Projections of Irish Cattle and Milk Output under EEC Conditions*

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CATTLE and milk production are the most important enterprises in the agricultural sector of the Irish economy, accounting for about 57 per cent of gross output in 1970. There has been much speculation as to the likely levels of these outputs under EEC conditions and to date a number of people have made general statements as to the likely movements of cattle and cow numbers if and when we join the Common Market. Fewer people, however, have attempted to quantify these movements, and to the writers knowledge only three studies have been made to date in which actual projections of cattle and dairying output have been made.

The first of these was a paper by Josling and Lucey read at the Annual Conference of the Agricultural Economics Society of Ireland in October 1970 [1]. In this paper it was projected that by 1980 milk output would reach about 1,685 million gallons compared with 672 million gallons in 1968, while cattle output which was given in terms of beef and veal was expected to double over the 12 year period. The output of cattle in 1980 would, therefore, be about 2·8 million head compared with 1·38 million in 1968. The number of cows required to produce this cattle output would be about 3·3 million compared with 1·6 million in 1968. In making their projections Josling and Lucey used the best scientific methods available but in the paper referred to here, they did not carry out any consistency or productivity tests to ascertain if the land area of the country could support such a massive increase in stock. The study is, therefore, deficient in this regard. They do stress, however, that the results are presented as indicating the direction in which production may be expected to develop on EEC enlargement, which indicates that the figures may be taken more as direction indicators than as firm projections. The authors state that their model tends to show swings in production by 1980 which are likely to overestimate what is likely to occur.

The second study which was carried out by a Committee of the Irish Grassland and Animal Production Association (GAC) estimates that cow numbers would

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increase by 680,000 between 1971 and 1976 or by about 38 per cent; cattle output would increase by 635,000 or by about 44 per cent of the 1970 level, while milk sales would increase by 275 million gallons or by 42 per cent of the 1970 figure [2]. Though these results indicate fairly explosive annual changes, the overall result does not appear to be too unreasonable under EEC price conditions. Unfortunately, however, the Grassland Association Committee give no idea of the way they arrived at their results and we must conclude, therefore, that the figures presented are based on judgement rather than on scientific models. I should hasten to add that in ordinary circumstances "judgement" projections may very often be better than the "so called" scientific ones but in this instance where we are entering an entirely new situation it would be desirable to supplement judgement with estimates having some kind of a scientific basis.

The third study to be mentioned is the recent Government "White Paper" on the Accession of Ireland to the European Communities [3]. The cattle and milk estimates in this paper are more conservative than those in the other two studies. The "White Paper" estimates that cattle output will increase by 500,000 head between 1970 and 1978 or by 35 per cent, that the national dairy herd will increase to 2·25 million head in the same year or by 25 per cent above the 1971 level of 1·8 million, and that total milk output which was 656 million gallons in 1970 will expand to over 1,000 million gallons by 1978. Like the Grassland Association figures, the projections made in the "White Paper" seem to be based on judgements rather than on economic models and for this reason they are of necessity subjective. I have no doubt but that the various relevant causative factors and constraints were carefully considered in arriving at these estimates but since the results of such examinations are not discussed there is no way of assessing the validity or otherwise of the judgements made.

In view of the above considerations the writer feels that some more work needs to be done in this area particularly in relation to consistency and feasibility tests. With this objective in view, estimates are initially made in this paper of the way in which Irish cattle and milk production would move under EEC conditions if there were no major economic or biological constraints. The various constraints on expansion are then examined and their likely effects on outputs estimated. Finally a judgement is made as to the output levels which can be expected by 1978. This of course is a subjective estimate but it is hoped, in arriving at it, all the more important relevant factors have been taken into account. Regression methods are used in making the initial estimates.

ANALYSIS AND PROJECTIONS

Structure of the Irish Cattle and Dairying Industries

In any projection study it is necessary to understand clearly the structure of the industry under review. For this reason we describe briefly below some of the essential features of the Irish cattle and dairying industries. We commence with a definition of cattle output.

Cattle Output

Output of cattle in any year is defined as live exports plus slaughtering for domestic consumption and export, less live imports. Changes in stocks of cattle on farms between the beginning and end of the year may also be included in output. It follows from this definition that output, including stock changes in any year must be equivalent to births less mortality. Since mortality is fairly constant from year to year, and births are a function of the number of cows, it follows also that there is a close relationship between cattle output and cow numbers. This relationship is shown in Table A:1 for the years 1953 to 1970.

Despite the intimate connection between cow numbers and cattle output there is some variation from year to year in the cattle output/cow ratio. This arises for the following reasons:

(1) The cows are counted in June whereas the output relates to the calendar year. Births after June are, therefore, included in the figure for stock changes. This can affect the ratio in years when the normal seasonal calving pattern is upset as happened during the early years of the calved heifer subsidy scheme.

(2) The figures for stock changes included in output are based on the January livestock enumeration. As this is only a 25 per cent sample the results must inevitably contain a sampling error. Fortunately however, errors, if any, in stock changes cancel out over time and for this reason trends in the cattle output/cow ratio are best studied by using moving averages rather than yearly figures. Such moving averages are given in Table A.1 and show that there was little variation in the ratios between 1954 and 1960, the cattle output being on average about 84 per cent of the June cows in those years. After 1960 however, the ratios show a steady increase to over 90 per cent in 1964 and 1965 when they started to decline again to about the pre 1960 level.

(3) The changes in the ratios in the early 1960 years appear to be associated mainly with the Bovine Tuberculosis eradication scheme. Under this scheme which really got under way in 1959–60 [4], there was massive culling of old semi-infertile cows which in ordinary circumstances would have been retained for another year. Also cows were culled immediately on completion of lactations so that there were few dry cows on farms in these years. In addition culled cows were quickly replaced by calved heifers with the result that the apparent productivity of the national herd was raised considerably. With the completion of the scheme in 1965, however, traditional patterns of culling reasserted themselves so that at the present time we are back to an 85 per cent ratio similar to the pre 1960 level. The present scheme for the eradication of brucellosis will, no doubt, effect a permanent improvement in productivity as also to some extent will schemes aimed at reducing calf mortality. I am reliably informed, however, that the scope for improvement is not great. We cannot hope for much more than 2 per cent from the Brucellosis scheme and little if anything from calf mortality eradication schemes. It would seem reasonable, therefore, to project forward a cattle output/cow ratio of about 87 per cent.

Milk Yields

Because of the nature of the Irish climate, pasture is an exceptionally reliable and cheap feed for grazing animals. For this reason and also because of the relatively low prices obtaining for milk, Irish cows have traditionally received very little grain feeding. The result of this has been relatively low milk yields per cow, compared with yields in other countries.

Throughout the 1950s and in the early 1960s the average yield has been less than 500 gallons per cow milked. With the increase in milk prices in recent years, with improvement in techniques of grass production and as a result of the increase in Friesian cows, yields have improved in the late 1960s, but even at the present time the national average is only about 530 gallons per cow.

If we join the EEC, however, milk prices will increase substantially. Grain prices, of course, will also increase but not to the same extent as milk prices and, therefore, we can expect a substantial increase in grain feeding or perhaps in the feeding of roots like mangels or fodder beet. The result of this will be a significant increase in milk yields from the milking herds and this expectation will have to be taken into account in making projections of the dairying industry. For this reason an attempt has been made in this paper to make separate projections of "cows from which milk is sold" and "other cows". As will be shown these separate projections are not entirely satisfactory but nevertheless they should be of some use to policy makers.

The Regression Analysis

Because of the close relationships between cattle output and cows it is not necessary to project each enterprise separately. Once we establish the level of one, the other follows automatically. For various reasons it seems best to project the cow numbers directly and to estimate cattle output from these rather than the other way round. We commence, therefore, by establishing through regression analysis the relationship between cow numbers in the state, and a number of other (explanatory) variables.

In general two basic models were tried out. The first was a linear model of the type:

$$Y = a + b_1X_1 + b_2X_2 \ldots b_nX_n$$

where Y represents different classifications of cow numbers in 1953 to 1970 and $X_1, X_2 \ldots X_n$ are the explanatory or independent variables.

The second model was similar to the first except that in this case a curvilinear function was used of the following form:

$$Y = aX_1^{b_1}X_2^{b_2} \ldots X_n^{b_n}$$

This function is linear in the logarithims and can be written as

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 \ldots\ldots + b_n \log X_n$$

In this type of function each regression coefficient (b_i) is an elasticity of supply, indicating the percentage by which the dependent variable Y would change for each one per cent change in the independent variable X_i. We also tried a number of first difference formulations to test the models and to indicate which independent variables were likely to be the most reliable. In addition distributed lag models were tried for series which gave poor fits with the other types of equation. Unfortunately the results from these were not too good.

Dependent Variables

The dependent variables which are given in Table A.1 were:—

(1) Total cows in June

(2) Dairy cows (i.e., cows from which milk was sold)

(3) Other cows (i.e., cows from which milk was not sold)

Official figures for items (2) and (3) are not available and these series were estimated by the author. Dairy cows were estimated by adding to cows on farms sending milk to creameries (collected each year by The Department of Agriculture and Fisheries), an estimate of cows producing milk for the liquid trade. The latter figures were estimated on the basis of (*a*) the amount of milk sold for liquid consumption and (*b*) milk sold per liquid milk cow taken from An Foras Taluntais Farm Management Survey results [5] trended backwards to 1953. "Other cows" were obtained by subtracting "dairy cows" from total cows. Though the level of these two series may not be correct, the trend should be reasonably accurate and therefore they should serve for the purpose in hand, namely to make projections of milk production.

Independent Variables

The following independent variables were used: (see Table A.2)

X_1 = Average annual price of creamery milk with skim returned lagged 1 year (pence per gallon).

X_2 = Average annual price of calves under 1 month, lagged 1 year (£ per head).

X_3 = Index of moving average of wheat, barley prices weighted by amounts of these crops sold, lagged 1 year (1953 = 100). Price of feeding and malting barley are included.

X_4 = Average annual price of fat lambs, lagged 1 year (£ per head).

X_5 = Dummy variable for Calved Heifer Scheme, based on total payments under scheme adjusted back to dates of calvings.

X_6 = Dummy variable for Beef Incentive Bonus Scheme, based on average payment per cow under scheme adjusted back to dates of calvings.

A dummy variable was tried for the BTE scheme and an index of the price of feeds, seeds and fertilisers was also tried as well as deflated prices for milk and calves but these proved insignificant in all cases, as did indices of the farm labour force and milk yield per cow. If we were using the equations to project total agricultural output it would be necessary to incorporate new farm price movements in some way, but in this case where we are interested only in projecting a single enterprise, such a variable is not essential. In this case it is the prices of alternative farm products which matter.

Results of Regression Analysis

About forty equations were tried incorporating different combinations of the variables and using different lags. Some of the best of these equations are shown in Table 1. The figures in brackets in this table are the *t* values. In this case where there are 10–11 degrees of freedom a *t* value of 1·80 represents significance at about the 10 per cent level, a value of 2·2 represents significance at about the 5 per cent level while one of about 3·1 indicates a 1 per cent level of significance.

As can be seen from Table 1 exceptionally good "fits" as measured by $\bar{R}^2$ were obtained for "total cows" Y and "dairy cows" Y_2. The linear models seem to give slightly better results than the curvilinear ones but since $\bar{R}^2$ from linear and logarithmic models are not strictly comparable we cannot be sure at this stage as to which formulation is best.

The "fits" obtained for "other cows" on the other hand are not nearly so good. This is only to be expected as most of the other cows are kept for supplying unsold milk to farm households and for feeding calves and are, therefore, unlikely to be affected by the same economic stimuli as "dairy cows". Equations (not given here) for cows suckling calves gave little better results. Again this is not surprising as the available data for cows suckling calves show very little trend. The d.w. and *t* values are acceptable for all the equations shown in Table 1.

Individual Regression Coefficients

Price of Milk (X_1): As can be seen from the exceptionally high *t* values the price of milk lagged one year is one of the most important determinants of "total and "dairy" cows. The coefficients of this price are highly significant in all the equations for "total and dairy" cows but they are not significant in any of the equations

TABLE 1: *Regression Equations*

Eq. No.	Dependent Variable	Intercept	Independent Variables						-2 R	S.E.E.	d.w.	Geary τ
			X_1	X_2	X_3	X_4	X_5	X_6				
1	Y_1	31,450·25000	13,193·85000	1,043·1600	−233·92000	−2·94310	2,138·19000	—	0·99311	1,470·05000	2·03	7/16
			(23·101)	(7·319)	(−1·9639)	(−0·0032)	(2·3601)					
2	Y_1	31,469·00000	13,192·55000	1,042·8820	−234·189	—	2,137·57300	—	0·99374	1,401·90000	2·03	7/16
			(33·961)	(9·6655)	(−2·936)		(2·534)					
3	Y_1*	4·61406	0·85288	0·09766	−0·19848	0·01053	0·00384	—	0·98605	0·00637	1·89	7/16
			(16·310)	(5·3874)	(−2·1727)	(−0·18002)	(0·24792)					
4	Y_1*	4·59034	0·86015	0·09931	−0·18621	—	0·00445	—	0·98728	0·00608	1·88	7/16
			(27·130)	(6·6353)	(−3·2029)		(0·30835)					
5	Y_2	−611·06250	13,077·19000	266·9930	−164·34600	−1,494·12800	1,161·57000	−3,984·633	0·98383	1,890·92000	1·45	7/16
			(17·455)	(1·2993)	(−1·0637)	(−1·1780)	(0·8545)	(−0·7788)				
6	Y_2	6,769·38000	12,760·87000	209·3020	−317·17900	—	—	−7,126·23	0·98442	1,856·41000	1·88	8/16
			(28·123)	(1·1544)	(−3·3651)			(−1·6954)				
7	Y_2*	4·56050	1·16610	0·01020	−0·36250	—	—	—	0·98270	0·00891	1·57	6/16
			(27·694)	(0·4867)	(4·7140)							
8	Y_3	315,161·60000	3,003·56600	8,401·1900	−1,182·78000	19,328·13000	—	—	0·78838	21,762·73000	1·33	9/16
			(0·3658)	(4·0184)	(−0·8330)	(1·4524)						
9	Y_3	343,052·90000	—	8,145·4300	−1,460·31000	23,189·96000	—	—	0·80365	20,962·53000	1·77	9/16
				(4·292)	(−1·2633)	(2·972)						
10	Y_3*	5·31697	0·09758	0·24714	−0·08747	−0·20377	—	—	0·76304	0·02085	1·90	8/16
			(0·6314)	(4·2069)	(−0·3261)	(1·0908)						
11	Y_3*	5·51460	—	0·2369	−0·17490	0·29460	—	—	0·77492	0·02032	1·80	8/16
				(4·3046)	(−0·7809)	(2·5365)						

Notes: Y_1 1/10 (Total cows), Y_2 = 1/10 (Dairy cows), Y_3 = Other cows. (Asterisks denote logarithmic equations)
X_1 = Price of Milk (p/gal.). X_2 = Price of calves (£/head), X_3 = Index of cereal prices 1953 = 100, X_4 = Price of lambs (£/head)
X_5 and X_6 = Dummies for Calved heifer and Beef Incentive Bonus Schemes. Lags: Cereal prices 1½ years: All Others 1 year.

for "other" cows.* As can be seen from the coefficients of equations 3, 4 and 7, a 10 per cent increase in the price of milk in any year is associated with an increase of 8·5 per cent to 8·6 per cent in the number of "total" cows the following year, and with an increase of 11·7 per cent in the number of "dairy" cows.

Price of Calves (X_2): The price of calves is the most important determinant of "other" cows and the second most important determinant of "total" cows. The coefficients of this variable are highly significant in all equations for the above cows.* Calf price, however, is not a significant determinant of "dairy" cows. Equations 10 and 11 show that a 10 per cent increase in the price of calves in any year is associated with, about a 2 per cent increase in the number of "other" cows in the following year.

Cereal Prices (X_3): The coefficients of cereal price have negative signs in all cases, indicating that an increase in this price tends to cause a reduction in cow numbers, or alternatively increased cow numbers is associated with a reduction in grain prices. The cereal price coefficients are not significant in the equations for "other" cows but they are significant in most of the equations for "total" and "dairy" cows and are highly significant in the logarithmic equations 4 and 7. The latter equation shows that a 10 per cent increase in the price of cereals in any year is associated with a 3·6 per cent decrease in the number of "dairy" cows $1\frac{1}{2}$ years later. This result is very satisfying since a significant cross price relationship of this kind in an equation makes it very useful for projection purposes.

Price of Lambs (X_4): The coefficients of this variable are not significant in any of the equations for "total" and "dairy" cows. Some of them are significant, however, in the equations for "other" cows but as they have positive signs in these equations they indicate that an increase in the price of lambs in any year is associated with an increase in cow numbers a year later. This result which at first sight appears to be perverse, seems to indicate that "other" cows and sheep are complementary enterprises on many farms. We feel, therefore, that it may not be unrealistic to use one of these equations later in projecting "other" cow numbers.

The Calved Heifer Scheme (X_5): The coefficient of the calved heifer scheme (CHS) is significant at the 5 per cent level in the two linear equations for "total" cows and in one of the linear equations for "other" cows. It is insignificant in all the other equations. The rather poor significance of this variable seems to be due to a difficulty in including it in the equations. The grants were paid to farmers who increased cow numbers but as there was no "fine" on farmers who decreased numbers, the payments in the later years of the scheme were not necessarily associated with increases.

Beef Incentive Bonus Scheme (X_6): The coefficient of this variable was almost significant at the 10 per cent level in one of the equations for "dairy" cows, (Eq. 6), the negative sign indicating that this scheme was responsible for a switch out of milk selling and presumably into "other" cows. Unfortunately a significant

*Similar results were obtained using first difference equations, indicating that a high degree of reliance can be placed on the coefficient of X_1 and X_2).

coefficient for this variable could not be found in any of the equations for "other" cows.

Conclusions from the Regression Analysis

The results of this analysis are very encouraging, showing that good "fits" can be obtained with supply equations of this kind. They also indicate that despite what is sometimes said to the contrary the relationship between lagged prices and production in Ireland are not perverse. Dairy and grain farmers appear to respond to price changes in a very positive manner and there is no doubt but that other farmers behave in a similar manner. Of course when farmers expand an enterprise due to a price increase they very often decrease other enterprises.

Projections

Because of the fundamental changes which are likely to occur if and when we join the EEC the projections cannot be made in an orthodox manner. What I do is to substitute present EEC prices in the regression equations in order to determine the level of production we might have at present if we had joined the EEC six years ago, and assuming that cattle and cow numbers were at the same level in 1963 as they were in 1970. This may appear somewhat unrealistic but it seems better than trying to project prices forward to 1978. The prices used are: Milk, 20p per gallon; Calves, £45 per head; Cereal price index, 101; Lambs, £14. It is assumed that the other variables will not be present under common market conditions. The above prices were adopted after discussion with various individuals and agencies.

Before the equations could be used for projection purposes they had to be adjusted slightly to allow for the fact that in doing the regressions the milk prices used were those for creamery milk with skim returned to the farmer whereas the EEC prices relate to whole milk. The adjustment involved reducing the regression coefficient for milk in the linear equations by 10 per cent and the constant term in the logarithmic equations by a similar proportion. The figure of 10 per cent was the estimated average difference over the period 1953 to 1970 between the price of whole milk with and without the inclusion of skim. The different equations give different results and for this reason the results from a number of equations are given in Table 2. The figures in brackets in this table after the numbers are the 5 per cent confidence intervals.

As can be seen from Table 2 the projections for total cows range from 2·85 millions to 3·03 million. The two projections for "dairy" cows are close to 2·1 million while those for "other" cows are 782,000 and 887,000. The confidence intervals attached to all the results are relatively small but those associated with the logarithmic equations are about twice as large as those associated with the linear results. We must now consider what the estimated figures mean.

From the way in which the models were formulated the figures indicate that if Irish farmers had the benefit of present EEC prices and were given time to ad-

TABLE 2: *Cow Numbers Projected from Different Equations*

Equation No.	*Type of Equation*	*Dairy Cows*	*Other Cows*	*Total Cows*
		(000's)	(000's)	(000's)
2	Linear	—	—	2,923 (± 31)
4	Logarithmic	—	—	2,847 (±88)*
6+9	Linear	2,138 (±41)	887 (±46)	3,025†
7+11	Logarithmic	2,099 (±96)*	782 (±81)*	2,881†
1970 Levels		1,124	575	1,699

*Average of upper and lower intervals.
†Indeterminate.

just to this situation they would increase cow numbers in the direction of the levels indicated. This does not mean of course that we will in the foreseeable future, reach even the lowest of these numbers, indeed it is the author's opinion that it would be unrealistic to consider seriously at the present time any figure for total cows which is in excess of 2·5 million. We discuss below the reasons for this opinion.

Constraints on Expansion

There are four main constraints on the expansion of cow and cattle numbers although of course they are not all independent of one another. These constraints are: (1) biological; (2) capital; (3) productivity of land and (4) management.

Biological and Capital

It can be taken that there are no realistic biological constraints *per se* on expansion. Sufficient heifers will be available each year to give up to 10 per cent per annum increase in cows. However though the heifers may be available they may not be used for breeding as there will be demands on them for slaughter and export, resulting in very high prices for good quality animals. A farmer keeping back a good heifer for expansion may have to forego current income to the extent of perhaps £150 unless he borrows the amount required. Additional capital will also be required for buildings and other fixed costs for cows and followers (i.e. calves and other cattle) amounting to a further £100 or more (GAC Report p. 18). But even if the necessary capital is made available through the banks and ACC many farmers will be reluctant to borrow, and will prefer to finance their programmes out of profits. This will slow down expansion considerably. Hence capital will undoubtedly prove a major constraint, though I understand that there has been a substantial increase in ACC lending during the current financial year. I do not have figures for bank lending to farmers in the current year.

Land and Management

Land and management restrictions which are closely interrelated are other serious constraints on expansion of the cow herd. Using June 1969 figures it has been estimated that every grazing livestock unit (l.u.) in the State in that year required 2·34 feed acres (see Table 3) which was made up of 2·11 acres of grassland, 0·19 acres of meals and 0·04 acres of root and green crops. This was equivalent to 2·2 tons of Barley Equivalent (BE) per l.u.[1] Total grazing livestock units in that year were 5·03 million. Now if sheep numbers were to remain at the same level as in 1969, horses etc. were to decline to 80,000 units, cow numbers were to increase to 2·50 million and cattle were to remain in the same proportion to cows as in 1969 the number of livestock units in the State would increase to 7·02 million and they would require 15·4 million tons of BE or an increase of 4·4 million tons over the 1969 figure of 11·0 million. This extra feed must come either from home production, from imports or from a combination of both. If there were no increase in home production we would need to import the whole of this extra feed in addition to the 1969 imports of 0·48 million tons. Under this assumption the total imported feed bill at 1972 EEC prices (£41·5 per ton) would come to the staggering total of about £200 million. As this appears to be a completely unrealistic figure it follows that an expansion programme of this magnitude cannot come about unless there is a very substantial increase in the productivity of Irish land. We must therefore consider what the prospects are in this regard.

In another paper [6] it was shown that despite increased fertiliser use in recent years there had been very little increase in the output of starch equivalent per acre of grassland between 1952 and 1964. The figures were 11·9 cwt. SE per acre in 1952 compared with 13·2 cwt. in 1964. It has not been possible in the time available to do such a detailed study on a comparable basis for the years since 1964 but I have compared in a rough way (see Table 3) stocking rates for the years 1963 and 1969 and have found very little improvement over these six years. It is true that the area of grassland per l.u. over the period has decreased but this has been almost completely counterbalanced by increased feeding of concentrates (see also Table 4). Some people may be unwilling to accept these figures as they may know of many farmers who have doubled their grassland yields during the 1960s. This is no doubt true, but unfortunately there are many others whose pastures are now producing much less than they were 8 years ago. Indeed in certain parts of the country large tracts of land which were reasonably well grazed in the past are now almost derelict. Also fertiliser use on grassland is not very widespread. The results of the 1965 Census of Agriculture showed that in that year only about one quarter of the total hay and pasture acreage in the State received fertilisers. It could be argued that the level of EEC prices will be a sufficient incentive to entice a rapid increase in fertiliser use on grassland. I am prepared to agree with

1. Higher feed requirements per unit, and hence per acre yields, would be obtained if we had used an average of January and June livestock figures, but the absolute level of the per unit figures does not affect the present argument.

TABLE 3: *Comparing Stocking Rates 1963 and 1969*

Livestock	*Livestock Units*		*Crops*	*Area of Forage Crops*	
	1963	*1969*		*1963*	*1969*
	(000's)			(000's)	
Cattle and cows	3,792·0	4,328·2	Hay and pasture	9,900·2	10,630·7
Sheep (lowland)	606·3	529·5	Turnips and mangles	143·7	126·4
Horses, ponies, asses	249·7	168·9	Sugar beet ($\frac{1}{3}$ sown area)	29·4	20·5
			Fodder beet	13·2	8·6
Total Grazing Stock	4,648·0	5,026·6	Other root and green crops*	37·3	23·0
Feed acres per l. u.	2·35	2·34	Total forage acres	10,123·8	10,809·2
Meals acreage per l. u.	0·17	0·19			
Hay and pasture acres per l. u.	2·13	2·11	Meals fed to grazing stock (acreage equivalent)†	799·8	970·0
Root and green crop acres per l. u.	0·05	0·04			
Forage acres per l. u.	2·18	2·15	Feed acres to grazing stock	10,923·6	11,779·2

*Kale and field cabbages plus other root and green crops less vegetables (CSO).

†Estimates by author from data obtained from CSO. Meals first converted to barley equivalents (BE) and then to acre equivalents on the basis of 1 feed acre per ton of BE.

this argument up to a point, but I am doubtful if the increases will be as great as many people are inclined to think. In the report of the Committee on the Review of State Expenditure in Relation to Agriculture [7] it was shown (p. 92) that there were only 88,000 viable holdings in the State in 1965 compared with 150,000 non-viable and 44,000 potentially viable holdings.

As the last two of these groups occupy almost $\frac{1}{3}$ of the land area of the country their potential is very great. Unfortunately however, a large number of the non-viable farms are held by part-time farmers and by people who are well over middle age. It will be difficult to change the attitudes of many of these people and unless some means can be devised of getting young energetic people on to these farms there is likely to be little change in the production on them. One means of improving the output on such farms would be for the Land Commission to allow long term letting of land. Much good should come from such a policy but even if this change were made now it would take a good while to work through the system. Hence the bulk of the expansion over the next five or six years will have to come from the 88,000 viable holdings. There is still plenty of spare physical capacity on the latter farms but, unfortunately, the stock of management on them is strictly limited and can only be expanded very slowly. We cannot, therefore, expect a revolution in feed production in the next six years and we must be prepared to see all increases in cattle numbers accompanied by substantial increases in cattle feed imports, and possibly also by decreases in sheep numbers.

Projection Levels

The above discussion indicates that the production of extra feed will be one of the main constraints on expansion of cow numbers under EEC conditions. Opinions differ as to the increases in land productivity which will come about over the next six years, but it is the author's opinion that it will not be sufficient to enable farmers to keep the GAC estimate of 2·46 million cows and their followers. The government figure of 2·25 million is probably the more realistic projection but if legislation can be introduced which will make land available to young energetic people a level of 2·30 million cows might be obtained by the end of the 1970s.

This level of cow numbers together with their followers would represent an increase of about 1·7 million livestock units above the 1969 level. If we assume that lowland sheep remain at their 1969 level and that horses decline to 0·08 million l. u. the total grazing livestock units in the State in 1978 would be about 6·51 million units (see Table 4) or an increase of 1·48 million units over the 1969 level of 5·03. In 1969 each grazing livestock unit in the State is estimated to have consumed 0·19 tons of concentrated feed. If we assume that by 1978 this consumption will have increased to 0·25 tons per unit then the total concentrates required for grazing stock in that year would be about 1·63 million tons compared with 0·97 million tons in 1969. It is presumed that most of these extra concentrates

TABLE 4: *Grazing Livestock Units and Feed Requirements in 1963 and 1969 with Projected Levels in 1978*

		1963	1969	1978	Change 1969–78
			(million)		
Total grazing livestock units*	(No.)	4·65	5·03	6·51	1·48
Total feed required	(tons BE)	10·19	11·01	14·32	3·31
Concentrates fed	(tons BE)	0·80	0·97	1·63	0·66
Estimated feed imports†	(tons BE)	0·27	0·48	1·14	0·66
Forage required	(tons BE)	9·39	10·04	12·69	2·65
Forage acreage	(acres)	10·10	10·81	10·81	
			(tons)		
Yield per forage acre		0·93	0·93	1·17	0·24

*Includes cows, "other" cattle, lowland sheep and horses.
†Total imported feed for pigs and poultry as well as for grazing stock.

(0·66 million tons) will come from imports. The remaining 2·65 million tons of BE would have to come from forage and if we assume no change in the forage acreage, forage yield would have to increase to 1·17 tons per acre compared with 0·93 tons in 1969. This represents an increase in yield of about 25 per cent of the 1969 level.

In view of past performances this is a big increase in yield but it is possible that it may be obtained under EEC price conditions. If it is not, and if cow numbers increase to the level assumed above, the shortfall in feed will have to come from further increased grain feeding resulting in massive feed imports. Sheep numbers would also probably decline.

Of the 2·3 million cows projected about 1·7 million should be "dairy" cows and the remaining 600,000 will be "other" cows. This is a rather small increase in the latter animals but I feel that the big push will be into milk production rather than into cows for the breeding and feeding of calves. High prices for milk will cause a rapid expansion of dairy cows putting great pressure on land space. Dairy farmers will therefore have to sell most of their calves. With such large numbers of calves coming to market calf prices will probably not rise to anything like the same extent as those for beef or milk. For this reason there will be no great incentive for cattle farmers to breed their own calves. Dramatic increases in single suckling cows are therefore not envisaged. Some increases are however likely to occur in cows for double suckling. Finally I expect that the increases which will take place will not be at an even rate over the transition period. We can expect an increase in cow numbers in 1972 and 1973 with a slackening off for the next few years and then probably a big spurt in the final transition years in expectation of higher prices when we become full members.

Milk Production

In our circumstances the bulk of the milk will continue to come from summer production of grass. Grain feeding of cows will therefore not rise to the British or Continental level. However, there will be heavier grain feeding than at present at the beginning and end of the season and yields from dairy cows are likely to increase to about 700 gallons per cow. The amount of milk produced for sale is therefore likely to be about 650 gallons per cow and the total sold about 1,105 million gallons. If we assume that about 95 million gallons of this will be sold for the liquid trade the amount of manufacturing milk will be about 1,010 million gallons.

Beef Production

The output of cattle including stock changes from 2·3 million cows will be about 2·0 million animals. About 470,000 of these will be cull cows and the remainder "clean" cattle. At the present stage of my studies I have not formed any definite opinions as to the form in which the cattle will be disposed of. This question is currently being studied by the Irish Livestock and Meat Commission. However, the following points may be of interest in this connection.

1 Pressure on the land area will push farmers towards early sales, but at the prices ruling for young feeder cattle on the continent an export trade in these type of animals does not appear to be an economic proposition.

2 It is expected that the usual ½ million or so store cattle will continue to go to Britain but with the dropping of the British support programme, lighter weight animals may be purchased.

3 The remaining clean cattle will go out either as live animals or as dead meat. There will be a strong demand for live fat cattle for export, and factories are going to have to fight hard to stay in business.

4. The ages at which animals will be ready for slaughter is a matter of conjecture. There will certainly be pressure to fatten the cattle at early ages but the extent to which this happens will depend a good deal on the seasonality of beef prices. In most EEC countries beef prices are fairly even throughout the year and if that pattern were to develop here, practically all our cattle would be slaughtered in autumn at 2½ years of age. However if seasonality patterns both here and in Britain stay at current levels there should be some development in winter fattening of 20–24 months old cattle. The prospects of major shifts in this direction are however not too optimistic.

SUMMARY AND CONCLUSIONS

Three important projections of Irish cattle and dairying output under EEC conditions have already been made. In the first of these, Josling and Lucey estimated that by 1980, milk output would reach about 1,685 million gallons compared with 672 million gallons in 1968, while cattle output which was given in terms of beef and veal was expected to double over the 12 year period. The output of cattle in 1980 would therefore be about 2·8 million head compared with 1·38 million in 1968. The number of cows required to produce this cattle output would be about 3·3 million compared with 1·6 million in 1968. The authors indicate however that the figures may be taken more as direction indicators than as firm projections.

In the second study a Committee of the Irish Grassland Association (GAC) estimated that cow numbers would increase by 680,000 between 1971 and 1976 or by about 38 per cent. Cattle output would increase by 635,000 or by about 44 per cent of the 1970 level, while milk sales would increase by 275 million gallons, or by 42 per cent of the 1970 figure.

The third study to be mentioned is the recent Government White Paper relating to the EEC in which it was estimated that cattle output would increase by 500,000 head between 1970 and 1978 or by 35 per cent, that the national dairy herd would increase to 2·25 million cows in the same year or by 25 per cent above the 1971 level of 1·8 million. It was projected that milk output which was 656 million gallons in 1970 would expand to over 1,000 million gallons by 1978.

The purpose of this paper is to make estimates (using regression analysis) of the way in which Irish cattle and milk production would move under EEC conditions if there were no constraints on expansion. The different technical, economic, management and institutional constraints are then examined and their likely effects on outputs estimated. Finally a judgement is made as to the output levels which can be expected by 1978.

Structure of cattle and dairying industries

Output (including stock changes) of cattle in any year is equal to births less mortality. Since mortality is fairly constant from year to year, and births are a function of the number of cows in the State, it follows that there is a close relationship between cattle output and cow numbers. The cattle output/cow ratio was about 84 per cent prior to 1960. It rose during the BTE campaign to 91 per cent in 1965 and since then it has dropped back to a level of about 85 per cent. It may increase to 87 per cent when the Brucellosis eradication scheme is completed.

Because of the nature of the Irish climate cows are fed mainly on grass and receive very little meals. For this and other reasons average milk yields are low by British and continental standards—less than 500 gallons per cow prior to 1960 and about 530 gallons per cow at present. If we enter EEC, milk will still be produced mainly from grass, but high prices will stimulate more grain feeding at the beginning and end of the season, and yields from the dairy herd proper (i.e., cows from which milk is sold) are likely to rise to an average of 700 gallons per cow. This yield is not comparable with the present one of 530 gallons which relates to all cows milked.

Analysis of present situation

It was found that the most important determinant of cow numbers in any year is the price of milk in the previous year. Other important factors are the price of calves and the calved heifer subsidy scheme during its early years. The price of cereals in any year has a negative effect on cow numbers. In other words an increase in cereal prices in any year causes cow numbers to decrease 1½ years later.

Projections

When the regression equations were used to project cow numbers under EEC conditions it was found that if there were no constraints on expansion, increased prices would cause cow numbers to expand to about 3 million by the end of the 1970s. However, because of various constraints, cow numbers could not realistically increase to this number. The most important constraints are capital feed requirements and land tenure problems. Taking these factors into consideration it was felt that we could not expect any more than 2·3 million cows by 1978, and to achieve this target would require 3·3 million tons of barley equivalent over and above the 1969 level. Of this it is expected that 0·66 million tons would

come from concentrates leaving 2·65 million tons to be supplied by an unchanged forage acreage. To supply this extra feed, the production of forage would have to increase by about 25 per cent.

In view of past performances this is a big increase in yield but it is possible that it may be obtained under EEC price conditions. If it is not, and if cow numbers increase to the level assumed above, the shortfall in feed will have to come from further increased grain feeding resulting in massive feed imports. Sheep numbers would also possibly decline.

Of the 2·3 million cows projected about 1·7 million should be "dairy" cows (i.e., cows from which milk is sold) and the remaining 600,000 should be "other" cows. Milk sales from the dairy cows should be about 1,100 million gallons compared with 656 million gallons in 1970. Cattle output should be about 2 million compared with 1·45 million in 1970.

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APPENDIX

TABLE A.1: *Relationship Between Cows and Cattle Output, 1953–1970*

Year	Milch Cows (a)	Cattle Output*	Output as per cent of Cows	Three year moving acreages: Milch Cows	Cattle Output*	Output as per cent of Cows	Dairy Cows (b)	Other Cows (c)	Increase in Milch Cow Numbers
	(000's)	(000's)	*per cent*	(000's)	(000's)	*per cent*	(000's)	(000's)	*per cent*
1953	1,174	955	81·3	—	—	—	748	425	—
1954	1,204	1,015	84·3	1,192	1,006	84·4	773	430	2·6
1955	1,198	1,048	87·5	1,196	1,003	83·9	772	426	−0·5
1956	1,187	947	79·8	1,207	1,016	84·1	788	398	−0·9
1957	1,236	1,052	85·1	1,227	1,014	82·6	823	413	4·1
1958	1,260	1,042	82·7	1,256	1,072	85·3	801	459	1·9
1959	1,272	1,121	88·1	1,272	1,076	84·6	782	489	1·0
1960	1,284	1,064	82·9	1,282	1,094	85·3	799	484	0·9
1961	1,291	1,096	84·9	1,295	1,116	86·1	816	474	0·5
1962	1,309	1,186	90·6	1,307	1,159	88·6	859	451	1·4
1963	1,323	1,194	90·2	1,344	1,224	91·1	888	434	1·1
1964	1,400	1,292	90·8	1,423	1,298	91·2	943	457	5·8
1965	1,547	1,409	91·1	1,510	1,358	90·0	1,014	534	10·5
1966	1,582	1,374	86·9	1,566	1,370	88·7	1,055	528	2·3
1967	1,568	1,328	84·7	1,586	1,361	85·9	1,119	449	−0·9
1968	1,607	1,384	86·0	1,611	1,370	85·0	1,164	444	2·5
1969	1,657	1,401	84·5	1,654	1,411	85·3	1,152	505	3·1
1970	1,699	1,449	85·3	1,713	—	—	1,124	575	2·5
1971	1,782	—	—	—	—	—	—	—	4·9

(*a*)—Cows of all kinds in State (June enumerations).
(*b*)—Cows from which milk was sold (estimated).
(*c*)—(*a*)−(*b*).

Note: *Output includes stock changes.

APPENDIX

TABLE A.2: *Independent Variables used in Regression Equations*

Year	*Price of Milk p/gal.* X_1	*Price of Calves £/head* X_2	*Index of Cereal Prices 1953 = 100* X_3	*Price of Lambs £/head* X_4	*Dummy for CHS* X_5	*Dummy for BIBS* X_6
1953	7·81	8·87	100·00	6·86	0·00	0·000
1954	7·77	8·05	93·74	6·55	0·00	0·000
1955	7·73	9·41	87·16	6·45	0·00	0·000
1956	7·73	8·79	84·26	5·85	0·00	0·000
1957	7·72	10·27	87·03	6·46	0·00	0·000
1958	7·40	16·45	78·58	6·25	0·00	0·000
1959	7·47	16·60	90·26	5·46	0·00	0·000
1960	8·10	10·11	83·10	5·70	0·00	0·000
1961	8·18	10·25	78·19	5·30	0·00	0·000
1962	8·13	11·64	73·42	5·32	0·00	0·000
1963	8·46	11·89	74·19	5·70	0·00	0·000
1964	9·22	14·52	79·68	6·97	1·00	0·000
1965	9·35	18·15	78·90	6·67	0·80	0·000
1966	9·90	12·05	86·32	6·24	0·60	0·000
1967	10·46	8·86	87·03	6·75	0·40	0·000
1968	10·70	12·17	91·16	8·10	0·20	0·000
1969	10·60	19·72	91·35	8·82	0·07	0·675
1970	10·94	22·87	90·19	9·45	—	1·000

Source: *Irish Statistical Bulletin* and personal communication, Central Statistics Office and Department of Agriculture and Fisheries.