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Department of Agricultural Marketing

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Department of Agricultural Marketing

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Herd Size and the Impact of Reducing EEC Dairy Support Prices

Lionel Hubbard
Department of Agricultural Economics

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HERD SIZE AND THE IMPACT OF REDUCING EEC DAIRY SUPPORT PRICES

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1. Introduction

Dairy farming forms a very significant part of agriculture in the European Community (EC). It is important first in terms of its size. Twenty-five million dairy cows in the Community are dispersed over almost 2 million farms, and current annual production of 100 million tonnes of wholemilk accounts for 20 per cent of the total value of final agricultural output with beef and veal, a closely related enterprise, accounting for a further 16 per cent. Secondly, dairying provides many farmers with a regular cash flow, and is a major source of income on a very large number of the Community's small and medium sized farms. Indeed, in many instances dairying is the only form of intensification suited to the land and labour resources available, leaving the farmer with very few alternatives to milk production (Bergmann and Hairy).

The importance of the dairy sector is also reflected in its share of the Community's agricultural support expenditure (FEOGA). Milk and milk products have regularly accounted for around a third of this. In the dairy sector this expenditure is used primarily to buy, store and dispose of surplus production of the main intervention commodities of butter and skimmed milk powder. Recently world prices for dairy products have been uncharacteristically high, allowing the EC to export at relatively low cost. As a consequence, the 'mountains' of intervention stocks have been considerably reduced. However, they are now rising again, and overproduction remains a serious problem and one that is likely to worsen in the future. Even Bergmann and Hairy, who argue that the surplus problem is of secondary importance in comparison to the income and social considerations of the small farmer, make reference to the potential increase in milk production in those countries and regions of the Community where yields per cow are low and herds small. A more alarmist note has been sounded recently by Agra Europe (1981) who forecast the dairy surplus to double in size by 1985. The problems associated with the

Community's dairy sector are thus essentially those of surplus production and the income position of the small farmer.

The first half of this discussion paper examines the growing surplus in EC milk production. Projections of milk output, taking into account changes in herd size and milk yields, are made through to 1988 for four member countries - Germany, France, Ireland and the U.K. The projections are used to indicate the magnitude of likely EC surpluses and associated FEOGA expenditure (Sections 2, 3 and 4). The second half of the paper offers a measure of the impact on the Community's farmers if dairy support prices were substantially reduced in an attempt to curb surplus production (Sections 5 and 6). A summary and the conclusions are presented in Section 7.

2. The Dairy Surplus

Production of milk in the Community currently exceeds domestic consumption by around 13 per cent, and it is this surplus which leads directly to the FEOGA expenditure referred to above. The European Commission, in its own forecasts of the market situation through to 1988, estimates that production will increase at 1.0 to 1.5 per cent a year and demand for milk and milk products at 0.5 per cent a year. These growth rates, which may be regarded as somewhat optimistic in terms of the surplus production problem[1], result in the Community's self-supply index increasing from its current level of 113 to 117-121 per cent by 1988. Even allowing for the Commission's optimistic assumptions, this means a substantial increase in the Community's surplus production (refer to Table 1), and consequently a substantial increase in FEOGA expenditure. Extrapolating the Commission's growth rates for production and consumption through to 1992 results in a self-supply of 119-125 per cent and a surplus of 17-23 Mt. Massive surplus production over the coming decade is clearly a serious threat.

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1. During the 1970s production in the Community increased at around $2\frac{1}{2}$-3 per cent, while consumption remained, overall, virtually static.

Whilst the Commission's forecasts may be questioned, the reasons that lie behind the ever-increasing surplus are more readily agreed. Consumption of cheese is rising, and there is some evidence to suggest that demand for butter may show a marked response to a price cut, but with low rates of income growth, low income elasticities of demand and slow population growth, overall consumption of milk and milk products cannot be expected to alter very radically over the next ten years. Production of milk, however, will undoubtedly continue to expand during the coming decade, because of continued productivity and structural changes within the dairy industry. The former, and probably more important, factor will mean even higher yields per cow, due to genetic improvements in the animals and better husbandry methods. As far as structural change in dairy farming is concerned, the trend towards larger herds is likely to continue, and given that yields per cow tend to be higher, and growing at a faster rate, in larger herds, production of milk can be expected to increase as a result of the changing herd structure.

TABLE 1 - Market Situation for Milk and Milk Products in the Community of Ten

Item	1981(1)	1988(2)	1992(3)
	Mt	Mt	Mt
Production(deliveries to dairies)	97	104-108	108-114
Consumption(liquid milk equivalent)	86	89	91
Surplus	11	15-19	17-23
Self-supply (%)	113	117-121	119-125

SOURCE : Guidelines for European Agriculture. European Commission COM (81) 608.

NOTES : (1) Commission Estimate

(2) Commission Forecast

(3) Extrapolation of Commission's forecast

There exists much scope for continued increases in yields and further concentration structure, as the data in Table 2 suggest. If France, Italy, Belgium, Luxembourg and Ireland raised their yield per cow to the current EC average, this would add around 8 Mt to milk output in the Community.

TABLE 2 - Dairy Cow Yield and Herd Structure in the Community: 1980

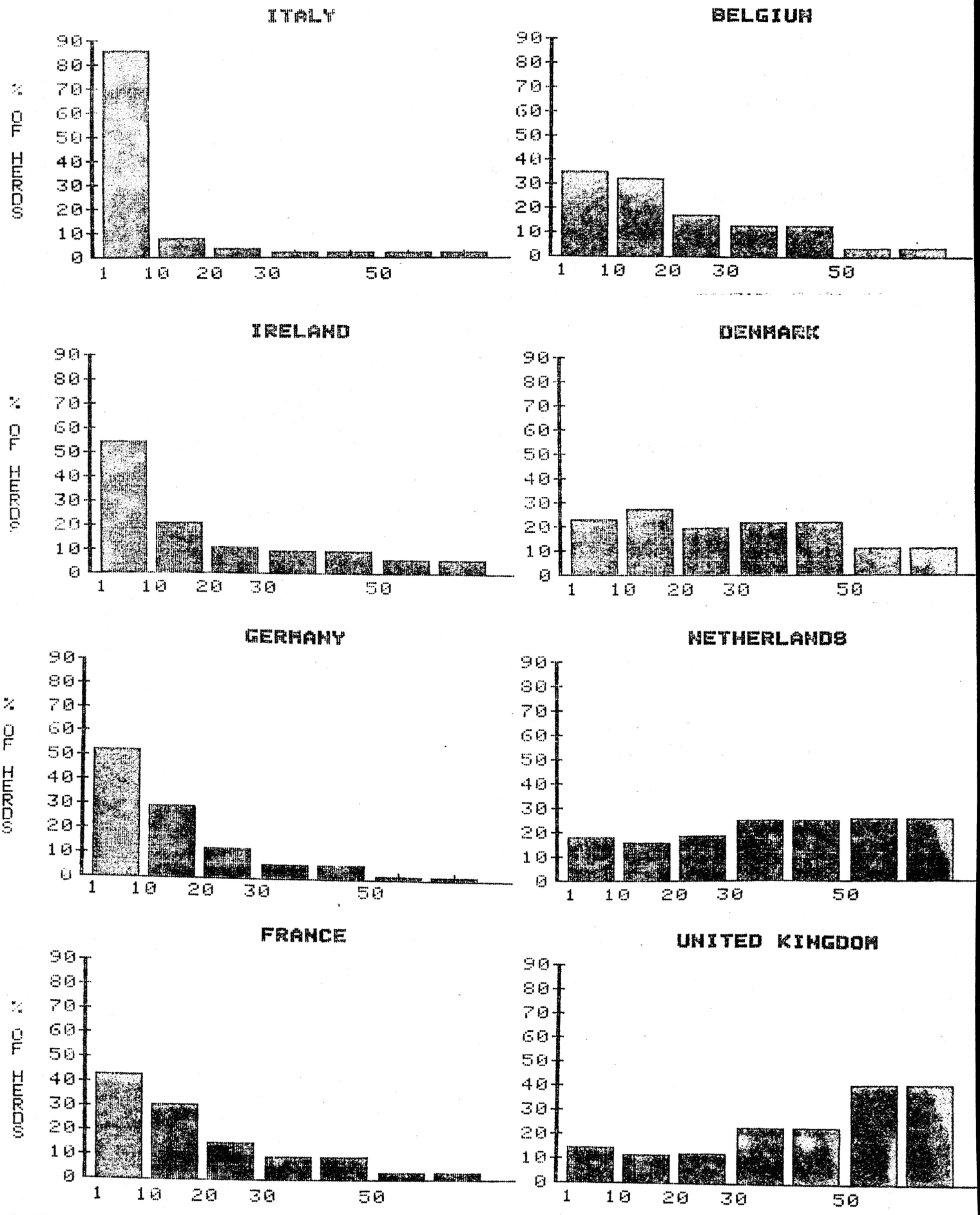
Country	Average yield (kg/cow/yr)	Percentage of milk from herds > 50 cows
Netherlands	5,035	55
United Kingdom	4,880	77
Denmark	4,855	31
Germany	4,550	7
Belgium	3,855	13
Luxembourg	3,775	15
France	3,665	9
Italy	3,362	24
Ireland	3,234	29
EC-9	4,140	28

SOURCE : MMB, EEC Dairy Facts and Figures 1981, and author's own estimates.

3. Herd Structure and Milk Yields in the Community

The herd structure of dairy farms varies greatly throughout the Community. Figure 1 shows for each member country the breakdown of herds by five herd size groups. The range in herd structure is well known, and indeed causes some disagreement amongst the member countries over the 'fairness' of some suggested policy measures in the dairy sector, e.g. co-responsibility levy exemptions for small farms.

FIGURE 1 HERD STRUCTURE BY COUNTRY



HORIZONTAL AXIS SHOWS HERD SIZE MEASURED IN NUMBER OF COWS PER HERD

The patterns of herd structure shown in Figure 1 are of course changing continually, reflecting the general trend, throughout the Community, towards larger herds. Since, in the present study, milk output is projected by combining projections of herd numbers and yield increases, a necessary step was to obtain a measure of the extent to which herd structure would change by the late 1980s. In order to do this, the patterns of structural change that occurred during the 1970s were projected forward through the use of Markov transition matrices. This approach to projecting structural change in agriculture has been widely applied (see for example, Colman 1967, Colman and Leech 1970, Buckwell and Shucksmith 1979 and Thorburn 1980). In essence, the number of herds (or farms) in each of several herd size categories is recorded over a number of years and a matrix of probabilities is then estimated that most accurately reflects the rate at which herds move from their existing size category from one time period to the next. If it is assumed that the forces underlying the structural change that occurs during the period for which data are recorded will persist unaltered, then the estimated matrix of transition probabilities can be used to project the past pattern of change into the future.

In the present study, data limitations prevented Markov matrices being estimated for each member country separately, and in the event only two matrices were derived. Data for Germany, France, Belgium and Ireland were combined for the first, and data for the United Kingdom, Denmark and the Netherlands for the second, assuming that the countries in each group reflect the same pattern of structural change. Whilst this is clearly less than ideal, it is preferable to estimating a single matrix for all member countries in the Community, (particularly in the light of the contrasting types of herd structure in the Community). Moreover, although the use of only two matrices can be criticised as crude and restrictive, in the present study structural change is needed more as a guide than as a means of estimating accurately the number of herds at some future

date. The current exercise could be carried out (with even greater crudity) assuming no change at all in herd structure in the Community over the next ten years. Such a 'freezing' of the present structure is extremely unlikely, and it is felt that some measure of change, however imperfect, is to be preferred to none.

Both Markov matrices were derived using data for six herd size groups for the seven years 1973-79. The transition probabilities are shown and discussed more fully in Appendix 1. The smaller coefficients on the leading diagonal of the matrix for the United Kingdom, Denmark and the Netherlands indicate that, during the 1970s, structural change was proceeding at a faster rate in those countries than in Germany, France, Belgium and Ireland. The results of using the matrices for projections of herd structure are shown in Table 3.

Reference has already been made to the large variation in milk yield per cow throughout the Community. Over the last twenty years yields have increased on average by 1.5 per cent a year. Since 1975 the increase has been higher at around 2.5 per cent a year although the European Commission, perhaps due in part to its 'prudent price policy', expects the growth rate to return to 1.0-1.5 per cent during the 1980s (European Commission 1981).

From the limited data available on milk yields from cows in different size herds there is evidence to suggest that increases in yield per cow have been greater in the larger herds. Buckwell and Shucksmith (1981), using data for England and Wales to analyse milk yields by herd size, found that the growth in yield per cow was markedly different for different herd sizes (see Table 5). At the Community level, milk yield per cow by herd size is recorded in the EC Farm Accountancy Data Network results, and these data lend support to the assertion that the annual rate of increase in yield per cow increases with the size of herd.

TABLE 3 - Projections of Herd Numbers Using Markov Matrices

Herd Size (cows)	1979 (actual)		1988	
	'000	%	'000	%
Germany				
1-4	116.7	26	49.3	16
5-9	121.3	27	61.3	20
10-19	134.5	29	87.6	29
20-29	52.9	12	46.4	15
30-49	25.5	6	43.4	14
> 50	5.0	1	13.7	5
Total Nos. Herds	456	100	302	100
Total Nos. Cows	5442	-	5293	-
France				
1-4	117.7	23	49.7	14
5-9	107.2	20	55.7	16
10-19	161.1	31	97.7	28
20-29	77.9	15	58.6	17
30-49	47.1	9	67.2	19
> 50	12.0	2	25.1	7
Total Nos. Herds	523	100	354	100
Total Nos. Cows	7449	-	7230	-
Ireland				
1-4	39.6	37	16.8	23
5-9	17.8	17	11.4	16
10-19	21.9	21	15.6	21
20-29	11.3	11	8.9	12
30-49	10.0	9	13.7	19
> 50	5.3	5	7.0	10
Total Nos. Herds	106	100	73	100
Total Nos. Cows	1503	-	1524	-
United Kingdom				
1-4	7.0	10	4.3	8
5-9	3.6	5	1.3	2
10-19	7.7	11	2.9	5
20-29	8.1	12	4.7	9
30-49	14.9	22	12.8	24
> 50	25.8	39	27.4	51
Total Nos. Herds	67	100	54	100
Total Nos. Cows	3224	-	3142	-

NOTE : See Appendix 2 for the derivation of the number of cows.

TABLE 4 - Changes in Milk Yield Per Cow

Country	Annual % Change 1960-62/1975-77	1975-80
Germany	1.2	2.6
France	2.1	2.7
Italy	1.1	1.9
Netherlands	0.7	1.7
Belgium	-0.2	1.0
Luxembourg	0.3	2.7
United Kingdom	1.3	2.7
Ireland	1.5	4.2
Denmark	1.6	1.6
EEC	1.3	2.5

SOURCE : Commission of the European Communities, Agricultural Studies, p.214, July 1981. MMB, EEC Dairy Facts and Figures 1981.

TABLE 5 - Growth in Milk Yields Analysed by Herd Size: England and Wales

Herd Size (cows)	Coefficient for time trend	
	litres/cow	as % of 1979-80 yield
10-19	4.0	0.01
20-29	28.9	0.7
30-39	32.4	0.8
40-49	56.2	1.3
50-59	50.3	1.1
60-69	116.7	2.4
70-99	101.1	2.0
100-199	96.5(a)	1.9
>200	140.3	2.8

SOURCE : Buckwell and Shucksmith (1981).

(a) Not significant.

In the absence of sufficient data to undertake a statistical analysis of milk yields per herd size in each of the member countries, the present study resorts to the use of the following assumed growth rates, which, it is felt, are adequately representative and plausible.

TABLE 6 - Assumed Growth Rates in Milk Yields (1980s)

Herd size (cows)	Germany	France	Ireland	United Kingdom
	%	%	%	%
1-19	1.0	1.5	1.0	0.5
20-49	1.5	2.0	1.5	1.5
>50	2.0	3.0	2.5	2.0

4. Projections of Milk Production and FEOGA Expenditure

From the projections of herd structure, a knowledge of the average number of cows per herd (see Appendix 2) and the assumed growth rates in yield per cow, projections were made of milk production for Germany, France, Ireland and the United Kingdom, and these are shown in Table 7.

The projected production from the four countries in 1988 is 84.4 Mt, an increase of 16 per cent over the 1980 total. As a compound growth rate this represents 1.9 per cent a year and compares with the European Commission's estimate for the Community as a whole of 1.0-1.5 per cent a year. Applied as an average to the 30 per cent of EC milk produced by the other five member countries, this rate of increase would bring the Community's milk output to 121 Mt by 1988. Adopting the Commission's own optimistic expectations of an increase in consumption of 0.5 per cent a year and assuming that deliveries to dairies increase to around 95 per cent of production by 1988, as seems likely, these projections of output would lead to a surplus on the domestic market of 26 Mt. In the absence of any growth in consumption the surplus would be larger at 29 Mt.

TABLE 7 - Projections of Milk Production

Country	1980[1] (actual)	1988	% Change over 1980
	Mt	Mt	
France	26.8[a]	31.4	17
Germany	24.8	28.3	14
Ireland	4.9	5.8	18
United Kingdom	16.0	18.9	18
Total (four countries)	72.5	84.4	16
Total EC-9	104.0[a]	-	-

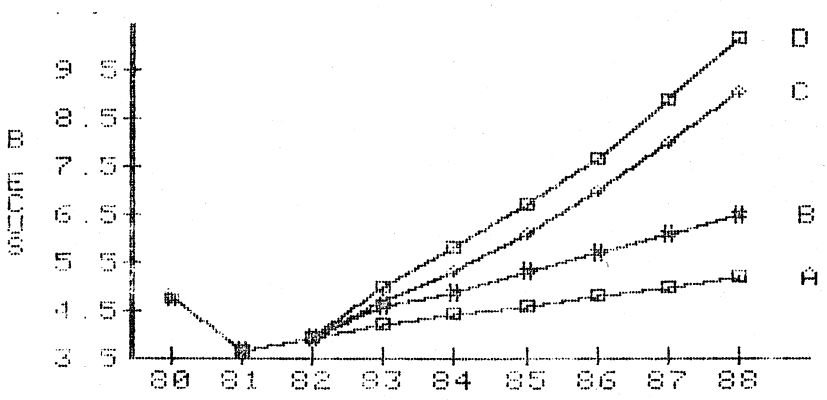
(1) SOURCE : Agricultural Situation in the Community 1981. European Commission.

(a) Estimated.

Increases of this magnitude in surplus production will naturally lead to substantial increases in FEOGA expenditure on dairy products. In 1981 this expenditure was equivalent to around 330 ECUs/t of surplus production, although with the lower world prices of the late 1970s it would have been over 400 ECUs/t. This unit cost is likely to increase as the EC surplus grows, since greater surpluses will themselves tend to exert a downward pressure on the world price (see Hubbard 1982). Estimates of FEOGA expenditure on dairy products through to 1988 are given in Figure 2.

FIGURE 2

FEOGA EXPENDITURE ON DAIRY PRODUCTS



NOTES : (A) Based on Commission's forecasts of 1.0 per cent a year increase in milk production and 0.5 per cent a year increase in consumption of dairy products.

(B) As (1) but increase in production is Commission's upper limit of 1.5 per cent a year.

(C) Production projections as estimated by the author with the Commission's forecast of 0.5 per cent a year growth in consumption.

(D) As (3) but with zero growth in consumption.

5. Some Policy Options

There are numerous suggestions of ways in which the problems associated with the dairy sector could be tackled. Surplus production has arisen primarily because of an open-ended price guarantee policy which has been implemented against a background of steadily improving productivity. Perhaps the most obvious change in policy should therefore be a reduction in the price guaranteed to producers. But, as has been pointed out, this could lead to serious income and social consequences for a large number of the Community's smaller dairy farmers. However, a lowering of dairy support prices would result in a reduction in FEOGA expenditure, and thus make available resources which could then be used in alternative ways to assist small farmers, through, for example, the regional and social funds or via some form of direct income support. Reducing support prices is the policy option examined in the present study, and some results for which are presented in the following section. First, however, the other policy options that have been suggested are outlined.

The co-responsibility levy for milk was introduced in 1977. Its dual aim has been to lower the guarantee price to (most) producers, and to use the levy income collected to promote the consumption of milk and milk products. The levy is currently set at 2 per cent of the target price for milk, and whilst there is no real suggestion that this rate should be radically altered, there is some debate as to the way in which partial and total exemptions should apply. Aside from this ongoing debate, the main criticism of the co-responsibility levy is that it has not lowered the price of milk to the consumer.

Although not yet implemented, the European Commission has proposed the introduction of a supplementary levy and a special levy. The former would mean producers participating in the cost of the disposal of milk in excess of a production target, while the latter would seek to reduce milk production by taxing 'intensive' high input-high output farms, e.g. those farms producing more than 15000 kg milk per hectare of forage (see European Commission 1981).

Quotas or production limits, beyond which the support price would not apply, are another possible policy option. Such a system could presumably operate along similar lines to the United Kingdom's old deficiency payments system or, alternatively, quotas could be assigned to individual farmers. The latter measure might go some way to offset the income problems of the small farmer if quotas were made marketable. The income problem in the dairy sector however, might be better alleviated through the use of some kind of direct income supplement, implemented in conjunction with one or more of the measures outlined above.

Whatever changes are made in EC dairy policy they will need to deal with the dual problem of surplus production and the income position of the small farmer. The effect on both of these of substantial reductions in EC dairy support prices is examined in the following section.

6. The Impact of Reducing EC Dairy Support Prices

The extent of the reductions in EC dairy support prices necessary to remove or limit the potentially ever-larger milk surpluses in the Community will depend on the supply response from dairy farmers. There are almost as many values assigned to the price elasticity of milk supply as there have been attempts to estimate the response. A good deal of recent work on the subject has now been brought under one cover by the European Commission (European Commission 1981). The object of this exercise was to obtain estimates of the price elasticity of milk supply in each of the member countries of the Community. Having reviewed the literature and the various approaches to deriving elasticities, and examined the values thereby obtained, the authors of the study had to make an overall judgement on the most probable value for the elasticity in each member country. The outcome of these judgements are reproduced in Table 8.

TABLE 8 - Expert Judgements on Price Elasticities of Milk Supply

Country	Estimated price elasticities of milk supply	
	Short term (2 years)	Long Term (> 5 years)
Belgium	0.4	0.5
Denmark	0.4	0.4
France	0.5	1.8
Germany	0.45	0.9
Ireland	0.4	0.7
Italy	1.0	2.5
Netherlands	0.4	1.1
United Kingdom	0.5	1.0
EEC (9)	0.55	1.3

SOURCE : Relationship between Milk Production and Price Variations in the EEC. European Commission, July 1981 (Study p.214).

Whilst the country specific estimates in Table 8 exhibit considerable variation across the Community, the various estimates on which the single judgement values are based encompass even larger differences, as illustrated in Table 9 for the long run elasticities. However, all the contributors concluded that in all but the very short run there exists a positive price elasticity, thereby dismissing the notion, so often forwarded for milk, of a perverse supply response. Also, all stressed the importance of the time lag necessary for the adjustments in production to fully work through, and thus the importance between short run and long run elasticities. Some reference was made to the regional differences in supply elasticities within member countries, and also to the differences in supply response that might exist for different sized farms. In the submission for Germany, Hanf reports that the results of Meinhold and Dieterich (1971) show large farms to exhibit greater elasticities, due to their high land-labour ratios. From his own work with Koester,

Hanf (1980) concluded that the reaction of supply is extremely dependent on the size of farm, with the long run elasticity of supply increasing with the size of farm and the size of herd (see Table 10). The evidence for Belgium, prepared by Van der Noort, supports this finding, with those farms having larger herds exhibiting higher elasticities of supply.

TABLE 9 - Long Run Price Elasticities of Milk Supply in the EEC

Country	Lowest Estimate	Highest Estimate	Expert's final judgement
Belgium	0.45	0.45	0.5
Denmark	0.4	0.4	0.4
France	0.13	1.87	1.8
Germany	0.14	1.94	0.9
Ireland	0.7	0.7	0.7
Italy	0.77	2.54	2.5
Netherlands	0.4	1.22	1.1
United Kingdom	1.0	1.72	1.0
EC (9)	-	-	1.3

SOURCE : See Table 8

TABLE 10 - Supply Elasticities of Milk in Farm Groups with Different Herd Sizes (Hanf and Koester 1980)

Herd Size (cows)	Elasticities in year t after the change of the price policy					
	1	2	3	5	7	10
<20	0.1	0.4	0.4	0.4	0.4	0.4
20-50	0.1	0.2	0.4	0.5	0.9	1.4
>50	0.1	0.2	0.6	1.6	2.5	3.5

Against this it must be said that, in his contribution for the United Kingdom Jones shows some results to suggest that price elasticity of supply decreases as farm size increases, wlthough no discernable pattern was found to exist for different herd sizes.

A priori, the case for long run elasticities to increase with the size of herd or farm might be based on two factors: the scope for cost adjustment, and the existence of enterprises other than dairying. If, as is often assumed, farmers with small herds operate with higher marginal costs, then these farmers may have greater scope for reducing their costs when faced with a reduced milk price. This will mean that they lower their output proportionately less than they would otherwise be expected to do. And if, as has already been mentioned, dairying represents, for many small farmers in the EC, the only form of agricultural intensification suited to the land and labour resources available, then the absence of alternative enterprises will mean that these farmers will tend to stay in milk production. Larger farms with larger herds probably enjoy less scope for cost savings, and their response to a reduced milk price might therefore be expected to be a proportionately greater cut back in production than from the smaller producers. The wider choice of alternative enterprises should also act to increase the elasticity of supply from these larger farms.

From the foregoing discussion of supply response it was decided in the current study to use the long run elasticities shown in Table 11. When weighted by production, the herd size specific elasticities in Table 11 give overall long run elasticities of 1.8 for France, 1.0 for Germany, 1.2 for the United Kingdom and 0.8 for Ireland. The trend towards larger herds means that these weighted elasticities will tend to increase over time, since in all four countries the elasticity of supply is assumed to be larger from the larger herds. However, this increase in the weighted average is negligible over the period to 1988.

TABLE 11 - Assumed Long Run Supply Elasticities for Milk

Herd Size (cows)	France	Germany	Ireland	United Kingdom
1-19	1.6	0.8	0.6	0.6
20-49	1.8	1.0	0.8	1.0
>50	2.0	1.4	1.0	1.2

If, when using the elasticities as a measure of the reduction in milk supply likely to follow from a lowering of dairy support prices, it is assumed that full adjustment in production is achieved after five years, then a 15 per cent reduction in prices (in real terms) in 1983 will result in a 20 per cent reduction in milk output by 1988. Given an overall price elasticity of demand for dairy products of around -0.5, this price fall will eliminate the surplus that would by then exist under maintained constant prices (refer to Section 4). Allowing for an EEC inflation rate of around 10 per cent in 1983, a 15 per cent reduction in the real price of milk would mean the target price being reduced from its 1982-83 level of 268 ECUs/t to around 250 ECUs/t, i.e. a nominal price reduction of 7 per cent. Should, as is likely, this be considered too severe a price drop, the target price could of course be lowered, in real terms, more gradually over several years without any reduction in the nominal price. But for the purpose of the present exercise the 15 per cent fall in the real target price is taken to occur in a single year, 1983.

As a result of a fall in the real price of milk, dairy farmers naturally suffer a loss in revenue and income. To assess the loss associated with a 15 per cent price fall, the change in producer's surplus (i.e. the area above the supply curve) has been estimated for the different herd sizes in each of the four countries. The benchmark against which the change in producer's surplus is measured is the maintenance of a constant real target price for milk. The estimated annual losses in producer's surplus, as a result of the 15 per cent

price reduction, are shown on a producer (herd) basis in Table 12. Over the five years, 1983-88, the loss incurred by any particular sized producer will vary very little, the productivity increases which move the supply curve to the right and thus slightly increase the loss in producer's surplus, being largely offset by a reduction in quantity supplied as the long run elasticity takes effect. The estimates in Table 12 can therefore be taken to apply to any year through to 1988.

TABLE 12 - Estimated Annual Loss in Producer Surplus Per Herd over 1983-88 Following a 15 Per Cent Price Reduction in 1983

(ECU)

Herd Size (cows)	Germany	France	United Kingdom	Ireland
1-4	460	400	260	230
5-9	1200	1100	1200	800
10-19	2700	2400	2600	1900
20-29	5200	4500	4900	3600
30-49	8100	7000	8300	5900
>50	16000	13300	23400	12700

SOURCE : Author's estimates.

The losses in Table 12 show that, for instance, a German farmer with a herd of less than 5 cows will suffer on average an annual loss in producer's surplus of 460 ECUs if, in 1983, the milk price is reduced by 15 per cent rather than being kept, in real terms, at its 1982 level. The biggest losses are incurred by the largest producers in the United Kingdom, as a result of their exceptionally large herds and high yields.

The losses in producer's surplus summed over all herds in each herd size category are shown in Table 13. The country totals for 1983 show that producer's surplus losses sum to 1100 million ECUs in Germany, 1400 million ECUs in France, 800 million ECUs in the United

Kingdom and 240 million ECUs in Ireland. Although these country totals do not alter very much by 1988, their composition reflects the changing distribution of herd numbers and the trend towards a greater proportion of milk being produced by the largest two (one in the case of the United Kingdom) herd size categories.

TABLE 13 - Total Loss in Producer Surplus in 1983 and 1988 Following a 15 per cent Price Reduction in 1983

(million ECUs)

Herd Size (cows)	Germany	France	United Kingdom	Ireland
		1983		
1-4	37	33	1	6
5-9	109	91	3	12
10-19	308	320	12	37
20-29	268	320	31	36
30-49	273	407	119	68
>50	137	236	613	76
All herds	1132	1407	779	235
		1988		
1-4	23	19	1	4
5-9	73	59	2	9
10-19	237	228	8	29
20-29	240	256	23	32
30-49	349	462	108	81
>50	217	331	655	90
All herds	1139	1355	797	245

SOURCE : Author's estimates.

Germany, France, the United Kingdom and Ireland together currently account for around 70 per cent of the Community's milk production, and the estimated loss in producer's surplus in any one year, resulting from a 15 per cent cut in the real milk price, totals around 3600 million ECUs. Applying an equivalent level of loss to the

Community members who account for the other 30 per cent of milk production, the EC total loss in producer's surplus would sum to around 5000 million ECUs, a figure roughly comparable with current FEOGA expenditure in the dairy sector, although a good deal less than the FEOGA expenditure that will be needed by 1988 if the current real price of milk is maintained.

At the beginning of this paper it was stated that the dual problem in the EC dairy sector was that of surplus production and the income position of the small farmer. If a 15 per cent price reduction was implemented in an attempt to eliminate the former, what affect would such a policy have on the income of the smaller dairy farmer? The total loss in producer's surplus incurred by those farmers with herds of less than 20 cows is shown in Table 14. The loss in producer's surplus falls over time in all three herd size categories because of the declining number of small herds. The total losses incurred by these producers in the four countries thus falls from 1000 ECUs in 1983 to 700 million ECUs in 1988. Again, on a Community wide basis these losses are likely to sum to around 1400 million ECUs and 1000 million ECUs, respectively. The rate of decline in the number of small herds may, of course, be affected as a direct consequence of the price cut, in which case the total annual loss in producer's surplus will diminish more or less gradually than these figures indicate.

TABLE 14 - Total Loss in Producer Surplus Following a 15 per cent Reduction in 1983: Herds of Less Than 20 Cows in Germany, France, The United Kingdom and Ireland

(million ECUs)

Herd Size (cows)	1983	1984	1985	1986	1987	1988
1-4	77	69	63	57	52	47
5-9	215	196	183	169	157	143
10-19	677	631	599	567	537	502
1-19	969	896	845	793	746	692

SOURCE : Author's estimates.

As a measure of the loss in 'economic welfare' suffered by the Community's small dairy producers, the figures in Table 12 could perhaps also be regarded as a measure of the payment that might be made to such producers to compensate them for the reduction in the milk price. Such an interpretation does, of course, presume that the production response of the price cut is unaffected by the compensation payment. It may be necessary in practice to make acceptance of production restrictions a condition of the compensation payments. It is not the purpose of this paper to explore the desirability or practicality of direct income payments as a means of supporting the small farmer. That there are disadvantages and problems associated with adopting such a system of support is well known, and indeed goes a long way in explaining why such a policy option has to date not been favoured. However, if price support in the dairy sector is intended to be primarily for the benefit of the small farmer, then the use of some form of compensatory payment in the face of a price cut will be far less costly than the present policy of surplus disposal. It has been one of the aims of this section to offer estimates of the likely magnitude of these costs. Table 15 shows probable FEOGA expenditure through to 1988 under existing policy and the cost of fully compensating different categories of producers for their estimated loss in producer's surplus.

TABLE 15 - Cost of Support in the EC Dairy Sector : 1983-88

	1983	1984	1985	1986	1987	1988
FEOGA Expenditure						
under existing policy						
(1)	4600	4900	5300	5700	6100	6500
(2)	5000	5800	6700	7700	8900	10200
(3) with a policy of compensatory payments for certain producers following 15 per cent cut in milk price						
All herds < 20 cows	1400	1300	1200	1100	1100	1000
All herds < 30 cows	2300	2200	2100	2000	1900	1800
All herds < 50 cows	3600	3500	3400	3300	3300	3200
All herds	5100	5100	5100	5100	5100	5100

NOTES : (1) Estimated FEOGA expenditure assuming Commission's forecasts of 1.5 per cent a year increase in production and 0.5 per cent a year increase in consumption (see Section 2).

(2) Estimated FEOGA expenditure using production projections from Section 4. Consumption of milk products is assumed to remain static over the period.

(3) The table shows the estimated total losses in producer's surplus incurred as a result of a 15 per cent fall in the real milk price in 1983 for all EC milk producers in the size categories shown.

7. Summary and Conclusions

The problems associated with the dairy sector in the EC can be summarised as those of surplus production and the income position of the small farmer. Surplus production currently amounts to around 13 per cent of domestic consumption. This is likely to increase markedly during the remainder of the decade as a result of an increasing supply of milk but a static, or near static, demand for dairy products. The European Commission forecasts self-supply to rise to 117-121 per cent by 1988. However, in the light of potential productivity improvements

and likely changes in the dairy herd structure throughout the Community, the assumptions adopted by the Commission in their forecasts appear somewhat optimistic.

In the present paper, projections of milk output for four member countries - Germany, France, Ireland and the United Kingdom - were made through to 1988. The total dairy herd in each country was disaggregated into six size categories and Markov transition matrices were used to project herd numbers in each size category. These projections were combined with assumed growth rates in yield per cow which were made country and herd size specific. Using this approach milk output by 1988 was estimated to increase by an average of 16 per cent over the four countries, a compound annual growth rate of 1.9 per cent. Applied to the Community as a whole, this rate of increase would bring total milk output by 1988 to 121 million tonnes and the surplus to 26-29 million tonnes. Surpluses of this magnitude, if realised, will clearly result in greatly increased FEOGA expenditure, and underline the need for policy measures to reduce over-production.

Various policy measures are currently being suggested to prevent ever-larger surpluses. The second half of this paper examines the option, perhaps most favoured by market purists, of a straightforward reduction in dairy support prices. It is suggested that a 15 per cent reduction in the target price for milk, in 1983, would be of sufficient magnitude to eliminate surplus production by 1988. Such a price reduction would, of course, probably have to be made over a number of years, but for the purpose of the present exercise it is assumed to occur in a single year. The supply response embodies a set of assumed long run elasticities (country and herd size specific) based on recently published estimates.

As a result of the price reduction dairy farmers suffer a loss in welfare. This loss is measured as the estimated change in

producer's surplus. Annual reductions in producer surplus at the farm (herd) level range from 230 ECU for herds of less than 5 cows in Ireland, to 23400 ECU for herds of greater than 50 cows in the United Kingdom. The total loss in producer surplus over all herds in the four countries sums to around 3600m ECU in any one year, although the proportion of this attributable to the smaller herds diminishes over time, as their numbers decrease. If applied pro rata to the remaining five member countries not included in the projections, the annual total loss in producer surplus would sum to around 5000m ECU, a figure roughly comparable with current FEOGA expenditure in the dairy sector, although a good deal less than the FEOGA expenditure that will be needed by 1988 if the real price of milk is maintained.

Looking more specifically at the losses suffered by the Community's smaller dairy farmers the calculations indicate that the total loss in producer surplus for all herds of less than 20 cows would be around 1400m ECU in 1983, falling to around 1000m ECU by 1988. As measures of losses suffered, it is suggested that these figures might also be interpreted as indicative of the level of compensation that would leave the smaller producers no worse off in the face of a price cut of 15 per cent. The sums involved are considerably less than those associated with the alternative of surplus disposal.

The results presented in this discussion paper confirm that increasing over-production of milk in the Community is indeed a serious threat, and is likely to be more severe than the European Commission's own forecasts suggest. Whilst reducing support prices for dairy products could be expected to solve the surplus problem, by reducing supply and raising demand, the losses in income suffered by dairy farmers would be appreciable. However, the results presented in the latter half of the paper, indicating the magnitude of these losses, show that some form of direct compensation, particularly if limited to the smaller producers, would sum to considerably less than the cost of surplus disposal under existing policy.

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APPENDIX 1

MARKOV TRANSITION MATRICES

The matrices were derived from data for 1973-79. It was initially hoped that separate matrices could be estimated for each member country. However the time series data on herd structures was insufficient to allow this, and in fact only by using combined data on the member countries for the seven years could two matrices be estimated satisfactorily. By applying the matrices to the base year data for each country and projecting forward on an annual basis, it is possible to compare the projected number of herds in each herd size group over 1974-79 with actual data. This allows some measure of the suitability of using a single matrix for several countries.

Matrix 1 provided a good fit for the German data except for the number of herds of more than 50 cows. For this largest herd size category, although the projection for 1979 was reasonably close (+5.9 per cent), the preceeding years' projections were substantially overstated. The mean absolute percentage difference between projected and actual numbers of herds over the 1974-79 period was 6.7 per cent (1.8 per cent over the first five herd sizes and 31 per cent for the sixth).

The goodness of fit for France is almost exactly the same for Germany. The projection for the number of herds of over 50 cows was very close for the final year (1979), but again substantially overstated the numbers in the preceeding five years. The mean absolute percentage difference over all six years was slightly worse than for Germany at 8.9 per cent.

Using the same matrix for Ireland however, produced a somewhat different pattern of projected herd structure. The mean absolute percentage difference was 7.5 per cent, and although the largest errors were again in the over 50 cow herd group this time the projections seriously understated the actual numbers recorded in the period 1976-79.

TABLE A1 - Markov Transition Matrices

Matrix 1 (Combined data for Germany, France, Ireland and Belgium)

	Entry /Exit	1-4 cows	5-9 cows	10-19 cows	20-29 cows	30-49 cows	>50 cows
Entry/Exit	0.99	-	-	-	-	0.01	-
1-4 cows	0.05	0.91	0.03	0.01	-	-	-
5-9 cows	0.06	-	0.90	0.03	-	-	-
10-19 cows	0.03	-	-	0.92	0.05	-	-
20-29 cows	0.15	-	-	-	0.85	-	-
30-49 cows	0.06	-	-	-	-	0.90	0.04
> 50 cows	0.05	-	-	-	-	-	0.95

Matrix 2 (Combined data for United Kingdom, Denmark and the Netherlands)

Entry/Exit	0.99	-	-	-	-	-	-
1-4 cows	-	0.81	-	0.04	0.13	0.01	-
5-9 cows	-	0.06	0.66	0.28	-	-	-
10-19 cows	0.15	0.03	0.11	0.72	-	-	-
20-29 cows	-	-	-	-	0.82	0.18	-
30-49 cows	0.11	-	-	-	-	0.80	0.09
> 50 cows	0.02	-	-	-	-	0.03	0.96

The second Markov matrix was used for projecting herd numbers in the United Kingdom. For the period 1974-79 the projections produced a mean absolute percentage difference of 8.1 per cent over the actual data. The largest errors were recorded for the 30-49 cow herd size group (+15.5 per cent), whilst for the other five herd size groups this figure was 6.6 per cent.

In general, the goodness of fit measures outlined above highlight that the two matrices, being derived from composite data for more than one country, offer a far less-than-perfect substitute for country specific matrices. Nevertheless, they do offer some indication of the likely changes in herd numbers, particularly for the smaller herds, if, over the coming years, structural change in the dairy sector continues as it did during the 1970s.

APPENDIX 2

AVERAGE HERD SIZE

The mean number of cows per herd for each herd size group can be ascertained by simply dividing the total number of cows in each herd size group by the total number of herds in that group. During the 1970s the mean herd size for any one size group exhibited little variation either over time or between countries, except for the largest and open-ended herd size group (> 50 cows). For the mean number of cows in this size group some differences can be identified through time and between countries. For Ireland and the United Kingdom the mean size remained stable during the 1970s at 70 cows and 90 cows, respectively. In Germany the mean size varied somewhat over the decade from 55 cows in 1973 to 79 cows in 1975 to 63 cows in 1979, while for France mean size has fluctuated between 48 cows (1973) and 83 cows (1977). The mean size of herd for each herd size group in 1979-80 is given for each of the four countries in the table.

TABLE A2 - Mean Herd Sizes : 1979-80

Herd Size Cows	Germany	France	Ireland	United Kingdom
1-4	2.6	2.5	2.0	1.6
5-9	6.8	6.8	6.8	7.1
10-19	13.7	14.0	13.6	14.6
20-29	23.6	23.6	23.3	24.5
30-49	35.8	36.1	36.7	38.9
> 50	62.9	52.7	69.8	91.9
> 50 1970s average	65.3	61.7	70.0	90.0

SOURCE : MMB EEC Dairy Facts and Figures.

For the purposes of projection the mean herd sizes used were those recorded for 1979-80, except for the over 50 cows herd for which the average over the 1970s was used.

The Department of Agricultural Economics and the Department of Agricultural Marketing launched a new series of Discussion Papers in the spring of 1982. The titles available are:

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