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The price elasticity of milk production in the EEC and the problem of discriminating between model estimates

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An important aspect of the milk and dairy industry in the Common Market is the reaction of milk producers on milk prices. There are two 'prejudices' in this field. The farmers behave of course like the economic man of the basic economics textbooks. The farmers behave quite differently; they increase, for example, their production in case of falling prices. For policy makers in the field of dairy products it is essential to know the real reaction in the farming industry. Surprisingly this information is not available for the EEC; there are various opinions and estimates but they are heavily disputed. Now we have a study which intends to settle the dispute (EEC, 1981). It is interesting to see the results and to notice that there really is a fundamental problem involved, for example: how to discriminate between economic models?

The production of milk can be found in almost all parts of the Community but there is some concentration process going on. The main areas are coastal areas of the north-western part (Ireland, Britain, Brittany, Belgium, Netherlands, Germany, Denmark) and the mountain areas such as the Alps in Germany en Italy. Furthermore the milk production is shifting towards larger farms with larger herds, although about half of the cows are still on very small farms. There is also a process of technological change going on based on various innovations in almost all aspects of the production process. This process varies from region to region and from one farm type to another. The data for all the relevant factors are not available in a uniform way on a central point. All this leads us to try to find the supply function of milk production in the EEC via aggregation of regional and national studies.

An acceptable estimate should be based on sound theory and reliable facts and figures. To estimate the supply elasticity we may remember that the supply function (under certain conditions) is indentical to the marginal cost function (Heady, 1952).

So one way of obtaining the supply elasticity is to estimate the marginal cost function and to estimate the price elasticity from there.

We can see that in general the cost functions can be based on production functions (Ferguson, 1966). So a logical method is to find the production function and derive the supply elasticity from it. A rather general function which may serve this purpose is the CES production (Miller et al., 1975).

A combination of cost and production function approaches can be made by applying linear programming models of all types of milk-producing farms. By simulation with milk prices the possible reaction of farmers can be detected quite easily.

There are numerous other econometric approaches explaining milk production (Y) as a function of various variables (X_i) such as price of milk, price of feed, productivity and so on. There are many potentional forms for such a function. Which indeed leads to a whole family of other econometric models.

We have also a more sociological approach of asking farmers about their intendend reactions in various cases of price changes by using the ways of public opinion polls.

Each of these 'methods' has its pros and cons but we cannot say from some kind of aprioristic point of view that they have no sound economic basis. The statistical material available is of various quality but never completely useless. In the EEC study hundreds of studies on European milk production are summarized, reformulated, updated and so on, also taking into account numerous American studies. This impressive material is summarized in Table 1.

The problem is the very big variation in the estimates per method as well as between methods for each country. The way out of this statistical cornucopia was found in a very pragmatic way. An expert would give his personal judgement for each country, taking into account the completeness of a method as seen from a theoretical point of view, the quality of the statistical data, the recentness of the data and perhaps also his personal prejudices. So we can derive at a subjective estimate per country and from these on by using a weighted average to a 'reasonable estimate' for the EEC as a whole.

The short-run elasticity for the EC would be 0.5 to 0.6. This leads to the conclusion that on the average farmers will increase their production of prices are expected to rise and decrease their production in the opposite case. For technical and psychological reasons it may be, however, that their reactions are not exactly the same in a situation of falling prices as in a situation of rising prices, in particular as far as short-term reactions are concerned.

The results do not support the hypothesis that production will increase when milk prices are expected to fall (sometimes indicated as 'backward sloping supply curve' or 'perverse supply reaction'). This does of course not exclude that certain types of farmers can and will react otherwise, but there is no evidence that their behaviour will dominate.

Furthermore, the results summarized in Table 1 confirm that the longer the period in consideration the more substantial the influences of price changes become, and it would appear that in the long run there is still less evidence of perverse supply reactions. Our results clearly support the opposite hypothesis of a positive price elasticity of supply.

Table 1. Price elasticities of milk supply in the EEC: Model results.[1]

Model type	B	DK	D	F	IRL	IT	NL	UK	EUR 9
a) short-run price elasticity									
Cost function	*	*	*	*	*	*	0.45	*	*
Production function	0.42	–	0.2-0.55	0.52	0.35	0.71	0.38-0.45	0.45-0.7	*
Linear programming	*	*	0.01-0.28	*	*	*	0	1.3	*
Other econometric models	0.25-0.33	0.3-0.5	0.06-0.8	0.11-0.27	0.5	0.59	–0.18-0.9	0.75	*
Public opinion poll	*	*	*	*	*	*	0	*	*
Final judgement of the expert	0.4 (±0.1)	0.4 (±0.1)	0.45 (±0.2)	0.5 (±0.1)	0.4 (±0.1)	1.0 (±0.5)	0.4 (±0.1)	0.5 (±0.1)	0.55 (±0.1)
b) long-run price elasticity									
Cost function	*	*	*	*	*	*	*	*	*
Production function	*	*	0.74-	1.87	*	2.54	1.22	1.72	*
Linear programming	*	*	0.4-	*	*	*	*	*	*
Other econometric models	0.45	0.4	0.14-1.8	0.13-1.87	0.7	0.77	0.4-1.22	1.0	*
Final judgement of the expert	0.5	0.4	0.9	1.8	0.7	2.5	1.1	1.0	1.3

* = not available.
[1] Maximum and minimum estimates.

The direct influence of milk prices on milk production in the long run is considerable. But we must be aware of the fact that in the long run milk prices – levels as well as trends – have influence in the rate of technological and structural change in that industry, so that these changes cannot anymore be considered as completely exogenous factors. They will obscure the estimates of the price elasticities of supply. We arrived at simple handy reckoners for our supply elasticities of milk in the EEC. They were based on *past* experience (sometimes only of the 1960s of the early 1970s). In applying them for the *future* one has to keep in mind that farmers, their behaviour, production techniques and alternatives have changed and will continue to change. The employment situation now is quite different from the one in the period 1960-1970. The labour mobility has been affected and this has a diminishing effect on the supply elasticities of pro-

ducts such as milk. The structure of the dairy industry is different from the one in 1960. We have more big and specialized farms and we may expect these farms to have different supply elasticities.

So we have to be careful when applying the complicated estimates as handy reckoners. Given all these considerations we can conclude that the net effect of 1 % change in milk price on milk production in the EC in recent history was or perhaps also will be in the present situation around 0.5 to 0.6 % in the short term and around 1.3 % in the long term. About future trends nothing definitive can be said.

The problem is clear now. How can we avoid these pragmatic and subjective ways out and find objective methods to discriminate between models and estimates? This problem is a logical follow-up of a former problem in econometrics e.g. how to find reliable estimates. We have now various statistics to make objective conclusions e.g. R^2, Durbin-Watson, T-test, turning point criterion and so on. But this is not enough. A large number of estimates pass these tests but do not always lead to (almost) the same estimate, quite to the contrary. The difficult is that (1) we use theory to judge estimates and tests and not the other way round and (2) we can compute almost any model leaving to the subject what to put in and what to leave out, what to publish and what not. There is no objective test. The danger is that only estimates which give results around the conventional ones will be published or vice versa. Just confusing policy makers as well as the economists, but also opening the way to arbitrary production and use of estimates.[1] We may say that better theories for supply behaviour should become available, the statistics should be improved on all levels and that there is a need to have a more objective method to discriminate between models and estimates.

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[1] This problem does not only arise in supply analysis of milk but in almost all economic models for demand, investment, saving, complete sector models as well in the field of world models. In fact theory allows a proliferation of models.