43.73)
Other Meat							-0.025*	-0.016*	0.047*	0.028	-0.007	0.009*
							(-2.67)	(-2.36)	(3.95)	(1.73)	(-0.27)	(8.62)
Milk								0.027*	-0.009*	0.006	0.018*	-0.011*
								(8.66)	(-3.09)	(1.01)	(2.79)	(-16.37)
Butter & Cheese									-0.043*	-0.005	0.033*	-0.024*
									(-5.54)	(-0.64)	(3.17)	(-49.21)
Other Dairy										0.018*	-0.034*	-0.019*
										(2.61)	(-2.32)	(-12.57)
Sugar & Confec.											0.027*	0.019*
											(2.94)	(18.19)

[a] Figures in parentheses denote t-ratios.
[b] Asterisk denotes that the coefficient is significant at the 5 percent level.

Table 3. Estimated price and expenditure elasticities[a]

	Grains	Fruits & Veg.	Beef	Pork	Poul.	Eggs	Other Meat	Milk	Butter & Cheese	Other Dairy	Sugar & Confec.	Other Food	Real Expenditure
Grains	-0.440*	0.224*	0.453*	0.343	-0.363*	-0.071	-0.691*	0.076	-0.122	-0.057	-0.348*	0.381*	0.66*
	(-6.48)	(4.23)	(5.05)	(1.87)	(-4.23)	(-0.96)	(-2.33)	(1.40)	(-1.65)	(-1.21)	(-2.23)	(4.33)	(41.95)
Fruits & Vegetables	0.057	-0.902*	-0.039	-0.006	0.052	-0.037	-0.111	0.072*	-0.023	-0.011	-0.080*	-0.042	1.06*
	(1.94)	(-14.30)	(-1.29)	(-0.16)	(1.16)	(-0.81)	(-2.80)	(2.65)	(-1.63)	(-0.10)	(-2.44)	(-1.62)	(4.24)
Beef	0.317*	-0.078*	-0.927*	0.844*	-0.075	-0.150*	-0.110	-0.139*	-0.507*	-0.303*	-0.255*	0.285	1.47*
	(4.86)	(-3.02)	(-3.88)	(9.61)	(-1.76)	(-2.81)	(-1.19)	(-5.16)	(-7.54)	(-3.69)	(-5.67)	(1.83)	(5.67)
Pork	0.366	-0.081	1.314*	-1.926*	0.001	0.704*	0.325*	-0.209*	0.382*	-0.005	-0.259	-1.354	1.35*
	(1.78)	(-0.78)	(9.49)	(-4.67)	(0.04)	(4.77)	(0.95)	(-3.04)	(6.63)	(-0.45)	(0.92)	(-1.79)	(14.36)
Poultry	-1.713	0.538*	-0.430*	0.015	-0.810*	-0.177	2.816*	-0.304*	-2.436*	0.331	1.289*	-0.320*	1.19*
	(-1.37)	(2.37)	(-2.69)	(0.48)	(-3.89)	(-0.90)	(2.58)	(-9.53)	(-2.58)	(1.28)	(2.73)	(-4.32)	(16.32)
Eggs	-0.173	-0.124	-0.441*	1.40*	-0.083	-0.937	0.143	-0.080*	-0.485*	-0.141	0.438*	-0.184*	0.68*
	(-1.10)	(-1.31)	(-3.67)	(5.95)	(-0.63)	(-1.01)	(0.41)	(-2.01)	(-5.12)	(-1.91)	(2.12)	(-2.54)	(17.66)
Other Meat	-0.349*	-0.115*	-0.054	-0.094	0.282*	0.013	-1.129*	-0.077	0.222*	0.133	-0.038	0.162	1.04*
	(-4.44)	(-2.92)	(-0.95)	(-0.90)	(4.26)	(0.29)	(-2.24)	(-1.45)	(2.41)	(1.91)	(-1.84)	(1.64)	(6.82)
Milk	0.090	0.290*	-0.235*	-0.196*	-0.086	-0.053	-0.197*	-0.587*	-0.121*	0.096	0.284*	-0.114*	0.84*
	(1.23)	(2.89)	(5.75)	(-2.78)	(-1.35)	(-1.52)	(-2.28)	(-10.02)	(-2.91)	(0.67)	(2.86)	(-2.67)	(12.21)
Butter & Cheese	-0.151	0.018	-0.767*	1.390*	-0.639*	-0.246*	0.671*	-0.095	-1.492*	-0.049	0.450*	0.231*	0.69*
	(-1.74)	(1.27)	(-11.23)	(5.84)	(-4.46)	(-3.31)	(4.23)	(-1.80)	(-6.64)	(-1.27)	(3.27)	(11.05)	(23.05)
Other Dairy	-0.125	0.059	-0.877*	0.053	0.192	-0.137*	0.832	0.189	-0.084	-0.513*	-0.837*	0.810*	0.51*
	(-0.57)	(0.34)	(-5.57)	(1.09)	(1.28)	(-2.20)	(1.79)	(1.13)	(-0.52)	(-4.86)	(-2.26)	(4.63)	(15.49)
Sugar & Confectionery	-0.395*	-0.220	-0.313*	-0.193	0.277*	0.159*	-0.117	0.174*	0.323*	-0.363*	-0.744*	0.194	1.21*
	(-2.36)	(-1.39)	(-2.92)	(-0.89)	(2.66)	(2.19)	(-0.31)	(2.68)	(3.07)	(-2.06)	(-2.69)	(1.12)	(13.70)
Other Food	0.421*	-0.156	0.455*	-1.326*	-0.087	-0.116	0.410	-0.125*	0.195*	0.382*	0.244*	-1.350*	1.21*
	(2.15)	(-1.78)	(2.25)	(-3.85)	(-1.03)	(-0.88)	(1.89)	(-3.55)	(2.11)	(4.84)	(3.35)	(-6.47)	(14.15)

[a] Price and expenditure elasticities are computed at mean values of expenditure shares.
[b] Figures in parenthesis denote t-ratios, and asterisks denote that the estimated elasticity is statistically significant at the 5 percent level

End Notes

[1]The use of a fixed effects model rather than the random effects model implies that the inferences drawn from the results of the model are conditional on the cross-sectional units in the sample. As such, results of the study are to be interpreted with this in mind.

[2]See Judge et al., chapter 13 for discussion of the estimation procedure.

[3]Bartlett's test (see Judge et al., p. 447) on the residuals from each equation did not suggest the presence of heteroscedasticity. Also, a test of serial correlation did not indicate any evidence of the problem.

[4]There is some disagreement in the literature regarding the appropriate formula for estimating elasticities in the LA/AIDS model. This is due to the fact that the LA/AIDS model is only a linear approximation of the full AIDS model (see Hahn 1994 and Buse 1994 on this issue).

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