The Influence of Price on Supply and Demand for Meats in Greece

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Abstract: Analysis of slaughter data leads to substantial intermediate supply elasticities with respect to price for mutton and lamb, goat and kidmeat, and beef and veal, due mainly to increased finishing of younger animals to heavier weights. Long-term elasticities are in the range of 0.65 to 2.00, 1.36 to 1.78, and -0.97 to 3.44, respectively For pigmeat and poultrymeat, those long-run supply responses can be regarded as virtually unbounded in the positive direction. Analysis of milking animals and milk produced leads to somewhat inconsistent results for ewes and goat does—numbers milked appear to respond positively to meat prices and negatively to milk prices. The supply elasticity for number of cows milked, however, appears to be substantial and positive. Demand analysis, subject to many stochastic prior restraints across the four classes of meat, leads to adverse trends against agnate meats and positive trends for other meats. Substantial positive income elasticities are estimated for all meats. The price-demand matrix is consistent and orthodox except for an asymmetric tendency.

Introduction

Ideally one would like to construct and justify two sets of relationships: one for the supply of each farm product with respect to the price of each and another for the demand for every food with respect to the price of each. One might also wish to fill in something about the recipes for making food out of agricultural produce and about the price (margin) policies of traders and trading institutions, even if the policies and (observed) margins have been too sensitive to paternalistic controls to leave much room for fruitful empirical analysis.

The usual excuse for such econometric ambitions is that their results would help policy makers control the agricultural sector through prices and other indirect policy instruments and perhaps assess the outcome of those policies in terms of the welfare of interested parties. But two-way traffic occurs here. Unless the government allows prices to move independently of each other and of corresponding production costs, sorting out the different price influences using time series analysis is virtually impossible. Relying to a greater extent on normative analysis would then be proper. Unless the production and demand responses are constrained to fit some theory of producer/consumer welfare, leaning on them in customary welfare analysis is difficult. They may (with luck) be used to predict quantities and monetary flows consequent to price policies but not standard shifts in producer or consumer surplus.

The supply analysis presented in Table 1 (pp. 156-157) is about sequences of production responses with respect to own-product prices. The analysis is incomplete in that it manifestly understates the influence of feed costs on the output of pig and poultrymeat, fails to incorporate cross-relationships among products, and has not been updated. We had considerable difficulty in treating cross-relationships with milk in a consistent manner, though they must be of importance at certain stages, especially in the feeding of young animals. The sequences are estimated directly from slaughterings. For various reasons, intake for slaughter outside the province is usually about twice as elastic as intake for local slaughter, but the detail is not given here.

In the basic model, the effects of current prices and prices over the previous 3 years are estimated holding constant the level of production 2-3 years ago. As about half of the relevant breeding herds could be expected to survive over 2½ years, about half of the total price response should be implicit in the lagged product. The restrictions used do not force that conclusion; they merely suggest a range almost certainly within *(0, 1)* for b centred on 0.5. The explicit price responses cover at least three kinds of reactions: an immediate and positive reaction to relatively certain prices in the same year, especially in finishing sheep, lambs, and kids to heavier weights; a negative response due to holding animals for breeding or for slaughter (of calves) at heavier weights (what the Italians would refer to as *vitello*) in response to longer dated price expectations; and the response of output from the increased stock, which could be all the greater in the second/third year if the price expectations were not fulfilled. Usually, deriving a sensible total sequence of price effects making use of the effects implicit in lagged product is possible, leading up to a long-run elasticity (with an explicit confidence range) that would be especially important when permanent changes in price regimes are under consideration. The results are probably more plausible for the younger classes of livestock. For sheep and goats, one does not have to accept the negative supply elasticity estimated for

numbers slaughtered, but that result could be a price for greater total product from limited grazing. For mature cattle, even with longer lags, no reasonable sequence could be developed, though the holding of animals off the market in response to higher current prices was clear enough, and the total sequence for cattle and calves is acceptable.

For pigs and poultry, rather different models were preferred with a shorter time horizon, although the initial delay for poultry production's response to price may mean that buildings were more important than birds. No sensible upper bound can be put on the supply response for pigmeat, and virtually any (upward) trend of production at given prices could be subsumed in the constant term. For poultry, an explicit trend was estimated consistent with a productivity improvement of the order of 3½ percent per year. For both pig and poultrymeat, the trends observed could be partially confused with the effects of lower real prices for feedingstuffs. Often, the case for support for the Greek livestock industry is based on the need to preserve foreign exchange. Typically in northern Europe, achieving that end quickly is difficult, and, in the UK, offering immediate support to reduce an immediate shortfall in the trade balance is pointless. Even within the lifetime of a government, remarkably little may be achieved. For Greece, the immediate responses would appear to be more substantial, as judged from the cumulative responses over 3 and 5 years, even if the increased production has to be debited for increased imports of feedingstuffs.

A demand system for four kinds of meat has been estimated from 1965-78 data subject to prior (stochastic) restraints. Eight restraints use the Greek Family Expenditure Survey (Government of Greece, 1977) to give an idea of the likely income elasticities of demand and trends in consumption due to urbanization and differences in taste across generations. Ten restraints are associated with symmetry and virtual want independence from other products to make the results more consistent with rational consumer choice. The *ex post* synthesis in Table 2 (page 158) violates the prior restraints on symmetry in that effects flow more readily from beef to poultry and other meats than vice versa. Prices of meats and their presumed marginal utilities are consistently depressed by increased supply of any meat. But it would be necessary to edit or constrain the results still further before they could be used in the analysis of the welfare of meat consumers.

Long-Run Elasticities for Milk Animals and Milk-Output-to-Milk and Meat Prices, 1962-78

An attempt was made to relate animals milked and milk production and yield to milk, meat, and feed prices for cows, sheep, and goats, respectively. The results are recorded in Table 3 (page 158). Subject to substantial upward trends in yields, meat prices appeared to have a positive influence on animals milked and even on milk output. Consistency between the production estimates and those derived from adding the elasticities and trends for animals milked and yields is not generally to be expected, especially with a Nerlovian approach. For sheep and goat milk, a logical inconsistency probably obtains in the results. How a zero or negative response to milk prices for milk output and a positive response to meat prices could occur is difficult to see unless the recipients of the money from milk products and meat had totally different priorities about how that money should be spent. The price elasticities of supply for cows' milk is probably around 1.0 but could be substantially higher. A greater own supply elasticity for cows' milk production and an *adverse* long-run trend (at constant prices) is obtained by adding the yield equation to that for cows milked. Doing that is probably more consistent with the drop in cows' milk production that has been observed since Greece's entry into the EC.

Note

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References

Alexopoulos, J.C., "A Study of Greek Livestock with Special Reference to Meats," Ph.D. thesis, University of Oxford, 1982.

Government of Greece, "1974 Household Consumption Survey," Athens, 1977.

Jones, G.T., "Another Approach to Estimating Different Income Elasticities for Different Income Classes with Detailed Results for South Brazil and Greece," *Oxford Agrarian Studies*, 1982.
Jones, G.T. *et al.*, "The Use of Cross-Sectional Evidence for Estimation of Trends in Consumption with Reference to British and Greek Data for Meats," *Oxford Agrarian Studies*, 1983.
Zanias, G.P., "An Estimate of the Supply Response for Cotton in Greece from 1950-79," *Oxford Agrarian Studies*, 1981.

Table 1—Supply Responses of Meat Products in

	Lagged	Product Specified		Own Price Elasticities Given Lagged Product				
Coefficients →	β	β_1	β_2	η_0	η_1	η_2	η_3	η
Lags (in years) →	2-3	1	2	0	1	2	3	0-3
By number:								
Sheep	0.45			0.08	-0.52	-0.35	0.57	-0.22
Lambs	0.44			0.05	-0.09	0.17	0.26	0.40
Sheep and lambs	0.44			0.05	-0.14	0.09	0.30	0.30
Goats	0.52			-0.22	-0.25	-0.09	0.47	-0.09
Kids	0.46			0.13	-0.01	0.03	0.34	0.50
Goats and kids	0.53			0.06	-0.06	0.01	0.35	0.36
Calves	0.53			-1.25	0.36	0.15	0.64	-0.10
Cattle and calves	0.47			-0.74	-0.21	0.31	0.66	0.02
Pigs		1.43	-0.42	0.49	0.75	-0.20		1.05
Piglets		1.45	-0.46	1.03	0.61	-0.64		1.00
Pigs and piglets		1.45	-0.46	0.74	0.71	-0.54		0.90
Poultry		0.45	0.07		0.21	1.73		1.52
By weight:								
Sheep	0.47			0.35	-0.47	-0.38	0.64	0.14
Lambs	0.54			0.23	0.15	0.21	0.16	0.76
Sheep and lambs	0.50			0.26	0.01	0.09	0.26	0.62
Goats	0.57			-0.06	-0.22	0.18	0.38	0.28
Kids	0.50			0.33	0.05	0.11	0.26	0.74
Goats and kids	0.52			0.20	-0.01	0.11	0.29	0.59
Calves	0.57			-1.24	0.75	0.40	0.85	0.75
Cattle and calves	0.62			-0.77	0.32	0.53	0.60	0.69
Pigs		1.41	-0.43	0.59	0.76	-0.29		1.06
Piglets		1.47	-0.48	1.41	0.54	-0.52		1.43
Pigs and piglets		1.45	-0.46	0.93	0.72	-0.55		1.10
Poultry		0.58	0.13		0.07	1.44		1.51

[Notes: See Zanias (1981, Appendix) on the method of fixing bounds for long-run elasticities. The values of η_0 are identified by reference to exogenous factors for bovine and porcine animals, but, in the latter case, the identification of price is rather unsatisfactory. All other parameters are estimated by ordinary least squares subject to prior constraints on the effects of lagged product and provisional maximum likelihood estimates of ρ. The deflators for price giving the best fit are consumer food price indices for poultry and porcine animals and a geometric mean between those and feed (grain) prices for ovine and caprine animals. The only other deflators tested regularly were specific feed-mix prices. A splice between those and the

Greece from Data for Slaughterings, 1962-78

Total Price Elasticities, Including Implicit Effects					Autocorrelation
η_3	η_5	η_L	$\eta_{\underline{L}}$	$\eta_{\overline{L}}$	ρ
0-3	0-5	Long Run	Lower Bound	Upper Bound	1
-0.28	-0.43	-0.40	-2.00	0.57	0.65
0.40	0.52	0.70	0.31	1.24	0.75
0.29	0.35	0.53	0.04	1.09	0.77
-0.27	-0.32	-0.19	-0.73	0.53	0.75
0.56	0.67	0.92	0.85	1.02	-0.37
0.37	0.45	0.77	0.26	1.40	0.01
-0.53	-0.35	-0.20	-3.25	0.88	-0.04
-0.37	-0.25	0.05	-2.00	0.96	-0.15
5.71	9.47		Unbounded		
6.91	10.40		Unbounded		
5.87	9.06		Unbounded		
2.19	2.91	3.18	-0.50	9.60	
0.19	0.08	0.27	-1.27	1.24	0.66
0.88	1.14	1.60	1.25	2.19	0.46
0.75	0.86	1.23	0.65	1.99	0.72
0.18	0.29	0.66	0.55	0.82	0.50
0.93	1.12	1.49	1.36	1.78	0.34
0.69	0.85	1.24	1.11	1.47	0.15
0.27	0.71	1.76	0.80	2.32	-0.66
0.39	0.77	1.62	-0.97	3.44	0.17
5.59	8.91		Unbounded		
9.29	14.50		Unbounded		
7.00	10.80		Unbounded		
2.42	3.64	5.20	1.60	37.00	

general feed cost index was used as an alternate in the equations for pigs and piglets, which gave a better fit than the specific grain/soya mix, a worse fit than the general consumer price index for food, and rather more reasonable estimates of the long-run elasticity of supply of 6 or 7 with an explicit range in the interval 1 to 20 for pigmeat. The prior values of β are 0.50 with a prior standard error of 0.17. The same values apply to $(\beta_1 + \beta_2)$ for poultrymeat. For porcine animals, the prior values of β_1 and β_2 are 1.4 and -0.50 respectively with prior standard errors (unlinked) of -0.17 for both. Autocorrelation (ρ) is implicit in the structure of the models for pigs and poultry.]

Table 2—Demand Analysis of Meats, 1965-78*

	Beef/Veal	Mutton/Lamb	Pigmeat	Poultry	Income	% Trend
Quantities:		Elasticities with respect to:†				
Beef/veal	-1.34	0.52	0.40	0.07	0.87	0.66
Mutton/lamb, etc.	0.45	-0.88	0.30	-0.04	0.69	-0.89
Pigmeat	1.32	0.47	-2.11	0.03	0.83	0.66
Poultry	0.96	-0.06	0.14	-1.25	0.64	0.74
Prices:		Derived price flexibilities of demand:				
Beef/veal	-1.71	-1.26	-0.50	-0.06	2.82	0.39
Mutton/lamb, etc.	-1.21	-2.16	-0.54	-0.02	3.06	-0.71
Pigmeat	-1.37	-1.28	-0.91	-0.06	2.88	0.41
Poultry	-1.41	-0.10	-0.46	-0.85	2.85	0.96

[*See Jones *et al.* (1983) for more details on the methodology and Jones (1982) for background on the prior income elasticities used in Jones *et al.* (1983). †Based on a weakly-constrained double-log model with natural values for time. The income and prices are deflated by a general consumer price index.]

Table 3—Long-Run Supply Responses for Milk and Animals, 1962-78

	Milk Price	Meat Price	Grain/Feed Price	Trend Percent/Year	Adjustment Rate/Year*
Animals milked:					
Cows	1.51	0.54	-2.40	-5.10	0.19
Ewes†	-0.42	0.37	-0.26	-0.86	0.43
She-goats†	-0.45	0.13	-0.01	0.49	0.54
Milk output:					
Cows	0.88	0.04	-1.50	1.30	0.19
Sheep	-0.28	0.51	-0.07	2.56	0.72
Goats	-0.05	0.02	-0.11	2.20	0.26
Yield:‡					
Cows	0.01	-0.09	0.07	3.90	0.56
Sheep	0.34	0.17	0.17	3.07	0.29
Goats	0.53	-0.13	-0.40	1.69	0.36

[*Unrestricted for sheep and goats and subject to prior restraints for cows. †Estimated for domestic and in-flock animals. ‡Estimated independently from animals milked and output and hence with a different error structure and adjustment process. The relationships are all linear so only two out of the three error patterns could approach normality.]