Sheep

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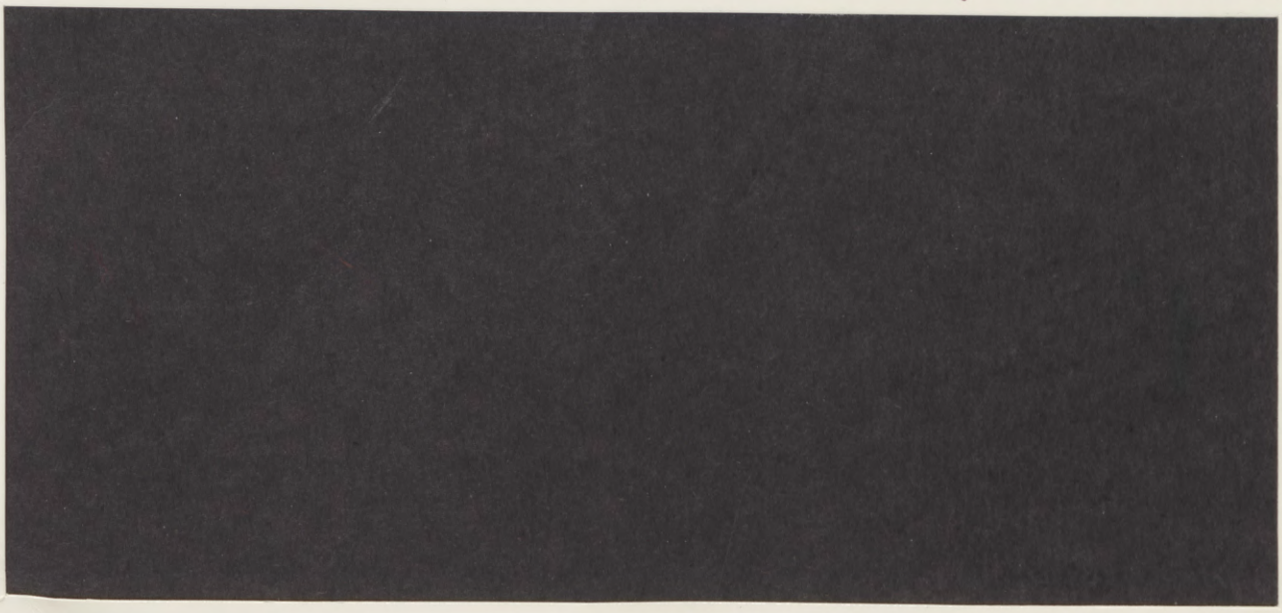
Adran Economeg Amaethyddol

Agric. cultural enterprise studies in England and Wales #20



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THE ECONOMICS OF HILL SHEEP FARMING

A Study of Hill Flocks in Wales and the North of England

by

W. DYFRI JONES

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Hill Sheep Report: No. 20

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June 1973

W. Dyfri Jones

AGRICULTURAL ENTERPRISE STUDIES IN ENGLAND AND WALES

University departments of Agricultural Economics in England and Wales have for many years undertaken economic studies of crop and livestock enterprises. In this work the departments receive financial and technical support from the Ministry of Agriculture, Fisheries and Food.

A recent development is that departments in different regions of the country are now conducting joint studies into those enterprises in which they have a particular interest. This community of interest is being recognised by issuing enterprise reports in a common series entitled "Agricultural Enterprise Studies in England and Wales", although the publications will continue to be prepared and published by individual departments.

Titles of recent publications in this series and the addresses of the University departments are given at the end of this report.

C O N T E N T S

I THE ECONOMIC STATE OF HILL FARMS

Farm Incomes

Farming in hill land and upland regions is beset with many problems arising from natural, economic and social forces. Hill land is not as naturally productive as the lowlands due to limitations imposed by adverse climate, topography, soil and natural vegetation. Technical advances have been slow compared with other sectors of agriculture partly due to the lesser scope for applying new techniques and to the low returns to additional capital investment. Compared with the rate of innovations in intensive livestock and cereal production in the lowlands over the past decade, developments in hill farming have been almost imperceptible. Moreover, these natural disadvantages are often combined with certain other factors whose economic effect are equally important, namely a small acreage, remoteness from markets and centres of population, and poverty of communications.

Comparison between the type of farming areas distinguished in the Ministry of Agriculture report on Farm Incomes* show that two hill farming areas, namely Wales, and the North of England, had in 1969-70 an average net farm income only 17% as much per 100 (actual) acres and 55% as much per farm as the average for all the farming (excluding pigs, poultry and horticulture) types for which information is given.

Furthermore, not only do hill farms compare unfavourably with those in the lowlands in respect of net incomes and living conditions, they are also more vulnerable to year to year changes in both prices and climatic conditions. Variations in incomes due to the weather have in the past been partially, but by no means completely, offset by inverse fluctuations in the level of the hill sheep subsidy. Not only have hill farm incomes compared unfavourably with those for lowland farms over a period of time, but the situation in this respect, until recently, also tended to deteriorate after the mid-sixties. Whilst previously fluctuations in incomes have occurred in a context of fairly stable input prices, they now experience a rapid cost inflation as well. For instance the

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* *Blue Book on Farm Incomes in E & W. 1969-70.*

cost of labour increased from 20p per hour in 1960 to 38p per hour in 1970.

During the same period the prices of certain representative fertilizers and seeds, taken as a whole, increased by about 40%.

Meaningful comparisons of the economic conditions of hill farming in Wales with those in the North of England is rendered difficult by the dearth of comparable economic data. Net Farm Incomes, and Gross Outputs per farm and per acre for these areas are quoted in Table I below.

Table I

Gross Outputs and Net Farm Incomes on Hill Farms (Livestock mainly Sheep) in Wales and the North of England 1964-69

	WALES		NORTH OF ENGLAND	
	1965-66	1967-69	1964-66	1967-69
Number of Farms	65	55	27	26
Average Size of Business (S.M.D.)	729	685	966	794
Average Size of Farm (Acres)	368	447	874	677
Gross Output per Farm	3104	3793	4525	5104
Gross Output per Acre	8.4	8.5	5.2	7.5
Net Income per Farm	890	1018	1378	1438
Net Income per Acre	2.4	2.3	1.6	2.1

Source: Farm Incomes in England and Wales M.A.F.F.

The small size of the samples from each area do not allow very meaningful comparisons between the areas, but they suggest that farms in hill areas in the North of England are probably larger and provide higher net incomes per farm. However, measured on a per acre basis, both the average gross output and the average net farm income were higher for Welsh hill farms. This is very surprising in view of the much greater importance of dairy cattle in the North of England farms.

The net farm incomes per farm for samples of between 73 and 93 Welsh hill farms in the decade 1959-70 are shown in Table II. Three year average figures indicate a general upward movement in net incomes for these farms as a whole, especially during the first half. Although the average for all farms in the sample was not unsatisfactory, yet for the small farms, those of less than 100 effective acres that is, it was very much below the general average and far from being at a satisfactory level. In fact it is only the large farms, those with 200 effective acres or

more, which provided their occupiers with a reasonable standard of living.

Table II

Net Incomes on Welsh Hill Farms

Size of Farm (Effective Acres)	1959-62		1963-66		1967-70		1969-70	
	No. of Farms	£	No. of Farms	£	No. of Farms	£	No. of Farms	£
0 - 99	22	231	23	405	16	187	16	236
100 - 199	23	591	24	709	23	865	27	913
200 & over (under 80% R.G.*)	15	1503	18	2006	24	2082	31	1967
200 & over (over 80% R.G.*)	14	946	15	1647	17	1632	19	1123
All Size Groups	73	730	80	1095	80	1243	93	1191

R.G. = Rough Grazing

Charts I and II show the annual changes in net incomes for each size group of hill farms for the decade 1960-61 and 1970-71, comparing each with the changes in the retail price index. The main features illustrated by these Charts are

(a) the very sharp fluctuations in average net incomes for each size group and in the average for all size groups during the decade. This characteristic is much more pronounced within the small farms and also the large farms with over 80% rough grazing than in the other size groups.

(b) the general tendency appears to have been for *real* incomes on hill farms taken as a whole to decline slightly up to and including 1970-71. Despite the very substantial increases in average net incomes for the small farms in 1969-70 and 1970-71, these were not really sufficient to catch up with the rapidly increasing cost of living.*

Return on Capital

The net incomes on the small hill farms generally are such that they do not afford even a reasonable living wage to the farmer and his wife; they cannot possibly provide any management and investment income, as reward for management and risk-taking and as a return on his investment in tenant's capital. Tenant's capital comprises farm machinery and equipment, livestock, crops in store or in ground, and working capital.

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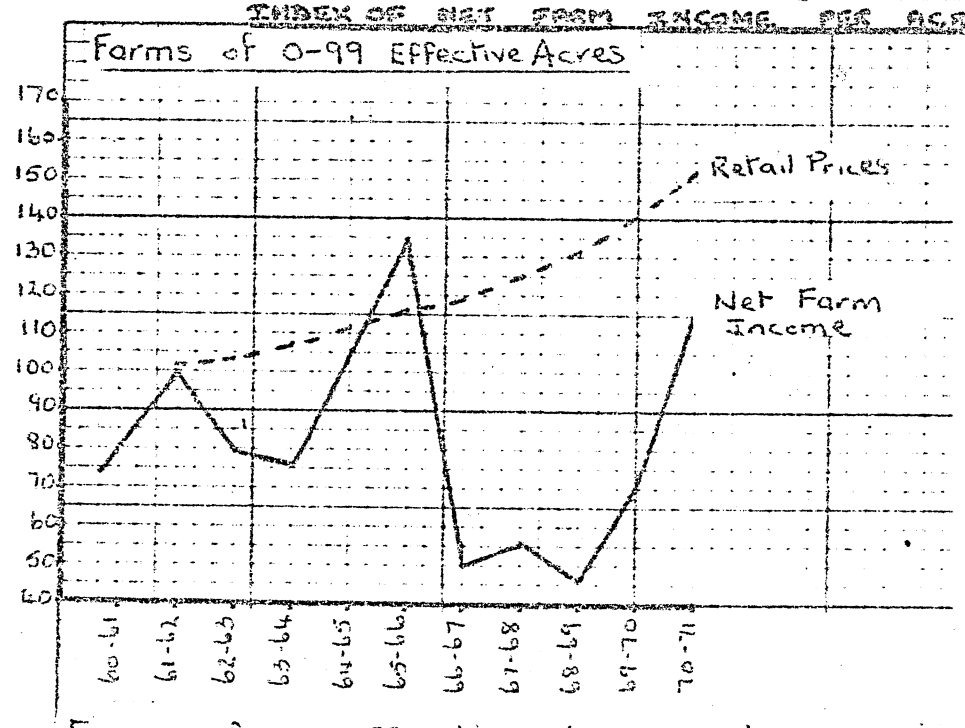
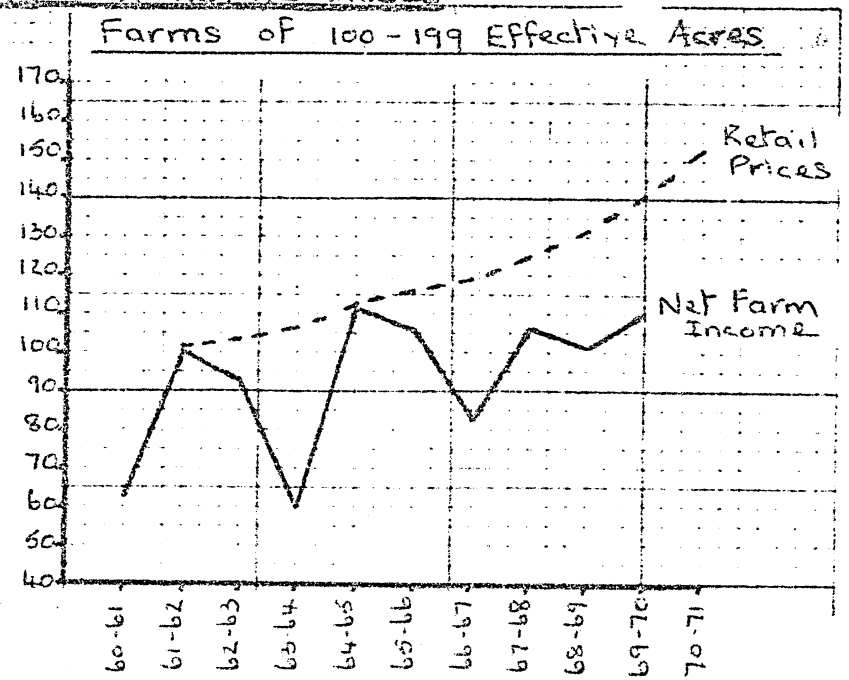
* *The situation improved substantially in 1971-72.*

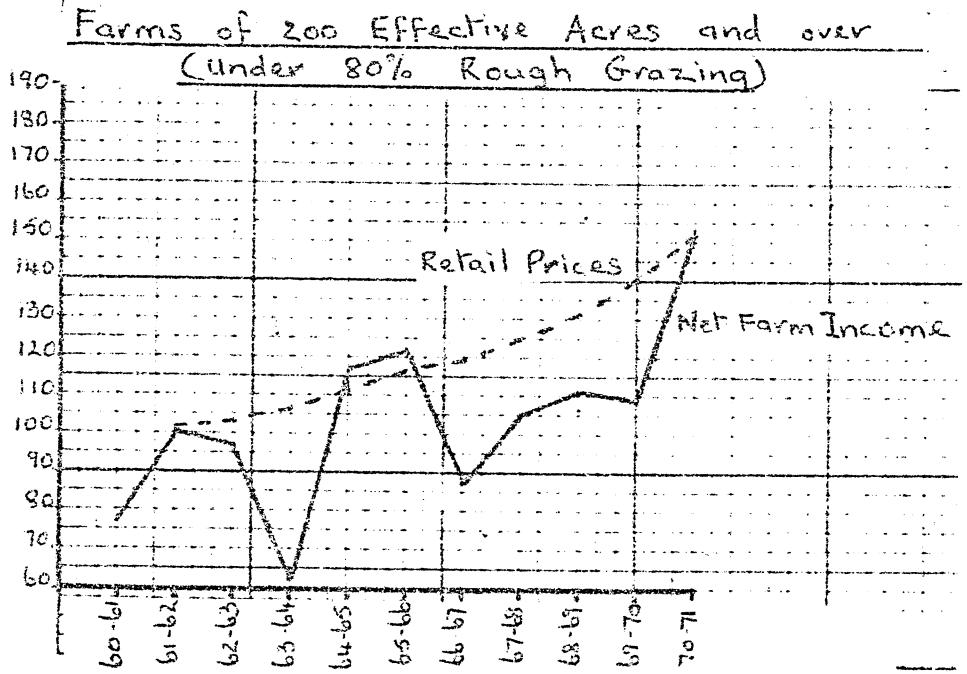
CHART I

LIVESTOCK REARING (POOR LAND) FARMS WALES (1961-62 = 100)

INDEX OF NET FARM INCOME PER ACRE & OF RETAIL PRICES







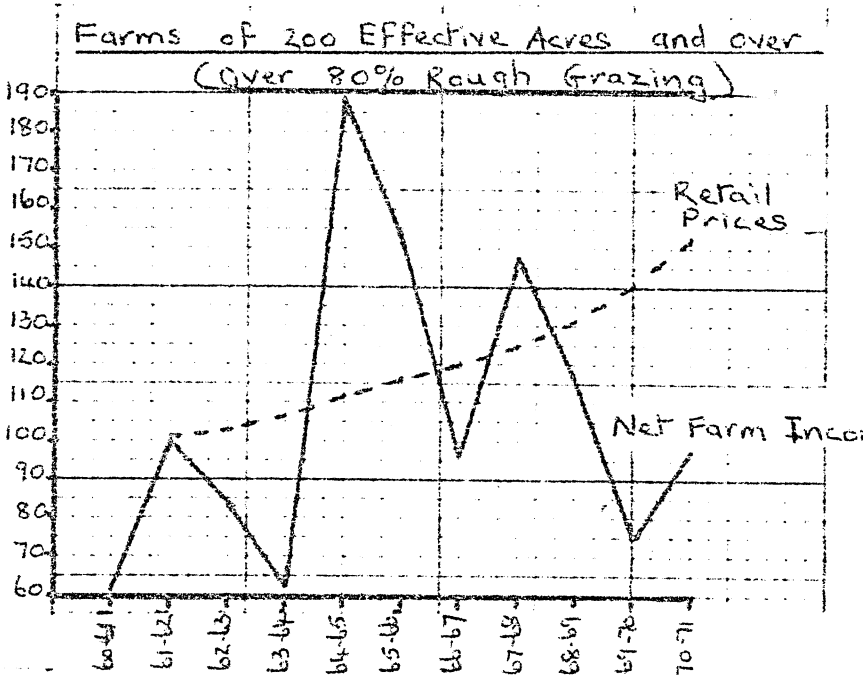
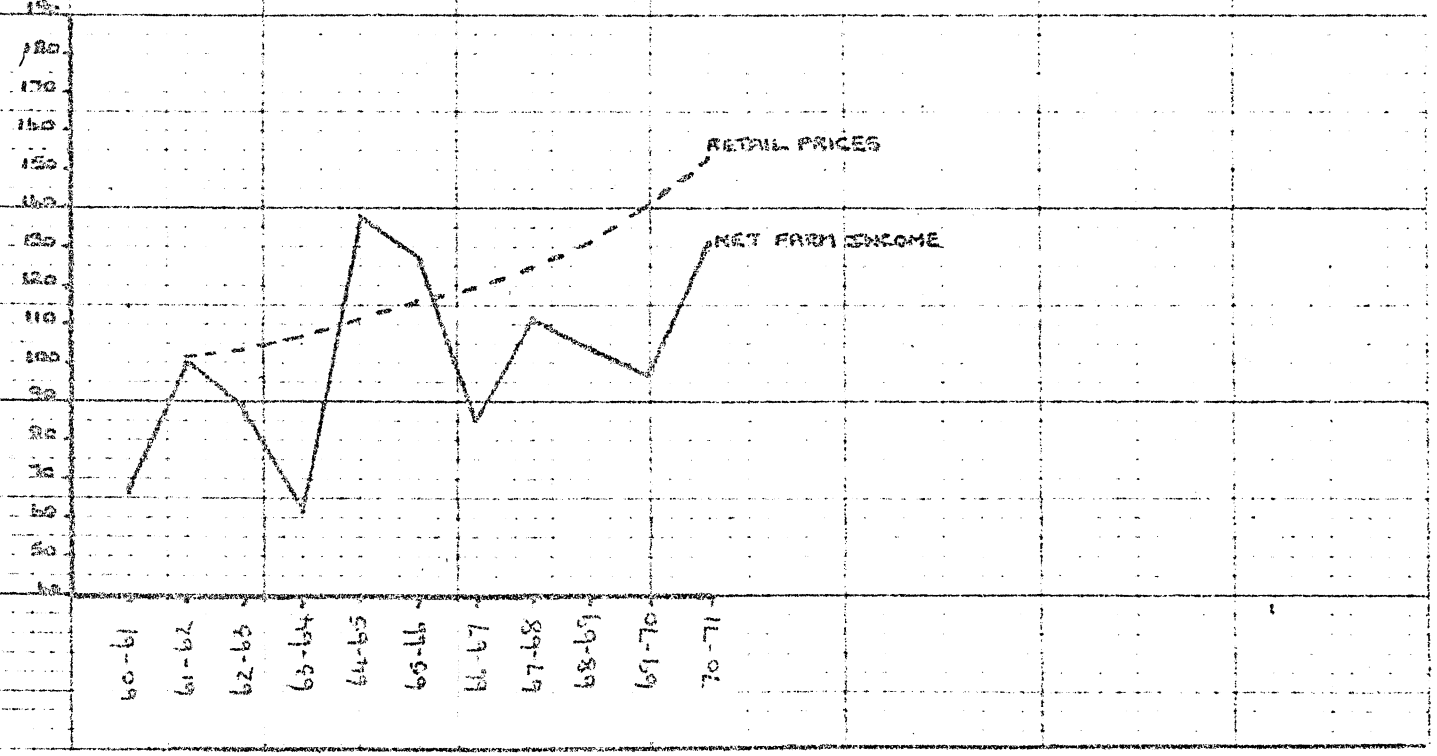


CHART II

LIVESTOCK REARING (POOR LAND) FARMS, WALES

INDEX OF NET FARM INCOME PER ACRE & OF RETAIL PRICES (1961-62 = 100)

ALL SIZES



The return on tenant's capital, here defined as management and investment income expressed as a percentage of total tenant's capital, is given in Table III.

Table III

Return on Tenant's Capital on Welsh Hill Farms

Size of Farm (Effective Acres)	Tenant's Capital per 100 Effective Acres				Return on Tenant's Capital			
	1959/62	1963/66	1967/70	1969/70	1959/62	1963/66	1967/70	1969/70
0 - 99	2652	2934	3415	3690	- 14.0	- 7.9	- 17.7	- 14.6
100 - 199	2308	2632	2957	3081	2.3	4.3	3.4	2.9
200 & over (under 80% R.G.*)	1923	2334	2831	2911	13.5	14.6	12.1	10.7
200 & over (over 80% R.G.*)	1207	1484	1580	1491	6.6	16.2	11.3	4.5

R.G. = Rough Grazing

Despite possibly some intensification and increased subsidies the return on tenant's capital for the small farms was hardly better at the end of the decade than at the beginning. The medium sized farms as a whole, provided a positive, but nevertheless unsatisfactory return, whilst the large farms in general provided a reasonable but generally declining return.

Government Support

Table IV shows the increasingly vital role state grants and subsidies have come to play in the economy of the hill farm.

Table IV

Grants and Subsidies* as per cent of Net Farm Income on Welsh Hill Farms

Size of Farm (Effective Acres)	1959-62 %	1963-66 %	1967-70 %	1969-70 %
0 - 99	82.0	84.1	177.0	91.6
100 - 199	51.4	73.2	91.0	93.9
200 & over (under 80% R.G.)	47.9	61.1	119.5	190.7
200 & over (over 80% R.G.)	38.6	76.1	87.4	76.8
Average for All Farms	48.3	69.7	96.7	105.8

Mainly Hill Cow, Hill Sheep and Calf Subsidies, Small Farm Scheme, Ploughing Grant.

In the 1959-62 period grants and subsidies amounted on average to nearly 50% of net income on hill farms. At the end of the decade however, as a result of increasingcosts and appreciable increases in state support from 1964-5 onwards, they had come to represent, on average, what there was of net income. Although in general, it is the small farms which were the most dependent on government grants and subsidies, yet in 1969-70, it was the large farms with less than 80% of their land classified as rough grazing, which were by far the most dependant.

Tenant's Capital and its Composition

An interesting feature shown by Table V is the increasing amount of tenant's capital required to finance the farm business. On the small farms tenant's capital was increased from about £26 to about £37 per effective acre, a 37% increase, during the decade. Apart from the inflation of recent years, to some extent, this increase may well represent an attempt to intensify with a view to increasing output per acre and to spreading overheads over a larger output. It may, to a small extent, reflect the adoption of minor aids to sheep management and handling such as new shearing machines, cradles etc. Investment in tenant's capital has increased on farms of all sizes but the rate of increase is noticeably greater on the small farms and also the larger ones with under 80 per cent rough grazing.

At no time has it been more necessary than now to increase the supply of tenant's capital and to make judicious use of it. Figures on the composition of tenant's capital on Welsh Hill Farms during the period under review help to throw light on what changes have taken place in its allocation between alternative uses on these farms.

Between 1959-60 and 1969-70, within all four size groups, more than half the absolute increase in tenant's capital was accounted for by higher investments in cattle; and within the group of small farms the increase in investment in cattle accounted for as much as two thirds of the total increase (Table V). While on the medium sized and large farms a higher investment in sheep accounted for between 25 and 30 per cent of the increase, on the small farms sheep accounted for only 10 per cent of the increase. Some of the absolute increase must have been due to price inflation, in the prices of cattle in particular, but much of it reflects the relative increases in stocking with cattle and sheep, a fact which is reflected to some extent in Tables VI and VII.

Table V

Changes in the Composition of Tenant's Capital by Size of Welsh Hill Farms

Farm Size and Items of Tenant's Capital per 100 Effective Acres

Size of Farm: Effective Acres & Items of Tenant's Capital	1959-60 £	1969-70 £	Change £	% of Total Change
0 - 99				
Cattle	857	1580	723	67
Sheep	782	894	112	10
Other Livestock	134	80	- 54	- 5
Crops	134	195	61	6
Machinery	704	941	237	22
Total Tenant's Capital	2611	3690	1079	100
100 - 199				
Cattle	785	1248	463	53
Sheep	748	976	228	26
Other Livestock	61	55	- 6	- 1
Crops	82	152	70	8
Machinery	530	650	120	14
Total Tenant's Capital	2206	3081	875	100
200 and Over under 80% Rough Grazing				
Cattle	624	1152	528	54
Sheep	784	1023	239	25
Other Livestock	22	31	9	1
Crops	98	138	40	4
Machinery	411	567	156	16
Total Tenant's Capital	1939	2911	972	100
200 and Over over 80% Rough Grazing				
Cattle	217	382	165	52
Sheep	690	783	93	30
Other Livestock	12	9	- 3	- 1
Crops	20	59	39	12
Machinery	236	258	22	7
Total Tenant's Capital	1175	1491	316	100

R.G. = Rough Grazing

The increase in the relative importance of cattle, compared with sheep, resulted, no doubt, from their increasingly greater profitability during the decade. Both hill sheep and hill cattle subsidies were raised substantially during the decade but whereas the guaranteed price of fat lambs rose by only 10 per cent that of beef rose by 37 per cent.

Table VI

Changes in Stocking Rates on Welsh Hill Farms

Size of Farm: Effective Acres	Livestock Units per 100 Effective Acres			
	1959-60	1964-65	1969-70	% Change 1959-60 1969-70
0 - 99				
Breeding Cows	8.9	9.8	11.1	25
Breeding Sheep	23.2	25.7	27.6	19
Total Livestock*	43.4	46.2	48.6	12
100 - 199				
Breeding Cows	7.0	8.7	10.7	53
Breeding Sheep	23.5	26.2	27.7	18
Total Livestock*	38.5	42.2	45.8	19
200 and over (under 80% R.G.)				
Breeding Cows	6.5	7.3	10.4	60
Breeding Sheep	23.5	25.2	26.8	14
Total Livestock*	35.2	38.2	42.7	21
200 & over (over 80% R.G.)				
Breeding Cows	2.0	3.7	4.2	110
Breeding Sheep	24.5	29.4	29.0	18
Total Livestock*	29.0	34.3	33.3	15

Including all cattle and sheep, pigs and poultry. However, pigs and poultry are hardly of any significance on these farms.

The increasing emphasis on cattle may also, to some extent, reflect the extent of hill land improvements on Welsh hill farms.

Investment in machinery also rose substantiaaly, on the small farms in particular, but to only a very small extent on the large farms with a very high proportion of rough grazings.

The increasing emphasis on cattle is reflected largely in the narrowing of the ratio of breeding cattle to breeding sheep (Table VII). However, these figures tend to exaggerate the situation slightly, since they do not include changes in the number of other cattle, which declined a little in relative importance due to their being sold at a younger age. It is worth noting that the ratio of breeding cattle to breeding sheep was narrowed to a much greater degree on the large farms with a preponderance of rough grazings than in any of the other size groups; Surprising perhaps, in view of the figures in Table V, the change, was least in the group of small farms.

Table VII

Ratio of Breeding Cattle Breeding Sheep* (numbers)

Size of Farms : Effective Acres	1959-60		1964-65		1969-70	
	No. of Farms	Ratio	No. of Farms	Ratio	No. of Farms	Ratio
0 - 99	22	1: 17.5	23	1: 21.0	16	1: 16.8
100 - 199	23	1: 25.9	24	1: 25.9	23	1: 20.3
200 & over (under 80% R.G.)	15	1: 25.9	18	1: 28.0	24	1: 19.0
200 & over (over 80% R.G.)	14	1: 93.1	15	1: 60.0	17	1: 54.5

* Including shearling ewes in this case.

Trends in Number of Breeding Sheep in the United Kingdom 1950-1969

An upward trend in the breeding ewe population was much in evidence in each region of the United Kingdom in the 1950's bringing the total population to 13.79 million in 1960, an increase of 37 per cent during the decade. (Table VIII).

This trend continued up to 1966 when the breeding ewe population reached a peak; but since then it has been reversed, bringing the total for the United Kingdom to 12.81 million in 1970*. Whilst the general trend noted in the sixties for the United Kingdom as a whole also held to varying degrees for England, Scotland and N. Ireland, movements in the ewe population in Wales were different. In Wales it continued to increase throughout the sixties to bring the total in June 1970 to an all time peak of 3.07.

Table VIII

Number of Breeding and Shearling Ewes 1950-1970.
United Kingdom

	1950 (million)	1960 (million)	1970 (million)	Change %
England	3.827	6.046	5.327	- 12
Wales	2.029	2.752	3.066	+ 11
Scotland	3.835	4.434	3.934	- 11
N. Ireland	0.372	561	478	- 15
United Kingdom	10.063	13.793	12.806	- 7

It is interesting to compare the changes in numbers of lowland, upland, and hill sheep, in each country during this period.

WALES

An overall increase of 36 per cent (722,967) in breeding ewe numbers took place in Wales in the decade 1950-60, 90 per cent of which, it is estimated, was in respect of lowland ewes. There was a modest increase of 23 per cent in upland

* *The total ewe population for England and Wales showed an upward trend again in September 1971, the first such movement since 1966.*

ewes but the hill ewe numbers appear to have increased only marginally (4 per cent) to bring the total in 1960 to over 1.1 million. (see Table X).

During the 1950's lowland sheep were reasonably competitive with other farm enterprises, and they partook of the advancement in numbers common to livestock generally. Furthermore, Government support in the form of hill sheep subsidies had as yet not attained proportions large enough to distort the 'natural' trend in sheep numbers.

It is in the 1960's, when they continued to increase, adding about 11 per cent to the number in 1960, that the trend in total number of ewes in Wales departs from that for each of the other regions. It was assumed that the lowland ewes represented the difference between, on the one hand the sum of the hill ewes (assumed to be those qualifying for the full rate subsidy) and the upland ewes (which, it was assumed, qualified for the half-rate subsidy) and, on the other, the total ewe population. On this basis, whilst the hill and upland ewes together increased by just over a million, the number of lowland ewes were roughly halved. In this connection, two factors of significance for sheep farmers should be borne in mind. First, it was during the sixties that the hill sheep subsidy was raised sufficiently to alter the cost/income relationship such as to encourage heavier stocking with hill and upland ewes.

Table IX

Rate* of Hill Sheep Subsidy in Great Britain

	Full	Reduced
	pence	pence
1961	17½	9
1962	30	15
1963	50	25
1964	125	62½
1965	90	45
1966	95	47½
1967	105	52½
1968	105	52½
1969	105	52½
1970 - March	105	52½
- October	142½	90

Does not include the winter keep supplement.

Secondly. a part of the 1967 annual review settlement consisted of an extension of the hill sheep subsidy to include about 2 million more ewes in flocks further down the hill in the United Kingdom.

Table X

Breeding Ewe Flocks in Wales 1960-70. (millions)

	1950 (million)	1960 (million)	1970 (million)	Change %
Lowland ewes	0.643	1.495	0.770	- 48
Upland ewes	0.126	0.154	0.702	+ 355
Hill ewes	1.060	1.103	1.595	+ 45
Total Breeding Ewes	2.029	2.752	3.067	+ 11

It is difficult to assess what proportion of the total reduction of lowland ewes can be attributed to their having changed their nomenclature from 'lowland' to 'upland' and what, if any, can be attributed to a genuine reduction in numbers, However,it is clear from the statistics that the number qualifying for the reduced rate subsidy in 1967-68 was increased out of all proportion to the increases apparent in previous years, and which undoubtedly reflected the long term increases in stocking densities.

Number of Ewes Receiving Reduced Rate Subsidy in Wales. 1965-68

1965-66	1966-67	1967-68
178,858	189,213	665,060

The probability is that the number of ewes classified as lowland ewes before the extension of the hill sheep subsidy in 1967, continued to suffer a genuine reduction of the order of about 150,000 to 200,000 in 1967-68, thereby following the same trend as the lowland flock for the whole of the United Kingdom.

The down-turn in lowland sheep numbers which has taken place over the past few years can be attributed largely to the level of the guaranteed price not having changed very much, coupled with the relatively little technological advance made in fat lamb production. The latter has not experienced the increases in productivity that have characterised pig, poultry, and milk production and its relative profitability has declined.

ENGLAND

A significant difference in the composition of the total ewe flock between Wales and England is that lowland ewes represent only about one third of the total for the former, compared with between 70 and 85 per cent for England.

The trend of increasing numbers of breeding sheep continued until 1965 but, since that time the total has been falling annually reaching 5.3 million in 1970. In the fifties the overall increase was very largely in lowland ewes.

Table XI

Trends in Breeding Flocks in England 1950-60

	1950	1960	Change %
	No.	No.	No.
Lowland ewes	2,868,485	5,049,959	+ 76
Hill ewes	863,797	880,059	+ 2
Upland ewes	95,149	115,724	+ 22
Total Ewes	3,827,431	6,045,742	+ 58

In more recent years there has been a change in the relative densities of stocking with sheep away from the lowlands to the uplands and to a lesser extent to the hills.

The decline in number of lowland ewes was most marked in the sixties in the Midland Counties, where over 40 per cent of the total reduction in lowland sheep in the whole of England was accounted for.

Other counties, widely dispersed throughout the country, which suffered reductions in sheep population, are Buckingham, Kent, Suffolk, Essex and, surprisingly, Cumberland and Northumberland.

Not all lowland areas suffered reductions in sheep numbers in the sixties. In no fewer than ten counties they either remained more or less unchanged or even increased.

The estimated changes (in the Sixties) in the relative numbers of the three categories of ewes, i.e. hill, upland, and lowland for fourteen counties in England, are shown in Table XII. In these areas, (with hills and uplands) taken as a whole, the lowland flock appears to have suffered a heavy decline, whilst both the hill and upland flocks, the latter especially, show large increases. The heavy drop in lowland ewes and the increase in upland ewes must again be attributed to a substantial extent to the change in 'nomenclature' which occurred in 1967-68. However, it is estimated that the 'actual'reduction in lowland ewes could have been in the region of half-a-million.

Table XII

Trends in the various sectors of the Breeding Ewe* Flock in a group of hill counties in England+ 1960-1970

	1960 (million)	1970 (million)	Change %
Lowland ewes	3.017	2.028	- 33
Upland ewes	0.116	0.609	+ 426
Hill ewes	0.880	1.141	+ 30
Total ewes	4.013	3.778	- 6

* Breeding ewes include shearlings.

\+ Derby, Cheshire, Hereford, Shropshire, Stafford, Cornwall, Devon, Somerset, Cumberland, Durham, Northumberland, Westmorland, Yorks, N.R., Yorks W.R. Lancashire.

II. PARTICULARS OF SAMPLES

WALES

Generally speaking, it was from the mountainous heartland of Wales that the sample of Welsh hill sheep farms was drawn. Nineteen were situated in Merionethshire, eight each in Carmarthen and Denbigh, seven each in Caernarvon and Cardigan, and two each in Montgomery and Brecon.

In general, although cross-breeding is adopted in some upland areas, it is the hardy pure bred hill breeds that are maintained on hill and mountain grazings. But subtle changes in environment have thrown up at least three varieties derived from the foundation stock which form the Welsh Mountain breed. The 'Cardy' Welsh mountain is the most primitive type - it is small, very hardy and kept on the hill throughout the year. The South Wales 'Welsh Mountain' is somewhat less hardy, bigger framed, and its fleece contains a much higher proportion of kemp. The Talybont Welsh Mountain is yet another type - slightly bigger than the South Wales and having a longer stapled, relatively kemp free, fleece.

On 90 per cent of the farms in the sample, one or another of these types of 'Welsh Mountain' were maintained and bred pure. The remaining 10 per cent of the farms, situated in a kinder environment practise some cross-breeding and carry somewhat larger speckle faced hill sheep, the Radnor x Welsh, the Cheviot x Welsh, and the Kerry x Welsh.

In view of the location of these farms within the central moorland area of Wales, it is not surprising to find that over three-quarters of their total acreage consists of

rough grazing. The relative shortage of *inbye* land and cultivable area sets limits on the amount of home-grown forage that can be grown. Land renovation by ploughing and the growing of pioneer crops is a well established practice on these farms, serving both to improve the natural pastures and to provide forage for fattening lambs.

It is only on few farms that, after spending their first winter on the lowlands, the ewes are kept on the hills throughout the year. As a general rule the ewes are bought down to the 'ffriddoedd' for a 'winter' period of from five to seven months, and returned to the hill after lambing.

Characteristic of these moorland farms is the short growing season in summer and an extended winter. This situation, together with the small proportion of inbye and crops, creates a severe winter-feeding prombem, which is largely overcome by the away wintering of the ewe lambs and sometimes of part of the breeding flock as well. Six out of the total of fifty-three farms provide evidence of a growing tendency for hill sheep farms to be run in conjunction with lowland farms in an attempt to overcome their wintering problems.

North of England

Most of the sample for the North of England were located on the eastern and western slopes of the Pennines, and on the southern slopes of the Cheviot Hills. A small number were located in the Lake District. The majority of the farms were completely pastoral in character, located within broadly similar altitude ranges (600' - 2,000') to the Welsh farms, except that a few of the latter reached up to altitudes of over 2,500 feet.

The two samples were broadly similar with respect to the proportion of rough grazing to total acres (about 90 per cent overall). This feature of sheep farming in hill areas is largely a function of altitude in as much as movement into high altitude areas sees a progressive diminution in "inbye" until, in many farms, the total land area is exclusively "outbye" or rough grazings. Furthermore, the larger farms tend to be located at the higher altitudes.

The size structure of the North of England sample differed considerably from its counterpart in Wales. Not only was the average size of farm for the former rather more than that of the latter (1013 acres compared with 937) but the former contained a much higher proportion of smaller farms. About three out of five of the North of England farms were of less than 400 actual acres carrying only 29 per cent of the total ewes. On the other hand only one in four of the Welsh farms fell into this size group. The size distribution of the flocks exhibit the same general trend. The average size of flock

differed markedly - 450 ewes in the North of England compared with about 680 for Wales. Whereas just under two-thirds of the North of England flocks had fewer than 400 ewes only one quarter of the Welsh flocks fell into this category.

In the North of England sheep management practices involved the use of a diversity of breeds which differed markedly from the almost exclusive reliance on the Welsh or Welsh based ewes in the Welsh sample. The Scotch Blackface and the Swaledale mainly were the basis of the traditional hill breeding policy. The Herdwick, a particularly hardy breed, was used in the areas of high altitude and sparse vegetation. It is a relatively slow maturing breed and shearling ewes are not often put to the ram. The Westmorland Rough Fell and Cheviot formed the basis of the breeding policy on but very few farms.

In both regions sheep production was carried on as part of a mixed livestock system but cattle occupied a more prominent position in the North of England. It is significant that on the larger holdings carrying flocks of over 600 ewes, cattle play only a minimal role, and sheep get the first claim on the inbye for wintering, lambing and for fattening.

Whilst on the Welsh farms the cattle enterprise consists almost exclusively of suckler cattle, dairying is not infrequently encountered in the North of England sample, either to the exclusion of other cattle or as part of a mixed dairy/suckler system.

III PROFITS AND PROFITABILITY

Financial and Other Performance Standards

The Survey was conducted over the two year period 1968-69 and 1969-70. The average size of Welsh flock was about 50 per cent greater than that for the North of England - about 680 compared with about 450. This difference in average size of flock appears to be due to (a) the *Welsh* farms, as a group, carrying fewer cattle in relation to the number of sheep than do the North of England ones and (b) the Welsh farms being generally the more heavily stocked - carrying about 16.7 livestock units of cattle and sheep per 100 actual acres, compared with 13.7 by the latter. A factor which, to some extent, may account for the apparent difference in stocking density is that Welsh ewes are generally smaller than those carried on North of England farms.

Gross Margins and Profits per 100 Breeding Ewes

The total sample included 53 and 55 Welsh and 49 and 56 North of England hill sheep farms for 1968-69 and 1969-70 respectively. *These farms were paid hill sheep subsidy at full rate.*

The following tables show the distribution of these farms, according to their gross margins and profits. It need hardly be said that in arriving at the profits the fixed costs for each farm have been allocated* between the farm enterprises, cattle and sheep, the sum eventually allocated to sheep being subtracted from the gross margin to give the profit for the sheep enterprise.

In 1968-69, 56 per cent of the Welsh flocks showed gross margins of less than £4 per breeding ewe, only one flock in 27 showed a gross margin of over £6 per ewe. For the same year, as many as one in five North of England flocks showed gross margins of £6 per ewe or more and only half showed gross margins of less than £4. In the second year both samples showed a general increase in the proportion of flocks showing relatively high gross margins. In both years the average gross margins per ewe was appreciably higher for the North of England sample than for the Welsh due largely, no douht, to diffferences between the size of ewes in the two areas.

It is apparent from Table XIIIB that in both years a lesser proportion of Welsh flocks showed losses and a higher proportion showed high profits (of £2.50 per ewe or more) than did those in the North of England. In 1968-69 little more than onethird of the flocks in Wales and barely more than one quarter of these in the North of England showed profits of £2 per ewe or more. In the following year when the average profit per ewe for the North of England had almost

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* *Method of allocating fixed costs -*

Home-grown bulk foods	*- as fed*
Grazing and Forage crops	*- according to grazing units of cattle and sheep.*
Labour	*- Time estiamted by farmer*
Overheads	*- 15? of direct labour cost*
Repairs and depreciation of equipment	*- Repairs as recorded Depreciation of equipment used only for sheep.*

Table XIII

Distribution of all Flocks according to Gross Margins and Profits

A. Distribution According to Gross Margins

Gross Margins per 100 Breeding Ewes	WALES				NORTH OF ENGLAND			
	1968-69		1969-70		1968-69		1969-70	
	No.	%	No.	%	No.	%	No.	%
£0 - £299	16	29.1	9	17.0	11	19.7	6	12.2
£300 - £399	15	27.3	13	24.5	17	30.3	9	18.4
£400 - £499	15	27.3	20	37.7	11	19.6	10	20.4
£500 - £599	7	12.7	8	15.1	6	10.7	8	16.3
£600+	2	3.6	3	5.7	11	19.7	16	32.7
Total Number of Flocks	55	100.0	53	100.0	56	100.0	49	100.0

B. Distribution According to Profit

Profit per 100 Breeding Ewes	No.	%	No.	%	No.	%	No.	%
Losses	5	9.1	4	7.5	11	19.7	5	10.0
Profits:-								
£0 - £ 99	10	18.2	8	15.1	22	39.3	7	14.3
£100 - £149	11	20.0	9	17.0	5	8.9	8	16.3
£150 - £199	9	16.3	9	17.0	3	5.3	9	18.4
£200 - £249	11	20.0	6	11.3	7	12.5	10	20.4
£250 - £299	4	7.3	10	18.9	2	3.6	2	4.1
£300+	5	9.1	7	13.2	6	10.7	8	16.3
Total Number of Flocks	55	100.0	53	100.0	56	100.0	49	100.0

doubled, a much higher proportion of flocks in that area showed a profit of £2 per ewe or more and the proportion showing losses was halved. The upward movement of Welsh flocks along the profit scale was much less marked.

Table XIV

Gross Output, Costs, Gross Margin and Profit per 100 Breeding Ewes

Identical Sample 1968-69 - 1969-70

	WALES		NORTH OF ENGLAND	
	1968-69	1969-70	1968-69	1969-70
Number of Flocks	53	53	49	49
Average Size of Flock (Breeding Ewes)	683	672	448	448
Average Size of Farm (Actual Acres)	937.1	937.4	1012.2	1014.8
Percentage Rough Grazing	86.1	86.8	88.7	88.7
GROSS OUTPUT	£	£	£	£
Sales				
Lambs - Fat	108.4	141.4	51.9	72.2
- Store	70.7	62.9	202.5	216.7
Rams (including Ram Lambs)	9.6	8.3	13.6	9.4
Draft Ewes	85.8	83.9	52.3	47.7
Other	14.5	11.3	11.3	16.8
Wool	65.7	63.9	67.9	71.7
Hill Sheep Subsidy	121.7	122.1	122.6	122.7
Total	476.4	493.8	522.1	557.2
Less Purchases	17.8	10.9	30.2	29.0
Valuation Change (+ or -)	- 3.0	- 2.3	- 22.5	+ 30.3
Gross Output	455.6	480.6	469.4	558.5
Variable Costs				
Concentrates - Home Grown	-	-	0.5	0.1
- Purchased	16.7	17.3	24.0	25.2
Purchased Bulk Foods	2.6	2.9	1.6	1.8
Agistment	59.3	60.7	17.2	19.7
Vet and Medicines	12.9	14.0	26.1	27.2
Transport	7.0	8.3	3.0	3.4
Miscellaneous	1.7	2.0	0.2	0.1
Total Variable Costs	100.2	105.2	72.6	77.5
GROSS MARGIN (excl. variable costs of forage)	355.4	375.4	396.8	481.0
Fixed Costs				
Grazing, Home Grown Bulk Foods and Forage	88.5	81.2	137.3	128.9
Direct Labour	108.4	116.9	121.4	130.7
Other Overheads	16.2	17.5	18.0	19.5
Miscellaneous	1.7	1.7	9.9	10.7
Total Fixed Costs	214.8	217.3	286.6	289.8
Total All Costs	315.0	322.5	359.2	367.3
Profit	140.6	158.1	110.2	191.2
Fixed Costs + % of All Costs	67.2	66.4	79.8	78.9
" " " " Variable Costs	204.8	197.5	394.8	374.1
" " " " Gross Margin	60.4	57.9	72.2	60.2

Table XV

Efficiency Factors for the Identical Farms

	WALES		NORTH OF ENGLAND	
	1968-69	1969-70	1968-69	1969-70
Number of Flocks	53	53	49	49
Total Livestock Units*per 100 actual acres	16.7	16.6	13.6	13.7
Proportion of Total Cattle: Total Sheep (L.U.)	0.3: 1	0.3: 1	0.5: 1	0.5: 1
Lambs Born per 100 Breeding Ewes	91.3	91.6	86.0	95.2
Lamb Deaths " " " "	15.5	12.2	14.1	8.1
Lambs Weaned " " " "	75.8	79.4	71.9	87.1
Ewe Mortality %				
(a) Deaths in Breeding Ewes % of Breeding Ewes	6.5	4.9	12.1	7.5
(b) Deaths in Ewe Hoggs and Breeding Ewes % of Breeding Ewes	7.5	6.1	12.5	7.6
Barren Ewes % of Breeding Ewes	6.0	6.2	n.a.	n.a.
Draft Ewes Sold per 100 Breeding Ewes	23.0	22.5	10.2	11.3
Disposal of Lamb Crop (per cent)				
Sold Fat	21.5	25.9	10.1	13.2
Sold Store	25.9	23.0	37.3	37.3
Replacements - Ewe Lambs	38.9	39.1	30.5	29.5
- Ram "	1.0	1.0	0.7	0.5
On Hand	12.7	11.0	21.4	19.5
Total	100.0	100.0	100.0	100.0
Labour per 100 Breeding Ewes (hrs. per Annum)	286	289	374	322
Prices Received (£ per head)				
Rams	11.0	11.3	15.9	11.9
Draft Ewes	3.8	3.8	5.1	4.2
Fat Lambs (incl. deficiency payment)	4.8	5.0	6.2	6.3
Store Lambs	3.4	3.3	4.6	4.5

* *Livestock Units:-*

	Wales	*North of England*
Livestock Unit = ponies	*2*	*2*
= cow	*1*	*1*
= heifer in calf	*1*	*1*
= cattle (2 years old & over)	*1*	*1*
= " (1-2 year old)	*2*	*2*
= "" (under 1 year old)	*4*	*4*
= sheep (1 year old & over)	*7*	*6*
= " (under 1 year old)	*14*	*10*

n.a. = not available

Welsh Flocks

The gross output, gross margins and profit per 100 breeding ewes all increased slightly in 1969-70 compared with the previous year.

Gross Output

The gross output of self contained flocks consists of the total value of sales of lambs, draft ewes and fleeces, and the hill sheep subsidy, less purchases of sheep, and adjusted for any change between opening and closing valuations. In other words it is the value of lambs sold fat and store, plus the hill sheep subsidy, less cost of flock replacement. Obviously the major factors affecting the level of gross output per 100 breeding ewes are the lambing percentage, mortality in ewes and lambs, and the flock replacement policy.

There was hardly any difference in the lambing percentage between the two years - between 91 and 92 per cent; but the fact that appreciably fewer lambs died in the second year meant that more were available for sale in that year. The average prices realised per fat lamb was £4.80 and £5.00 each, whereas the averages for lambs sold store were £3.40 and £3.30 each. All sales are included net of commission, which averaged £4.8 per 100 breeding ewes in both years. An important feature of Welsh hill farming over the last 15 years or so is that farmers have been selling an increasing proportion of their total lamb crop in fat condition e.g. for our sample of hill sheep farms this proportion has increased from 4 to 5 per cent in 1958-59 to about 26 per cent in 1969-70.

In 1969-70 total receipts from all lamb sales - fat and store - amounted to 43 per cent of the gross output, the contribution of fat lambs being more than twice that of the stores. The sale of draft ewes and the value of the fleeces each amounted to an appreciable sum - the former more and the latter as much as that realised from the sale of store lambs.

Of the utmost importance, of course, is the hill-sheep subsidy, averaging about £1.22 per breeding ewe each year; it was by far the most important item in 1968-69 and second to the sale of fat lambs in the following year.

In arriving at the ultimate gross output adjustments are made for the purchases of livestock (mainly rams), which are deducted, and for any change between opening and closing valuations of sheep.

Flock Depreciation

An interesting item which is in fact taken into account in calculating gross output, but not shown separately, is the flock depreciation or the cost of flock replacements. This is the difference between the opening valuation of rams,

breeding ewes (and shearling ewes) tupped plus purchases of ewes and rams on the one hand and the closing valuation plus the draft ewes and rams sold on the other. For the Welsh flocks, this item amounted to a relatively small sum of only £37 per 100 breeding ewes in 1968-69 and to only £30 in the following year. What is very significant in determining flock depreciation is the relative prices of the ewe lambs transferred in and the draft ewes sold. The breeding ewes, and the shearling ewes were transferred into the breeding flock in both years, at £4 each.

Table XVI

Estimated Flock Depreciation per 100 Breeding Ewes According to Frequency of Replacements and Mortality in Ewes

	WELSH EWES					
Average Flock Life	3 years		4 years		5 years	
	Annual Mortality	Flock Depreciation	Annual Mortality	Flock Depreciation	Annual Mortality	Flock Depreciation
	%	£	%	£	%	£
	5	25.7	6	43.0	7	54.0
	8	37.1	9	52.0	10	60.0
	12	52.3	13	64.0	14	68.0
	NORTH OF ENGLAND EWES					
Average Flock Life	3 years		4 years		5 years	
	Annual Mortality	Flock Depreciation	Annual Mortality	Flock Depreciation	Annual Mortality	Flock Depreciation
	%	£	%	£	%	£
	5	55.2	6	67.5	7	74.1
	8	72.3	9	82.5	10	87.0
	12	95.1	13	102.5	14	104.2

Assumptions:

	Welsh Flocks	North of England Flocks
Shearling Ewes transferred in at	£4.00	£6.50
Value of Draft Ewes, after:		
3 years in flock	£3.80	£5.70
4 " " "	£3.00	£5.00
5 " " "	£2.00	£4.30

Most of the ewes sold were draft ewes sold to lowland farmers at an average of £3.80 each, but some were sold in a fat condition at about £3.30 each. Ewe mortality, which obviously affects the flock depreciation, was not high in either year, averaging 6.5 per cent in 1968-69 and 4.9 per cent in 1969-70. Another factor affecting the depreciation figure is the average productive life of the ewe in the breeding flock; this is about 3 years on the Welsh hills. The average flock depreciation for the North of England flocks was very much higher at £107 and £88 per 100 breeding ewes in 1968-69 and 1969-70 respectively, the difference between the two regions being due to a higher death rate, a longer average life for flocks in the North of England (5 years), and a larger difference between the in-going and outgoing prices for ewes. The effects of all these factors on flock depreciation are reflected in Table XVI.

Variable Costs

Under this category of costs are included all food items excluding grazing but including agistment, veterinary and medical bills, transport and miscellaneous variable cost items. By far the most important item for the *Welsh* sample is the cost of agistment i.e. the cost of away-wintering of sheep; this came to approximately £60 per 100 breeding ewes or to about 55 per cent of total variable costs in both years. This relatively large item reflects one of the most important problems associated with hill-farming in Wales - that of providing adequate feed for wintering the breeding flock, the ewe replacements. and the breeding and young cattle. The away wintering of ewe lamb replacements on the more productive lowlands has been practised for generations. Attempts are being made to reduce or even to do away with this expenditure altogether by hill land improvement and the in-wintering of the ewe lambs. The former practice can alleviate the situation to some extent, but cannot wholly correct the imbalance between the summer stock carrying capacity of the hills and their inability to provide adequate winter feed. Many attempts are being made at in-wintering ewe lambs, but the cost of housing is relatively high and even if there is any saving in cost, the performance of the in-wintered does not match that of the out-wintered ewe. Despite the high charge for agistment, £2.00 to £2.50 per ewe lamb, and the high replacement rate for their flocks it is evident that most Welsh hill farmers still away-winter all or a large proportion of their ewe lambs.

The other items of variable costs, although together amounting to a substantial sum, individually are not of much importance. Some purchased concentrates, but no home grown, are fed to the ewe flock before lambing and possibly, on some farms, to lambs being finished off grass. The cost of veterinary attention and medicines together constitute an

appreciable but not a large item, which must vary to some extent with the severity or otherwise of the winter. Miscellaneous costs for the Welsh flocks largely consist of dog-food.

Gross Margins

The gross margin per 100 breeding ewes tupped averaged about £355 in 1968-69 and, largely because of an increase in gross output, about £375 in 1969-70.

Fixed Costs

These consist largely of grazing, home-grown bulk food and forage, and direct labour; also a share of general farm overheads, and miscellaneous fixed costs. It may be argued that the variable costs of grazing and those of home-grown bulk foods and forage should be included under variable costs, but in fact on these hill farms the total costs incurred on these items, including labour, machinery and power etc., are largely fixed in nature. The grazing and forage (rape) was actually costed on each farm, but a standard cost was used in respect of home-grown bulk foods, which was largely hay. The total fixed costs averaged about £215 per 100 ewes, which was about two-thirds of all costs.

Profit

The fixed costs, as defined above, amounted to about 60 per cent of the gross margin leaving a profit of £141 per 100 breeding ewes in 1968-69 and £158 in 1969-70. This increase was due mainly to an increase in output resulting from a better price for fat lambs.

North of England Flocks

The main difference in the figures for sales between the North of England and the Welsh flocks is in the receipts from the sale of lambs and draft ewes, especially the former. The receipts from the sale of all lambs were about 40 per cent higher for the North of England in both years, but contrary to the situation in the Welsh flocks, receipts from fat lambs are small compared with those from store lambs. The value of lamb sales, whilst they are affected to some extent by the relative lambing percentage, the proportion sold fat, the proportion of lambs weaned and length of flock life, are more the result of differences in the prices realized for lambs in the two regions. Both the average lambing percentages and the percentage lambs weaned were in fact more favourable in Wales than in the North of England in 1968-69, but less favourable in Wales in 1969-70.

The value of draft ewes per 100 breeding ewes were appreciably less for North of England flocks. This is a reflection, not of the relative prices of this category of ewe, which is higher for the North of England, but of the longer

average flock life (about 5 years compared with only 3) making for fewer draft ewes being sold annually in the North of England. This difference in culling policy between the two regions appears to arise largely from the fact that Welsh hill farms, the larger ones in particular, despite their poorer quality grazings, are stocked more heavily with sheep; the ewes, sustained at a lower level of nutrition, lose their teeth earlier and, despite their hardiness, have to be sold before they drop much in their value. The small loss in value of the Welsh ewes more than compensates for the effect on the cost of flock replacement of having to retain a higher proportion of lambs for breeding.

An important difference in the management of these flocks is the extent to which the ewe lambs are away-wintered, For the North of England the cost of agistment amounts to less than one-third of what it is on Welsh hill farms, and accounts also for the total variable costs per 100 breeding ewes being so much less. Such a difference is, at first, surprising, since for both samples of farms a roughly equal proportion of the farm land is categorised as rough grazing. The only explanation must lie in the fact that the North of England Hill farms possess a larger area of better quality, more sheltered, land (whether rough or in-bye land) than do the Welsh ones in general. This statement is substabtiated by the higher ratio of cattle to sheep, 0.5 : 1 livestock units, on the former, compared with 0.3 :1 on the latter; with some or all cattle being in-wintered a higher proportion of the better grazing is available for wintering sheep. Furthermore, the use of relatively more purchased concentrates and a higher cost of grazing, forage, and home-grown bulk must also be due largely to a high proportion of ewe lambs being home-wintered.

Apart from the cost of grazing, homegrown bulk food and forage (mainly rape), direct labour on sheep handling and management is a very important fixed cost. The cost per 100 breeding ewes is rather higher for the North of England flocks than it is for the Welsh. This reflects many possible explanatory factors, such as greater distances between homestead and hill, less assistance at shearing, dipping, etc. or more reliance on contract shearing; but it could also reflect a fair degree of error arising from farmers having to estimate the time devoted to various tasks.

A share of general farm overheads, e.g. fencing, ditching, hedging etc. was allocated to the sheep enterprise on each farm. Miscellaneous fixed costs, including repairs and depreciation on equipment and the cost of tractor time used largely for carrying food to sheep, was a significant cost item in the North of England, but not in W ales.

Efficiency Factors

Perhaps the most important factors affecting the size of gross margins and profits in hill sheep flocks are the lambing percentage along with mortality in lambs, which together determine the percentage of lambs weaned at about 3 months old. The larger the number of lambs weaned, after allowing for the number required as ewe replacements, the more lambs are available for sale in either store or fat condition.

The average lambing percentage for the identical flocks, was about 91.5 in both years in Wales, whereas for the North of England, the corresponding figures were 86 and 95 per cent respectively. Mortality in lambs was somewhat higher for the Welsh sample in both years and it was higher in the first than in the second year in both regions. Climatic conditions during and after lambing have, no doubt, a considerable effect on mortality in lambs. The net result was that the percentage lambs weaned were higher for Welsh flocks in the first but higher for the North of England flocks in the second year.

Lambing Rate

The effect of the *lambing percentage* on the financial results are well illustrated in Table XVII and in Charts III, IV and V. The higher the lambing percentage the greater the number of lambs sold and the larger the gross output per 100 breeding ewes. One very interesting point emerging in this table is that, in both regions, low mortality in lambs is associated with a high lambing rate in ewes. This relationship suggests very strongly that, quite apart from the weather, the quality of management plays an important part in determining these measures of performance in hill flocks.

There is obviously a very distinct positive relationship between the lambing percentage and veterinary and medicinal costs; this is apparent in both years and for both the Welsh and North of England flocks. Again, clearly for the North of England, but not so evident for Wales, the cost of concentrates are highest for the flocks showing the highest lambing percentage, suggesting that feeding of ewes, before lambing, with concentrates is worthwhile but more intensively practiced in the North than in Wales. However, since there is a distinct tendency for the cost of agistment to be less for those flocks incurring high concentrates costs, some of the concentrates are probably fed to the home-wintered ewe lambs. It appears that the highest lambing rates in the North of England are achieved with much heavier feeding of concentrates than are those achieved amongst Welsh hill flocks.

Table XVII

Disposal of Lambs, Gross Output and Gross Margin According to Lambing Percentage

Identical Farms 1968-69 and 1969-70

	1968-69			1969-70		
	Lambing Percentage					
	Up to 90	91-100	101+	Up to 90	91-100	101+
	WALES					
No. of Flocks	15	28	10	12	35	6
Average Lambing Rates %	81.4	94.6	105.4	82.1	95.2	103.5
Ram Replacements	0.6	0.8	1.1	0.5	0.9	0.8
Ewe Replacements	25.1	32.6	28.1	27.7	33.0	29.0
Lambs Sold Fat	5.7	19.7	32.0	7.7	26.5	27.7
Lambs Sold Store	16.0	22.6	16.5	18.0	16.7	33,6
Lambs Died	24.5	11.2	8.6	19.0	9.2	7.4
Lambs in Closing Valuation	9.5	7.7	19.1	9.2	8.9	5.0
Per 100 Breeding Ewes	£	£	£	£	£	£
Gross Output	339.8	504.8	613.0	368.0	534.3	596.2
Variable Costs						
Concentrates	20.7	11.5	29.4	20.1	15.0	23.5
Agistment	51.9	67.2	44.3	57.7	66.1	24.4
Vet and Medicines	9.2	13.4	21.8	9.9	15.1	23.5
Total Variable Costs	96.2	108.6	113.5	102.3	116.6	86.0
Gross Margin	243.6	396.2	499.5	265.7	417.7	510.2
Cost of Labour	108.7	108.2	108.3	116.5	118.0	109.2
	NORTH OF ENGLAND					
No. of Flocks	22	10	17	15	11	23
Average Lambing Rates %	73.9	94.1	108.4	78.2	95.6	108.1
Ram Replacements	0.6	-	0.9	0.1	0.6	0.7
Ewe Replacements	20.2	26.0	22.0	27.0	24.9	25.2
Lambs Sold Fat	5.3	2.7	20.4	7.7	6.9	17.1
Lambs Sold Store	24.3	26.9	29.8	26.7	41.9	31.4
Lambs Died	15.0	14.0	11.7	7.5	11.3	6.7
Lambs in Closing Valuation	8.3	24.5	23.6	9.2	10.0	27.0
Per 100 Breeding Ewes	£	£	£	£	£	£
Gross Output	354.4	478.6	758.9	415.8	507.8	697.6
Variable Costs						
Concentrates	19.2	13.9	50.5	12.0	23.5	36.6
Agistment	13.2	30.6	12.5	15.8	26.1	18.2
Vet and Medicines	21.4	29.5	34.3	21.5	25.7	32.5
Total Variable Costs	59.2	76.6	103.0	54.2	82.1	93.0
Gross Margin	295.2	402.0	655.9	361.6	42.5	604.6
Cost of Labour	114.9	111.1	150.0	120.6	126.4	141.0

CHART III

VALUE OF LAMBS SOLD PER 100 BREEDING EWES ACCORDING TO LAMBING PERCENTAGE 1969-70

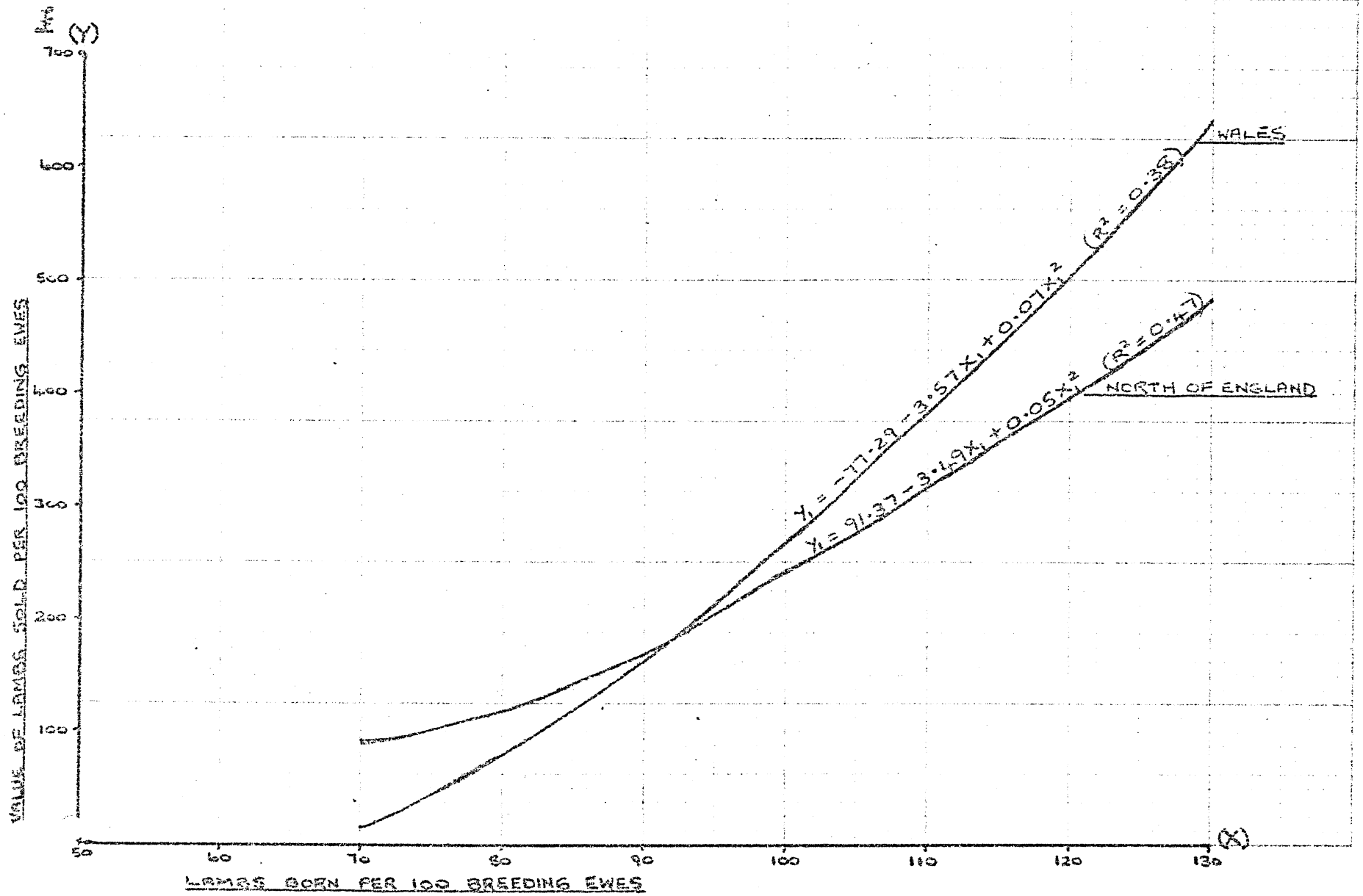


CHART IV

GROSS OUTPUT PER 100 BREEDING EWES ACCORDING TO LAMBING PERCENTAGE 1969 - 70

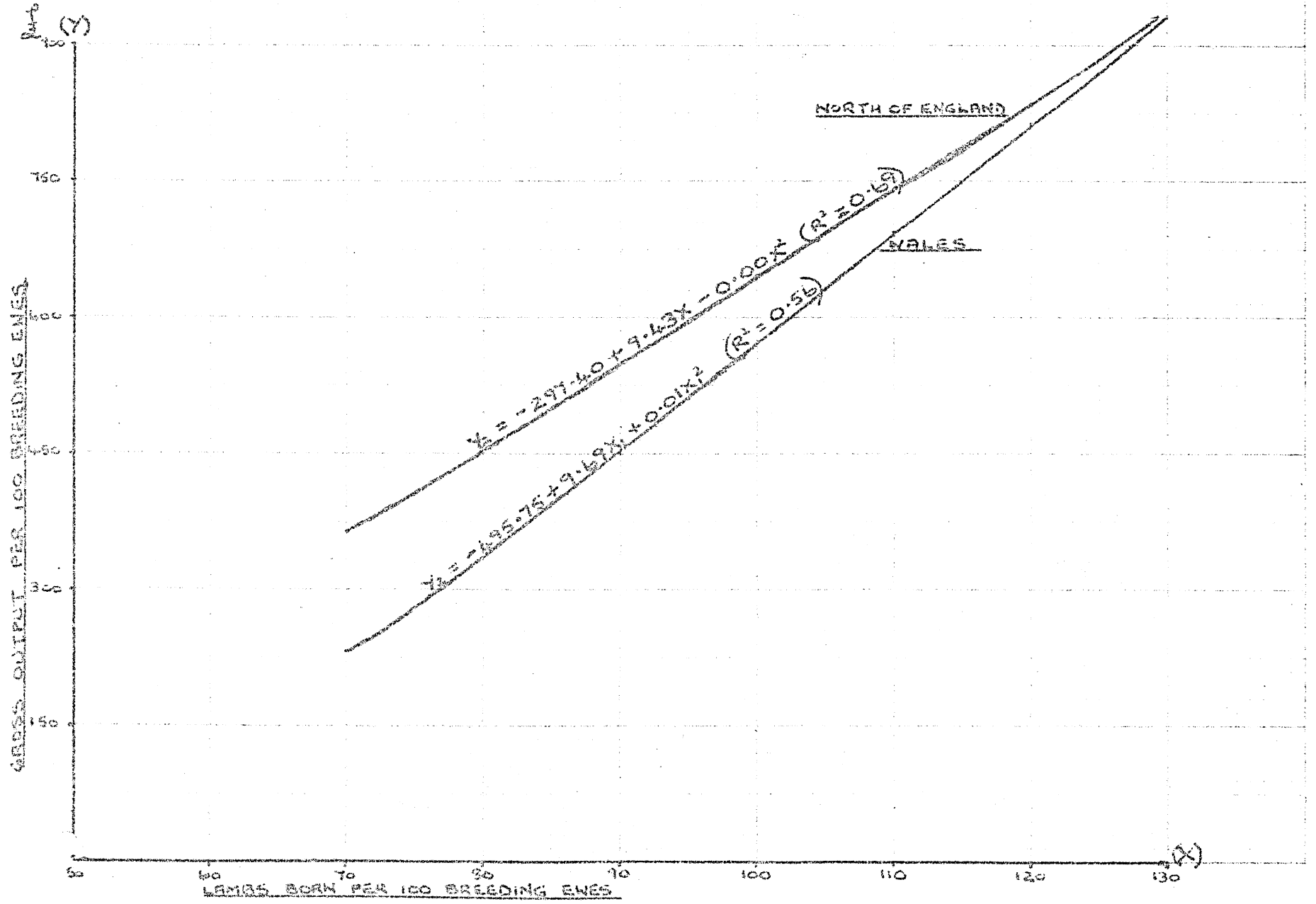
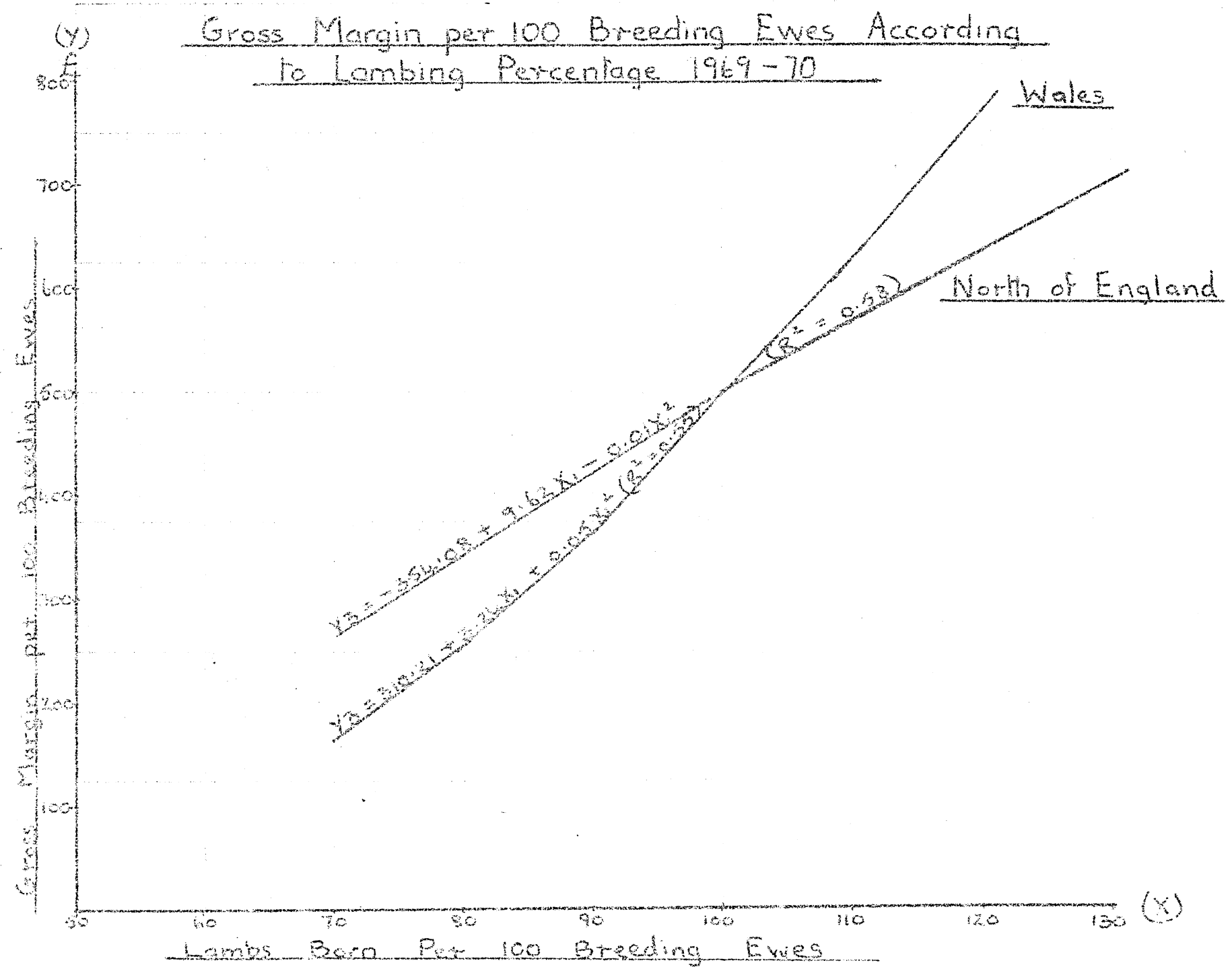


CHART V

Gross Margin per 100 Breeding Ewes According to Lambing Percentage 1969 - 70



In general the total variable costs per 100 breeding ewes are higher the higher the lambing percentage, but the absolute increases in these costs are small compared with the very large increases in gross output also associated with higher lambing percentages. Such increases in gross output are an obvious consequence of higher lambing rates and (as already mentioned) an associated lower mortality in lambs permitting a bigger surplus of lambs for sale. Furthermore, in general, the better the lambing rate the more lambs sold in fat condition, especially from Welsh hill farms. An important contributory factor common to all these measures would seem to be quality of management.

Quality of Management

Unfortunately quality of management is not something that can itself be measured in quantitative terms, nor can its effects on flock performance, which must be very substantial, be isolated from those of other factors, notably the weather. Quality of management also defies precise definition, for management of a sheep flock includes a diversity of functions calling for a diversity of personal qualities in the shepherd or farm manager. It includes the ability to properly assess the true potential of one's farm land and buildings in respect of stock carrying capacity; an eye for good stock, an ability which is crucial when culling the ewe flock, selecting ewe lambs for replacement, and purchasing replacement rams. Good stock in this case means stock that are capable of performing well under the circumstances of the particular farm. Another managerial quality is the ability to organize the farm resources and enterprises to best advantage, such as having the right ratio of cattle to sheep, and the right numbers of each with respect to the stock carrying capacity of the farm, to providing adequate winter keep and to earning a high profit. The good flockmaster, whether he be a shepherd, employed wholly for shepherding, or farmer, must have a keen interest in sheep and be devoted to their well-being. These qualities which are more fully realized and expressed with experience and education, largely explain the difference between good and bad management.

The care taken of the ewes and lambs before and after lambing whilst it depends in no small measure on these qualities, must to some extent be related to the time devoted to the flock at this crucial time. This is to say that the time devoted to shepherding, even when accurately recorded, cannot in itself be a good standard for comparing the quality of management between farms. Apart from not taking into account personal qualities, it must reflect variations in distance from farmstead to hills, from farm to farm and region to region, and the extent to which individual farmers rely on casual and contract labour for such tasks as shearing and dipping. The differences exhibited between the samples of Welsh and North of England flocks in respect of the relationship between cost of direct labour on sheep and lambing

percentage and mortalty, reflects more the physical differences and practices between the two areas than 'quality of flock management'.

What can greatly influence the lambing and mortality rates, often moreso than the quality of management itself, is the weather in any particular area before and after lambing. Harsh weather affects the ewes and lambs during pregnancy, the survival rate of both before and after lambing and the performance of the lambs. Severe weather has no more respect for good than for bad managers, but in the event of bad weather the former can often ensure a better survival rate and performance.

A rising lambing percentage, because of the much larger increases in gross output than in variable costs, results in more than proportionate increases in gross margins per 100 breeding ewes. This is well illustrated in both, Table XVII and in Charts IV and V. Such increases in gross margins are appreciably greater for Welsh than for the North of England flocks mainly because of the lesser increases in variable costs, especially in those of purchased concentrates, in the former. Thus according to Chart V for every 10 per cent increase in lambing rate, the additional gross margin per 100 breeding ewes for the English flocks is appreciably below £100 and tends to decline, whilst for Welsh flocks it is appreciably more than £100 and tends to increase.

Mortality

Ewe Mortality, together with the length of flock life affects the cost of flock replacements. If death occurs before or during lambing it also also affects the lambing percentage and hence the receipts from the sale of lambs and the gross margin. The figures for ewe mortality expressed in Table XV are in respect of ewes tupped i.e. breeding ewes only. For the Welsh Sample, with an average death rate in ewes of 7 per cent, and an average flock life of just over three years for every 100 ewes tupped 23 draft ewes were sold, and about 30 ewe hoggs entered the flock each year. In the North of England on the other hand, with a slightly higher ewe mortality and an average flock life of five years only, 10 or 11 draft ewes were sold, and only about 20 or 21 ewe hoggs were transferred in each year.

The effect of mortality in ewes, which occurs largely during pregnancy and at lambing, together with that of length of flock life, on the cost of flock replacements are shown in Table XVII. Naturally the larger the ewes and the younger they are when they die, the greater tends to be the effect of mortality on the cost of flock replacement. Because hill ewes in the North of England are kept longer, the average mortality rate for them tends to be higher. This together with the larger

size (and hence higher prices) of the English hill ewe tend to result in mortality having a greater affect on replacement cost for the English than for the Welsh flocks.

Lamb Sales

The larger English hill ewe produces a larger lamb than does the Welsh, a fact which is reflected in the substantial differences in the prices of both fat and store lambs between the two regions.

The prices for fat lambs vary seasonally with changes in supply - they are generally lowest from mid-July to mid-November, after which they rise to reach a peak about April. The standard prices, which are the weekly guaranteed prices, for 1968-69 and for 1969-70 are shown in Chart VI. The prices for store lambs are governed to a large extend by and broadly follow those for fat lambs.

Seasonal Distribution of Lamb Sales (per cent) 1968-69

	May	June	July	Aug	Sept	Oct	Nov	Dec
				WALES				
Fat Lambs	-	-	2	13	25	27	29	4
Store Lambs	-	-	9	26	36	25	4	-
				NORTH OF ENGLAND				
Store and Fat Lambs	3	1	-	5	49	42	-	-

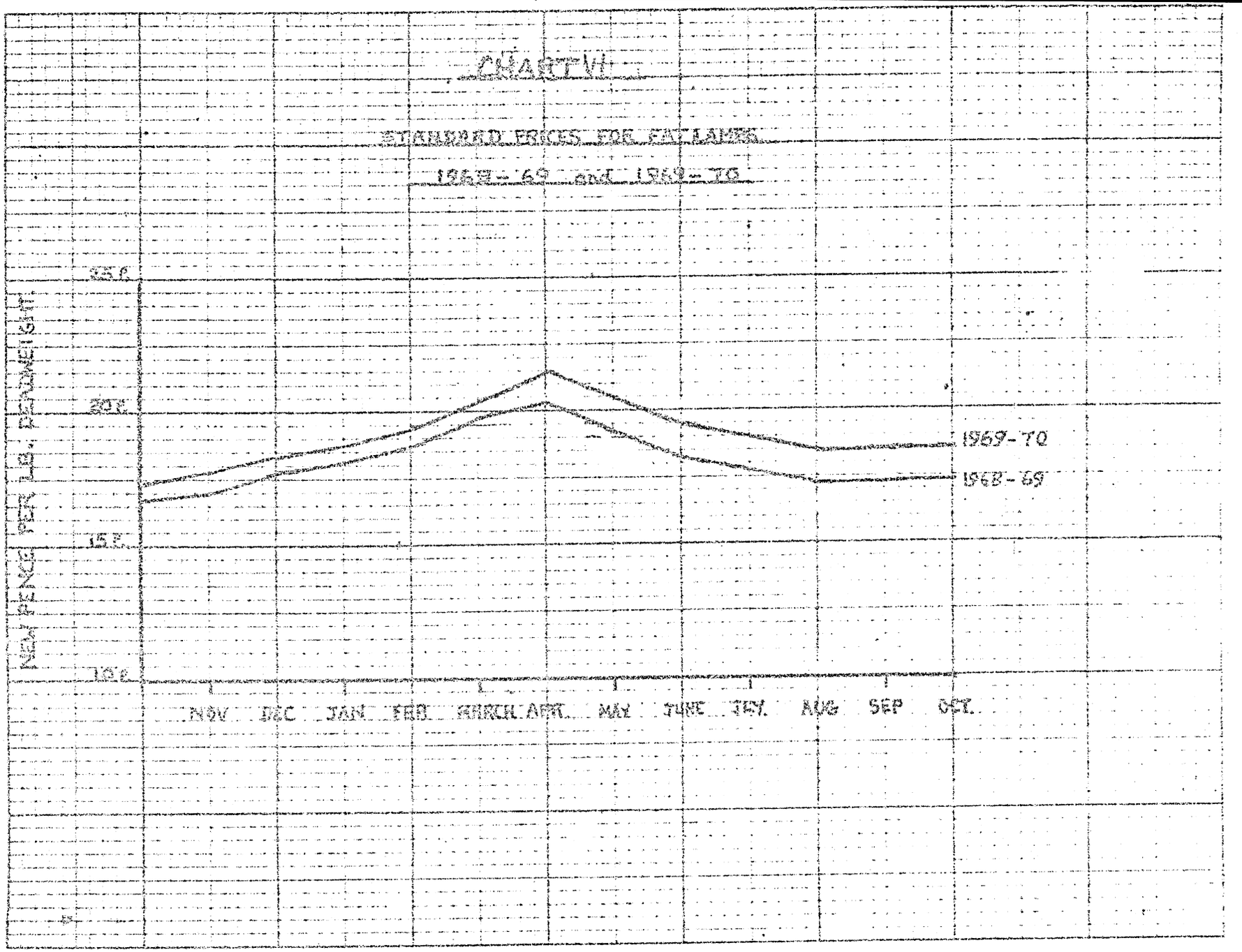
About 45 per cent of lambs sold off the sample of Welsh farms were in fat condition; 60 per cent of these were sold in October, November and December, the remainder mainly in August and September. The practice on most Welsh hill farms is to sell fat lambs as they reach suitable weights from mid-July onwards. The distribution of sales therefore depends on the stocking rate and the availability of grass on individual farms, a little concentrate feeding being sometimes necessary for those sold in August and September. Those sold in October, November and December are finished off rape, sown in July.

Because of the higher prices from about mid-October onwards, it may well be asked why are not more lambs kept until the autumn to take advantage of the then heavier lambs and of the higher prices ? Fat lambs produced on hill farms are, with but few exceptions, in the lightweight category (i.e. not exceeding 35 d.c.w.) even when sold in October and November. However, the price for each grade tends to rise in October and November and it is from this rise that selling late and at heavier (but still light) weight will result in higher returns. At the

CHART VI

STANDARD PRICES FOR FAT LAMBS

1968-69 and 1969-70



Autumn 1972 price of 27 pence per lb d.c.w., hand feeding with cereals and selling in October was, on paper, more profitable than selling in July or August off grass. Selling lambs fat off rape in October and November must have been much more profitable than selling earlier off grass. However, prices in 1972 were exceptionally high; and who could have foreseen the sharp rise in price and deliberately held back all their lambs to take advantage of the situation ? It is fairly certain that even with pre 1972 prices fattening off rape in the autumn was more profitable than fattening off grass and concentrates in late summer. This is probably true even if the rape seed is charged against the lambs.

On most Welsh hill farms, growing rape is part of an annual practice of improving hill pasture with the aim of maintaining or increasing the density of stocking. As such the rape costs nothing to the fattening of lambs. An important practical point to bear in mind in this connection is that keeping all the lambs back until the autumn may exert too much pressure on the dwindling supply and declining quality of grass, a fact which might slow down the rate of growth of lambs and reduce the number of store cattle.

There appears to be no single, permanent, answer to the question as to the best time and weight to sell fat lambs off hill farms. It depends on the rate at which prices increase in the autumn (which few can foresee) and upon the special circumstances which may dictate the method of fattening on individual farms.

Almost two-thirds of the store lambs from Welsh hill farms are sold in August and September.

Most lambs in the North of England are sold in the autumn and most are finished off grass, with very little concentrate feeding. In contrast to the situation on Welsh hill farms, only about 25 per cent of the lambs sold were in fat condition. Unfortunately in the seasonal distribution of lamb sales it was not possible to distinguish between store and fat lambs. Neither was it possible to include all lambs sold because the substantial number (about 10-20 per cent) sold after the end of the accounting year (October), were included in the closing valuation and not shown as sales in the following year.

Another factor which could affect the average performance of the ewe flocks in the two regions is the *density of stocking*. This affects the level of nutrition and the possible incidence of disease, and hence the performance of ewes and lambs.

Table XVIII

Density of Stocking 1969-70

	Per 100 Actual Acres	
	Wales	North of England
Cattle and Sheep (L.U.)	16.5	13.7
Number of Breeding Ewes	72	44
Number of Cattle (L.U.)	3.8	4.4
Ratio of Cattle: Sheep (L.U.)	0.3 :1	0.5 :1

In relation to the actual farm acreage, Welsh hill farms in general are more heavily stocked with cattle and sheep (measured in livestock units) than are those in the North of England. Although the sheep enterprise is the dominant one in both areas, the North of England farms are appreciably more heavily stocked with cattle than are the Welsh, a fact which suggests better quality grazings in the North. One would, therefore, expect better-performance by the ewes and lambs in the English region. However the figures on lambing percentages and mortalities do not bear out this expectation. The possible effect of stocking density on the performance of Welsh ewes is considered in rather more detail at a later stage.

Bearing in mind the apparent differences between the two regions in respect of the quality of land, size of ewe, size of flock, and the relative importance of the cattle and sheep enterprises a direct comparison of the results for the regions is not very meaningful, except in so far as it further reflects the physical differences between these areas and possible differences in management.

IV ANALYSIS OF RESULTS BY FLOCK SIZE

When considering the effect of flock size on financial results the impact of possible economies of scale, especially economies in labour utilization, immediately arise on the one hand as important positive factors. On the other hand, the possibility of deterioration in ewe and lamb performance with increasing flock size, arising from a lesser degree of individual attention than is usually possible with smaller flocks, is an important negative factor. Furthermore, larger flocks are usually on larger farms on which stocking rates (in terms of livestock units) are generally less intensive than on smaller farms.

Gross Output

The net result of the combination of these positive and negative factors is a tendency for gross output per 100 breeding ewes, a measure which largely reflects the individual performance of ewes and lambs, to decline with increasing size of flock[1]. This tendency is clearly shown by the data contained in Table XIX, illustrated in Chart VII.

Table XIX

Gross Output per 100 Breeding Ewes (identical farms) by Flock Size and Total Flocks

Year and Region	Gross Output by Flock Size[a]				
	0-400	401-600	601-800	801 & over	All Flocks
	£ per 100 breeding ewes				
1968-69					
Wales	536(12)	495(15)	514(10)	410(16)	460(53)
North of England	573(26)	513(12)	441(5)	389(6)	469(49)
1969-70					
Wales	544(12)	531(15)	524(10)	440(16)	485(53)
North of England	618(26)	577(12)	508(5)	531(6)	559(49)

[a] *Flock size expressed as number of breeding ewes. Figures in brackets denote number of*

The difference in gross output per 100 breeding ewes between flocks of under 400 breeding ewes and those of 801 and over is substantial: gross outputs of the largest flock group expressed as a percentage of those of the smallest is 76 and 68 for Wales and the North of England respectively in 1968-69, and 81 and 86 respectively in the following year.

Of the factors which influence the level of sales and gross output, the most important is the lambing percentage which together with mortality, and along with the flock's average length of life, largely determine the number of lambs available for sale after replacements have been ascertained. Within any particular flock, the more lambs retained for breeding, the higher becomes flock depreciation, the lower the number of lambs for sale, consequently, the lower becomes gross output.

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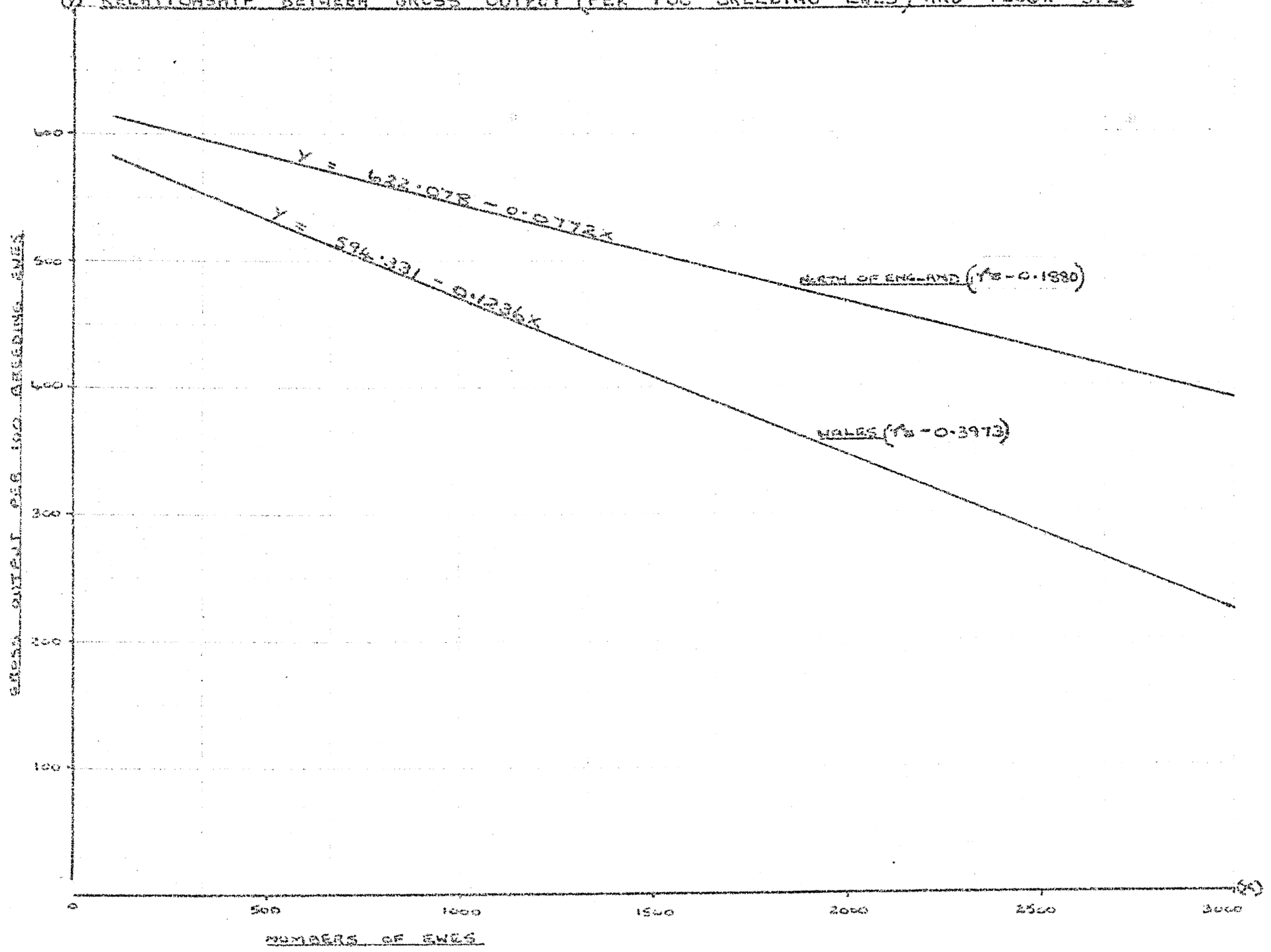
[1] *Regression analyses were made only on data for the 1969-70 season. The correlation for both gross outputs and gross margins with flock size were observed to be significant at the 95 per cent level only in the case of Welsh data.*

CHART VII

(X) RELATIONSHIP BETWEEN GROSS OUTPUT (PER 100 BREEDING EWES) AND FLOCK SIZE



Data on the sale of fat lambs contained in Table XX suggests that the number sold per 100 breeding ewes tends to decline with increased size of flock but no significant correlation exists (at the 90 per cent level)[1]. These data indicate that, on average, about twice as many fat lambs are sold from the Welsh flocks than from those in the North of England. Similarly, data on the sale of store lambs contained in Table XXI indicate no significant correlation between numbers of stores sold and flock size.

Table XX

Number of Fat and Store Lambs Sold per 100 Breeding Ewes by Flock Size

Year and Region	Lambs Sold per 100 Breeding Ewes by Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	fat lambs				
1968-69					
Wales	21.8	19.7	17.8	13.2	16.3
North of England	18.0	6.2	1.1	4.4	7.3
1969-70					
Wales	23.1	28.9	22.6	15.9	20.6
North of England	18.2	6.3	19.4	8.0	11.5
	store lambs				
1968-69					
Wales	14.8	22.1	19.4	19.6	19.6
North of England	39.4	46.0	47.7	38.8	42.2
1969-70					
Wales	12.8	13.1	20.9	20.4	18.3
North of England	47.7	57.8	39.5	48.9	49.6

The tendency for gross output per 100 breeding ewes to decline with flock size can possibly, in part, be explained by the tendency for fat lamb sales to decline together with a decline in sales of the less important saleable products, draft ewes and fleeces. The data in Table XXI suggests that smaller flocks in each region obtain slightly higher returns per head for lambs than the larger flocks. These differences are unlikely to be significant although the same negative trend is indicated in both years. There is, however, a clear indication that North of England flocks received

[1] *Regression analyses were only made on 1969-70 data.*

somewhat higher prices per head than Welsh flocks for both fat and store lambs a fact which Must be due to a difference in the breeds of sheep.

Table XXI

Average Sale Value per Head for Fat and Store Lambs by Size of Flock

Year and Region	Value of Lambs by Size of Flock				
	0-400	401-600	601-800	801 & over	All Farms
	£ per fat lambs				
1968-69					
Wales	5.1	4.6	5.0	4.6	4.8
North of England	6.4	6.7	7.2	5.1	6.2
1969-70					
Wales	5.0	5.0	5.0	4.9	5.0
North of England	6.2	6.9	6.4	6.0	6.3
	£ per store lamb				
1968-69					
Wales	3.9	3.5	3.9	3.2	3.4
North of England	4.4	4.8	4.5	4.4	4.6
1969-70					
Wales	3.8	2.8	3.5	3.4	3.3
North of England	4.7	4.7	3.8	4.4	4.5

Data for the sale of draft ewes and fleeces are presented in Tables XXII and XXIII. There appears to be a tendency to more rigorous culling for both years in small than in larger Welsh flocks. In North of England flocks, however, this consistency does not appear since the negative trend in the first year reverses in the second. The level of culling appears to be almost twice as high in Welsh flocks compared with the North of England, a fact which, as explained earlier, is associated with the level of nutrition at which they are sustained and the effect of this on the value of the draft ewe.

In both regions the value of wool sold per 100 breeding ewes declines consistently as flock size increases. Data on the relationship between value of wool sold and flock size are contained in Table XXIII, illustrated in Chart VIII. This correlation is significant (at 95 per cent level) however, only for the Welsh data. This observation again arises largely from the lower Level of nutrition associated with a higher proportion of poorer quality rough grazings.

CHART VII

RELATIONSHIP BETWEEN VALUE OF WOOL PER FLEECE AND FLOCK SIZE

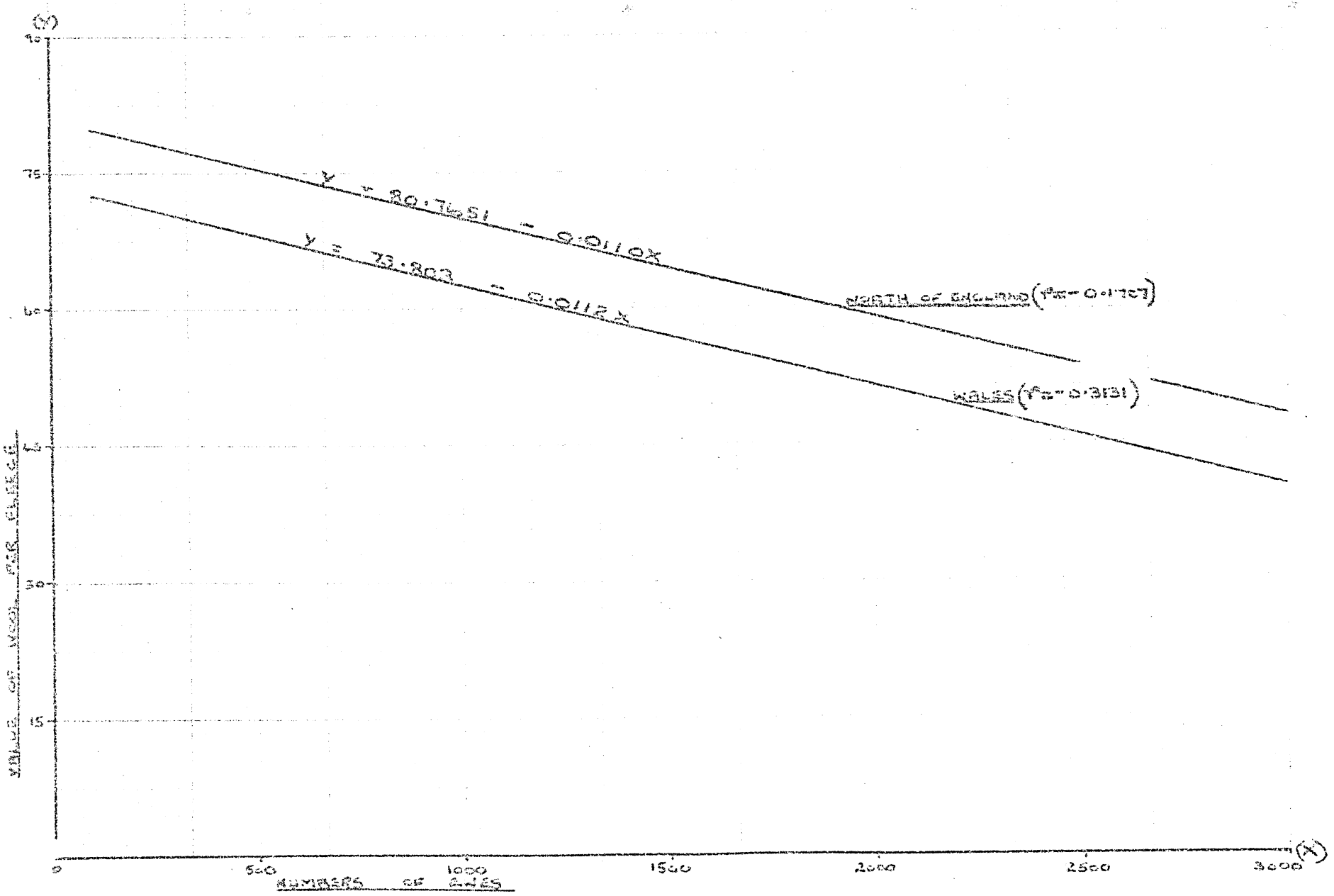


Table XXII

Numbers of Draft Ewes sold per 100 Breeding Ewes by Flock Size

Year and Region	Draft Ewes Sold by Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	numbers per 100 breeding ewes				
1968-69					
Wales	25.5	26.7	24.5	20.3	23.0
North of England	12.6	9.3	7.3	10.8	10.2
1969-70					
Wales	25.2	25.7	22.7	20.5	22.5
North of England	10.5	13.2	3.3	13.8	11.3

Table XXIII

Value of Wool Sold per 100 Breeding Ewes by Flock Size

Year and Region	Value of Wool Output by Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	£ per 100 breeding ewes				
1968-69					
Wales	72.3	69.3	71.4	61.5	65.7
North of England	81.1	70.2	64.0	61.9	67.9
1969-70					
Wales	67.1	69.5	67.9	59.6	63.9
North of England	81.1	76.9	64.4	65.7	71.7

Lambing Percentage

The data contained in Table XXIV and illustrated in Chart IX clearly indicate the tendency for the lambing percentage to decline with increasing flock size. This negative correlation is more marked in the data for Wales during the 1969-70 season (the data on which regression analyses were made) and more marked in the data for the North of England during the previous season. The correlation is significant (at 95 per cent level) only in the case of Welsh data but with a more marked trend in the data for the North of England in the earlier season, it is reasonable to expect a significant correlation from these data. This observation would confirm the tendency for more careful attention being given to sheep in smaller than in larger flocks.

CHART IX

RELATIONSHIP BETWEEN LAMBING PERCENTAGE AND FLOCK SIZE

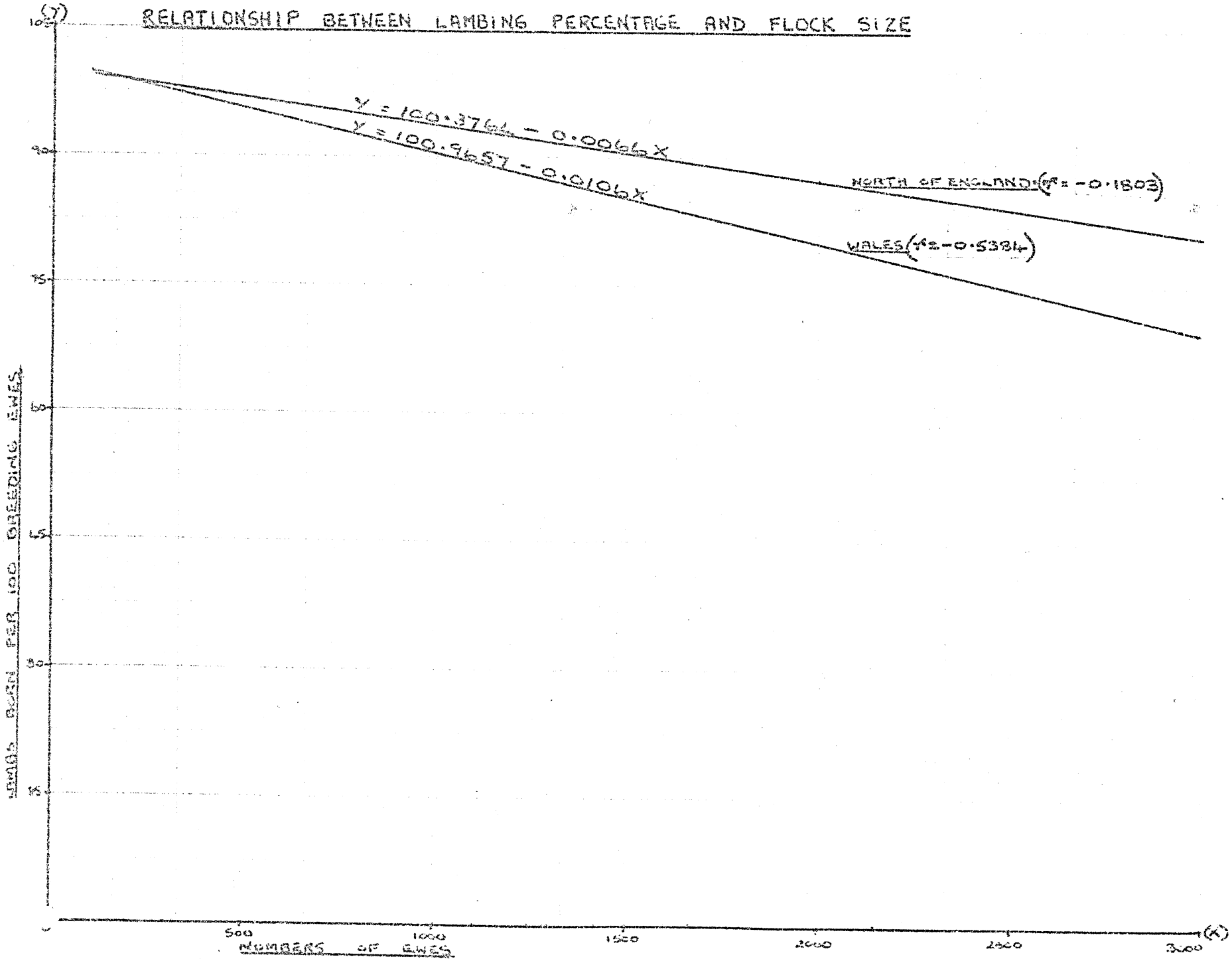


Table XXIV

Births per 100 Breeding Ewes by Flock Size

Year and Region	Lambing Percentage by Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	per cent				
1968-69					
Wales	97.6	95.3	93.6	87.5	91.3
North of England	94.8	85.6	90.4	79.3	86.0
1969-70					
Wales	96.0	96.1	94.7	87.7	91.6
North of England	100.5	95.9	89.9	93.8	95.2

Mortality in Ewes and Lambs

Data on mortality in both breeding ewes and lambs contained in Table XXV show a tendency for this to increase with flock size (see also Charts X and XI) although the tendency is not uniform and the correlations are not significant (at 95 per cent level).

Table XXV

Mortality in Ewes and Lambs by Flock Size

Year and Region	Mortality in Ewes and Lambs by Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	percentage mortality in ewes[a]				
1968-69					
Wales	7.7	6.4	6.5	8.3	7.5
North of England	10.1	11.7	11.7	14.7	12.5
1969-70					
Wales	4.9	4.7	6.2	7.0	6.1
North of England	6.2	8.1	12.4	5.9	7.6
	per centage mortality in lambs				
1968-69					
Wales	12.8	12.9	10.4	22.5	17.0
North of England	13.0	12.4	20.4	22.5	16.4
1969-70					
Wales	13.1	11.3	8.8	16.2	13.3
North of England	7.7	6.9	6.3	11.1	8.5

[a] *Mortality of ewes per 100 breeding ewes tupped*

The mortality in ewes is usually higher in winter and during lambing than in the remainder of the year. In general, ewe mortalities are higher in each size group for the North of England than for Wales and the increase in mortality with increasing flock size tends to be greater also in that region

CHART

RELATIONSHIP BETWEEN EWE MORTALITY AND FLOCK SIZE

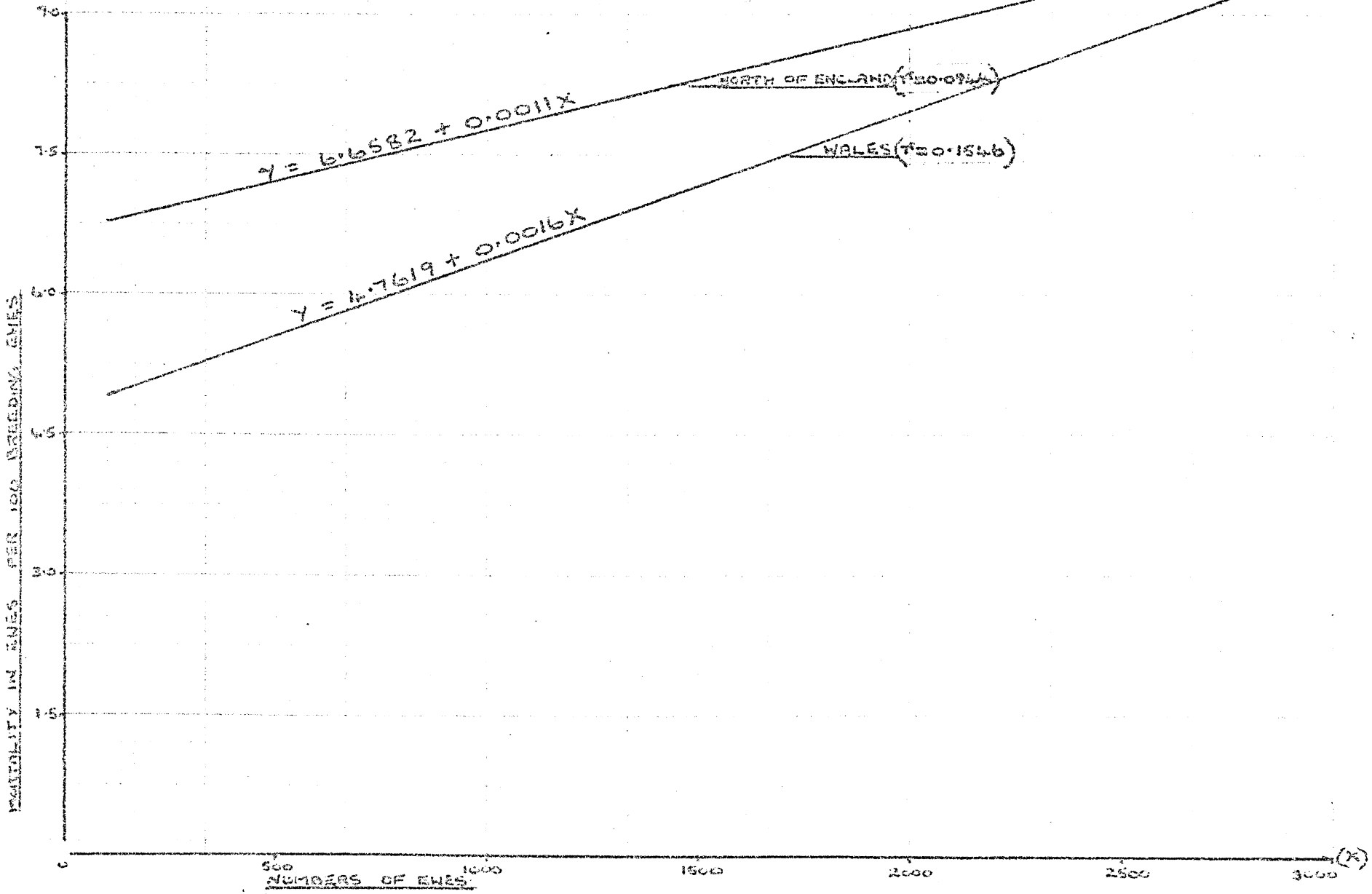
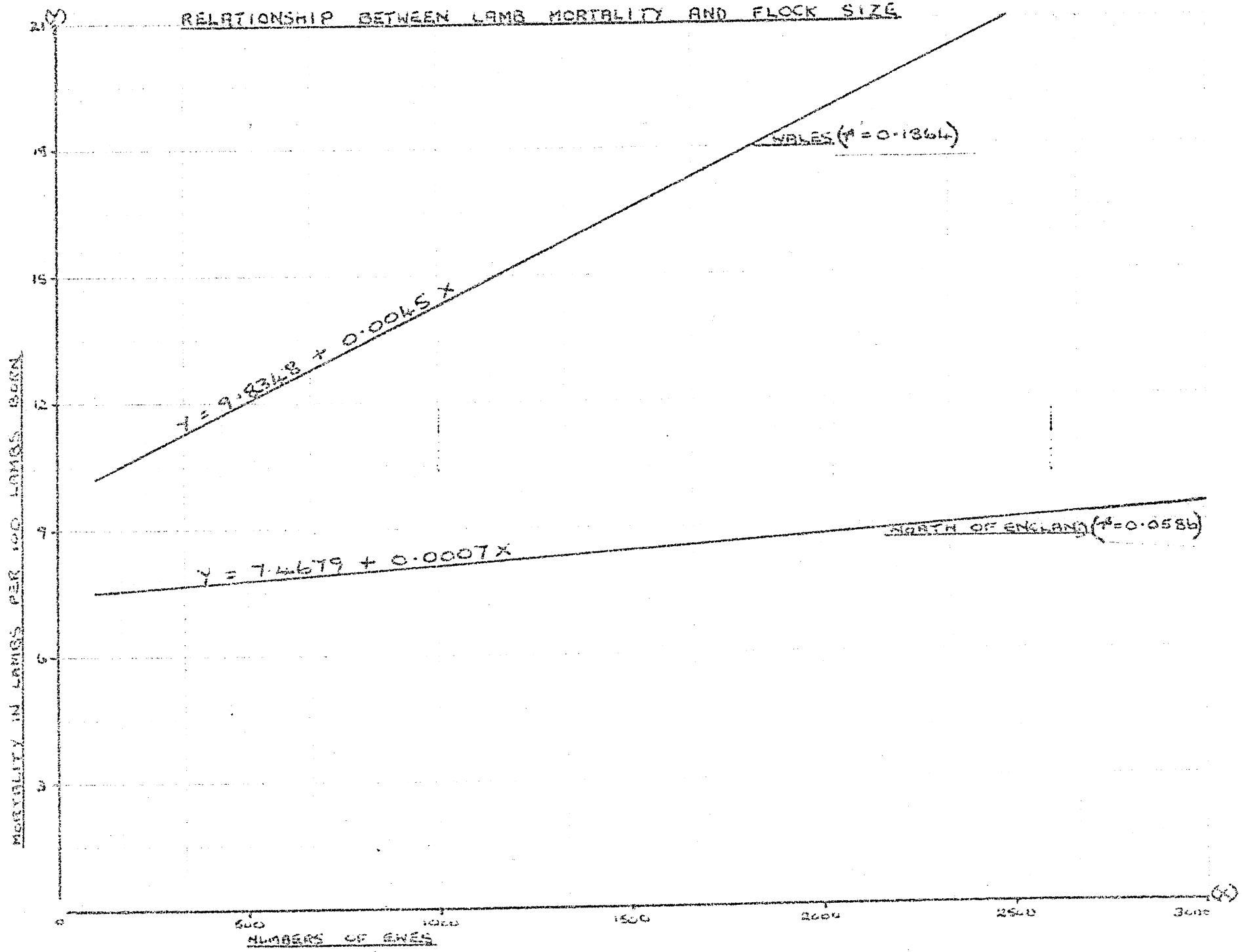


CHART XI


RELATIONSHIP BETWEEN LAMB MORTALITY AND FLOCK SIZE
WALES ($r^2 = 0.1864$)
$Y = 9.83148 + 0.0045X$
NORTH OF ENGLAND ($r^2 = 0.0586$)
$Y = 7.4679 + 0.0007X$
MORTALITY IN LAMBS PER 100 LAMBS BORN
NUMBERS OF EWES
0
500
1000
1500
2000
2500
3000
5
6
4
15
2

than in Wales. In addition to lesser individual attention in larger flocks, another factor which may affect mortality is stocking density. The density of stocking, especially with sheep, can affect mortality, and indeed the other Performances measures, via the nutrition level and the disease concentration in the ground.

However, the figures in Table XXX in the following chapter showing the number of ewes per 100 actual acres declining with size of flock, indicates that density of stocking with sheep is not a factor contributing to the higher mortality in ewes and lambs in larger flocks, unless the quality of rough grazings also deteriorates rapidly with size of farm.

Flock Replacement Policy

Data on replacements contained in Table XXVI comfirms the observation made earlier with respect to the tendency to more rigerous culling in smaller flocks. As already observed, replacement levels are also higher in Wales than in the North of England.

Table XXVI

Replacement Lambs (including Ram Lambs) Retained for Breeding by Flock Size

Year and Region	Flock Size				
	0-400	401-600	601-800	801 & over	All Farms
	lambs retained per 100 breeding ewes				
1968-69					
Wales	31.0	31.6	33.4	28.3	30.3
North of England	25.0	22.8	23.1	20.4	22.5
1969-70					
Wales	34.1	32.9	33.1	30.5	31.8
North of England	27.0	25.9	25.3	26.5	26.2

In general, the smaller flocks, both in Wales and the North of England show better gross margins per 100 breeding ewes than do the larger ones. Profitability, on the other hand, whilst it tends to decline (fairly consistently) with increasing size of flock groups for Wales, fluctuates much more and shows no such trend for the North of England. With so many items entering into the calculations it is difficult to explain this in precise terms. However, the explanation for the Welsh flocks lies broadly in the fact that, for the first three size groups, variable costs (the cost of agistment in particular) tend to rise even more rapidly than fixed costs decline. For the North of

England, on the other hand, variable costs although they fluctuate, tend to decline a little with size of flock. It is noteworthy that the latter show much greater economies (with size) in fixed costs than fo the Welsh flocks, the difference being due largely to a greater *apparent reduction* in labour usage with increasing size of flock for the North of England.

Table XXVII

Gross Margin and Profit per 100 Breeding Ewes by Flock Size

Year and Regions	Flock Size									
	0-400		401-600		601-800		801 & over		All Farms	
	G.M.	Profit	G.M.	Profit	G.M.	Profit	G.M.	Profit	G.M.	Profit
	£ per 100 breeding ewes									
1968-69										
Wales	451.2	187.7	385.6	136.4	396.4	174.6	310.2	120.5	355.4	140.6
North of England	477.8	76.3	442.2	165.5	366.7	106.0	328.1	85.6	396.8	110.2
1969-70										
Wales	464.1	218,6	418.5	163.5	396.8	195.0	334.3	131.0	375.4	158.1
North of England	527.7	140.8	501.7	224.3	423.8	141.3	462.7	213.2	481.0	191.2

It is worth noting the shifts which take place in cost structure with increasing flock size. Within the variable costs, with the exception of the 601-800 ewes size group the cost of purchased feed decline with size of flock. In both regions these reductions are associated with the cost of agistment which tends to increase with increasing size of flock. Veterinary and medicinal charges tend to decline with increasing size of flock.

Due, no doubt, to the larger flocks being on the larger farms which have larger proportions of rough grazing to total area, forage costs per 100 breeding ewes decline with size of flock in both regions. These costs are lower for Wales than for the North of England, probably because of the higher density of stocking made possible by the more widespread practice of away wintering of ewe lambs.

CHART XII

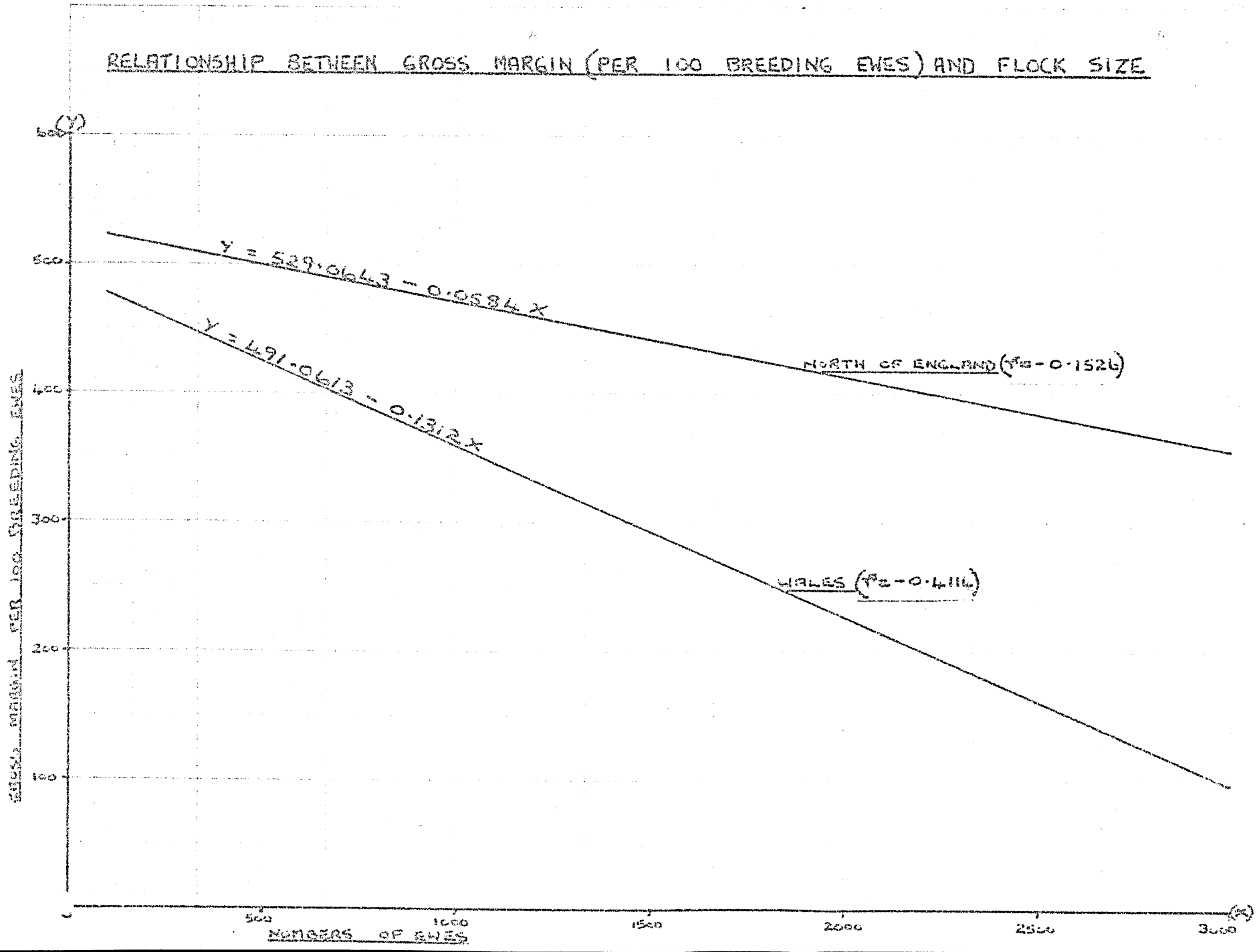

RELATIONSHIP BETWEEN GROSS MARGIN (PER 100 BREEDING EWES) AND FLOCK SIZE
(Y)
600
500
400
300
200
100
GROSS MARGIN PER 100 BREEDING EWES
Y = 529·0643 - 0·0584 X
Y = 491·0613 - 0·1312 X
NORTH OF ENGLAND (r^2 = 0·1526)
WALES (r^2 = 0·4116)
500
1000
1500
2000
2500
3000
(X)
NUMBERS OF EWES

CHART XIIC

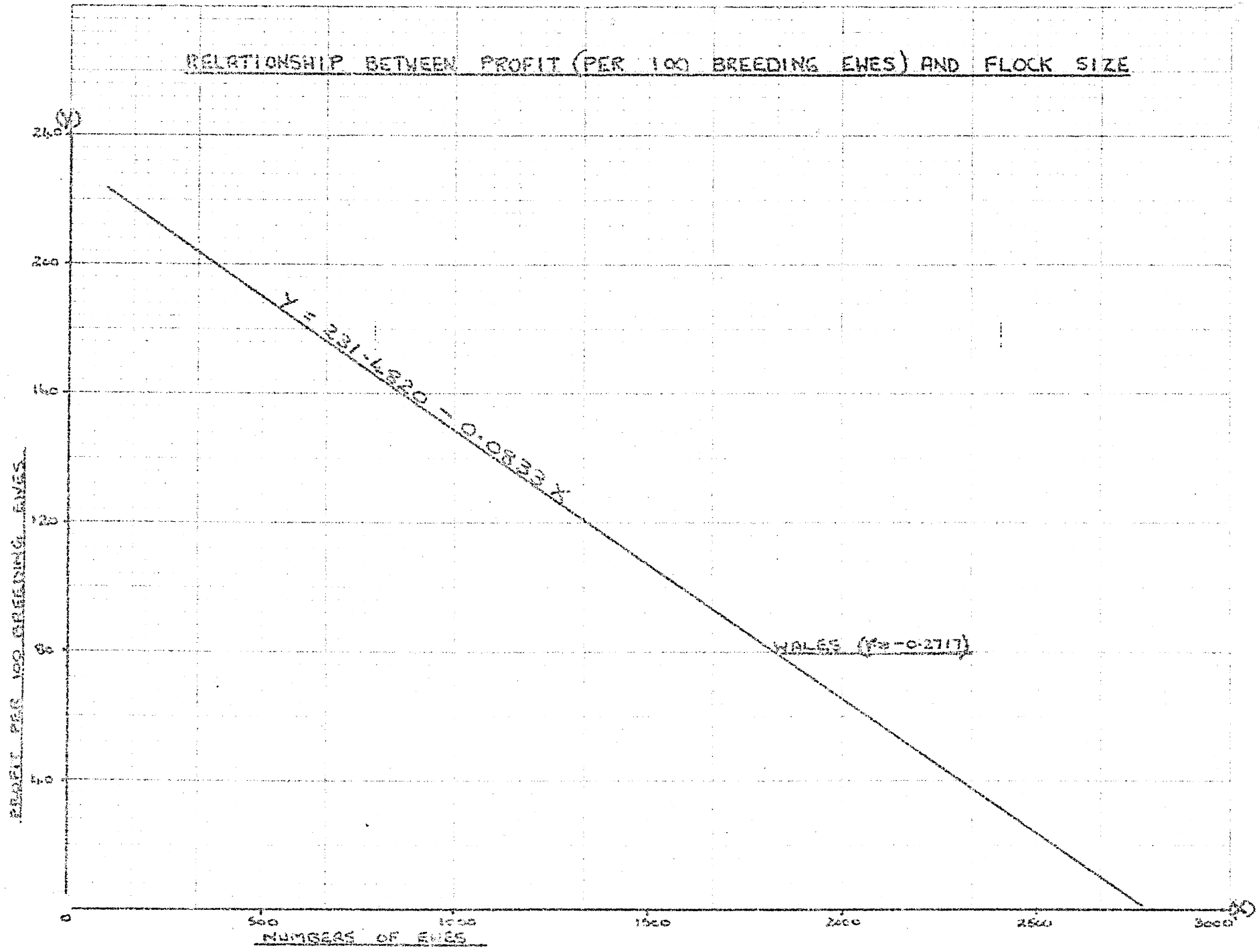

RELATIONSHIP BETWEEN PROFIT (PER 100 BREEDING EWES) AND FLOCK SIZE
Y = 231·4826 - 0·0833 X
WALES (r = -0·2717)
PROFIT PER 100 BREEDING EWES
NUMBERS OF EWES
0
500
1000
1500
2000
2500
3000
200
150
100
50

Table XXVIII

Variable and Fixed Costs per 100 Breeding Ewes by Flock Size

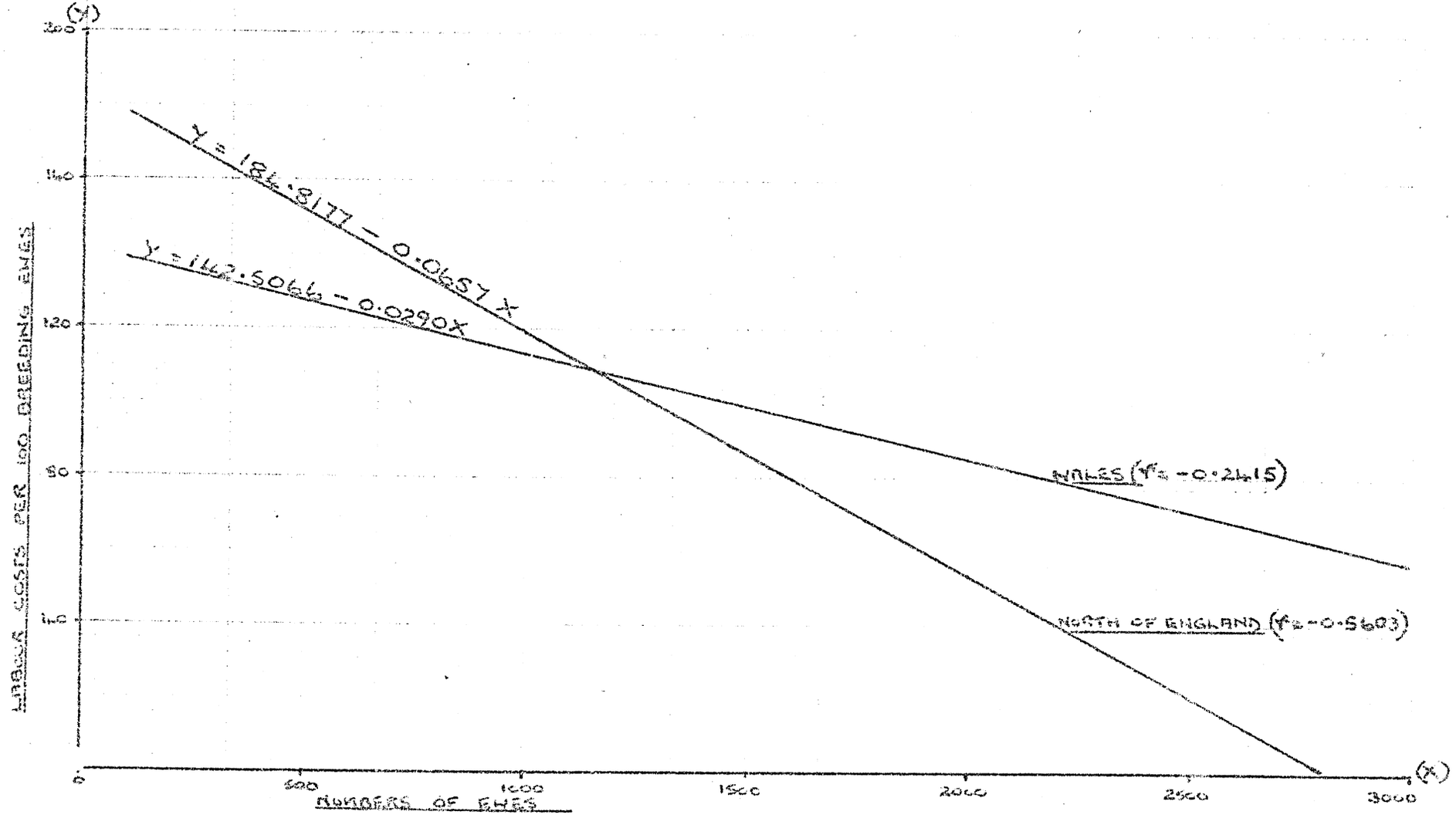
Cost Items	Variable and Fixed Costs by Flock Size									
	0 - 400		401 - 600		601 - 800		800 & over		All Farms	
	Wales	N. of E.	Wales	N. of E.	Wales	N. of E.	Wales	N. of E.	Wales	N. of E.
	£ per 100 breeding ewes									
1968-69										
Purch. Feed	23.1	43.7	22.3	33.0	27.5	20.9	14.3	14.7	19.3	26.1
Agistment	44.9	12.6	58.5	12.6	57.6	20.2	62.7	21.9	59.3	17.2
Vet. & Med.	13.9	35.6	16.1	22.2	15.9	29.6	10.4	21.8	12.9	26.1
Trans. & Misc.	12.7	4.6	12.4	3.4	116.2	3.2	12.8	2.4	13.4	3.2
Total Variable Costs	94.6	96.5	109.3	71.2	117.2	73.9	100.2	60.8	104.9	72.6
Forage	113.2	176.3	110.4	125.1	102.0	147.1	70.5	116.8	88.5	137.3
Labour	129.0	184.3	119.0	127.3	102.5	91.6	102.4	98.7	108.4	121.4
Misc.	21.4	40.9	9.8	24.3	17.3	22.0	16.8	27.0	17.9	27.9
Total Fixed Costs	263.6	401.5	249.2	276.7	221.8	260.7	189.7	242.5	214.8	286.6
Total Costs	358.2	489.0	358.5	347.9	339.0	334.6	289.9	303.3	319.7	359.2
1969-70										
Purch. Feed	22.4	41.1	20.4	26.2	33.2	35.4	14.8	17.7	20.2	27.1
Agistment	37.7	15.3	63.7	20.2	58.1	22.1	64.6	20.7	60.7	19.7
Vet. & Med.	15.2	33.5	16.8	25.4	15.9	24.2	12.1	25.7	14.0	27.2
Trans. & Misc.	14.4	3.9	11.8	3.3	20.1	2.6	14.7	4.0	15.1	3.5
Total Variable Costs	89.7	93.8	112.7	75.1	127.3	84.3	106.2	68.1	110.0	77.5
Forage	88.2	165.8	94.8	110.2	81.9	150.1	74.5	112.4	81.2	128.9
Labour	135.3	180.7	137.1	140.9	103.0	104.4	110.7	108.3	116.9	130.7
Misc.	22.0	40.4	23.1	26.3	16.9	28.0	18.1	28.8	19.2	30.2
Total Fixed Costs	245.5	386.9	255.0	277.4	201.8	282.5	203.3	249.5	217.3	289.8
Total Costs	355.1	480.7	367.7	352.5	329.1	356.8	309.5	317.6	327.3	367.3

Labour

Labour is the largest single input cost constituting approximately one-third of total costs in both years. Because of its importance, data on labour requirements are shown separately in Table XXIX and the relationships between labour costs and flock size are illustrated in Chart XIV. Approximately 10 per cent more labour is required for North of England than for Welsh flocks. The average labour used per ewe consistently declines

CHART XIV

RELATIONSHIP BETWEEN LABOUR COSTS (PER 100 BREEDING EWES) AND FLOCK SIZE



in each region as flock size increases. The owners of the smallest flocks in the North of England, as a group, seem to devote much more time to their sheep than do their counterparts in Wales; but for each of the other size groups the labour usage is rather similar for both regions.

Table XXIX

Labour Requirement per 100 Breeding Ewes by Size of Flock

Year and Region	Labour Requirement by Size of Flock				
	0 - 401	401 - 600	601 - 800	800 & over	All Flocks
	man-hours per 100 breeding ewes				
1968-69					
Wales	336	313	270	270	286
North of England	468	338	243	271	326
1969-70					
Wales	331	337	255	274	289
North of England	434	347	258	267	323

V DENSITY OF STOCKING, INDIVIDUAL PERFORMANCE, AND PROFIT PER FLOCK

Density of Stocking, Management and Individual Performance

It is evident from Table XXX and from Charts XVI - XIX inclusive that, as expected

(a) the size of flock increases distinctly with increasing farm acreage

(b) the overall density of stocking with cattle and sheep (expressed together in livestock units), and with sheep only, decline with

(i) increasing farm acreage (Charts XVI and XVII)

and (ii) increasing size of flock (Charts XVIII and XIX).

In the previous Chapters when the effects of various factors on the performance of ewes and lambs on the level of costs, gross output, gross margins and profits per 100 breeding ewes were examined it was suggested that the density of stocking was a contributing factor. No one will doubt that on any farm with a given standard of management the density of stocking, if raised to too high a level, must adversely affect the performance of ewes and lambs, simply because they are then deprived of an adequate level of nutrients and also become more susceptible to infestations and diseases. Unfortunately, it is not possible

CHART XV

Ratio of Sheep to Cattle (L.U.) by Size of Hill Farm. 1969/70

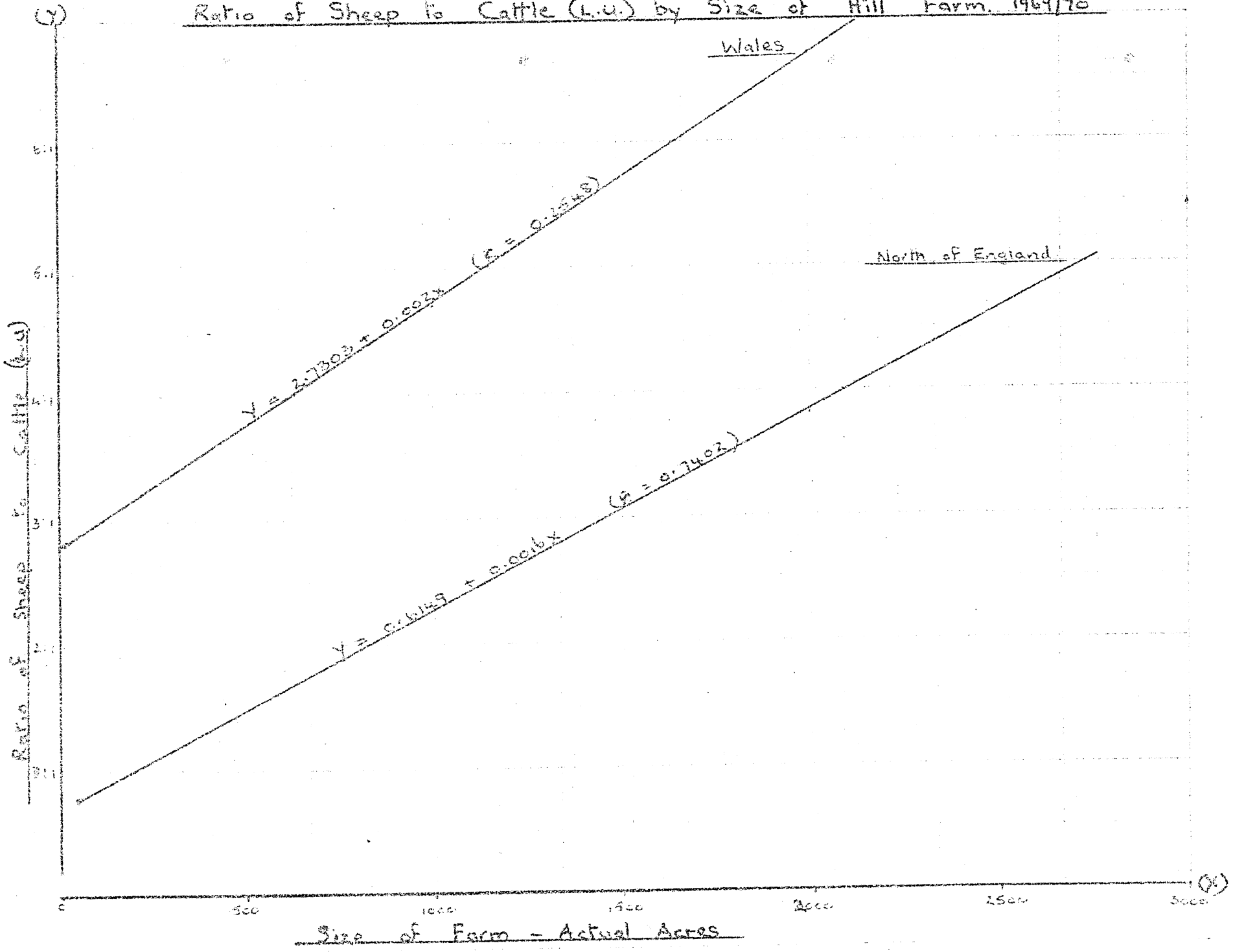
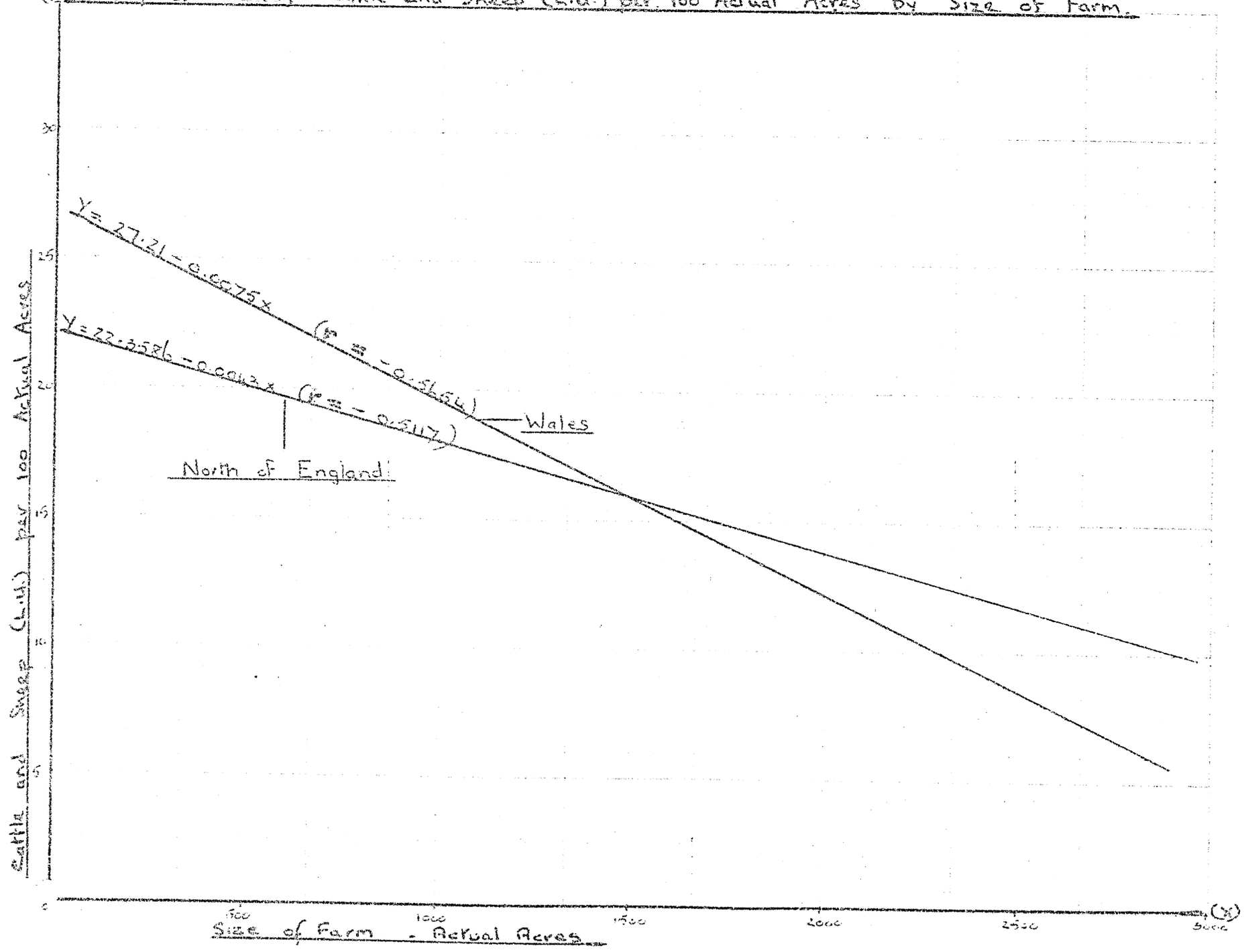


CHART XVII

(Y) Density of Stocking - Cattle and Sheep (L.U.) per 100 Actual Acres by Size of Farm.



to measure its effects satisfactorily since, as already suggested, it is a facor which is asociated with the size of farm, size of flock and, the quality of management, each of which can affect performance in different ways. However, an attempt was made to measure the degree of correlation between each, the lambing percentage, mortality, gross output, variable costs and gross margins per 100 breeding ewes on the one hand and density of stocking on the other.

The results obtained were contrary to expectations. Firstly the lambing rate, the gross output and gross margin per 100 breeding ewes were each significantly *positively* correlated with density of stocking with cattle and sheep measured in livestock units and also with sheep only. Secondly, a significant *negative* correlation emerged between mortality - in both ewes and lambs - and the density of stocking (see Charts XX and XXI).

Table XXX

Density of Stocking by Size of Farm 1969-70

	0-500	500-1000	1001-2000	2001 and over
		WALES		
No. of Farms	16	19	13	5
Average Size of Flock	357	607	921	1394
Per cent of Rough Grazing	65	82	88	97
Cattle & Sheep (L.U.) per 100 Actual Acres	26	18	17	10
Number of Breeding Ewes per 100 Actual Acres	97	78	73	52
		NORTH OF ENGLAND		
No. of Farms	18	13	13	5
Average Size of Flock	136	399	596	1389
Per cent Rough Grazing	77	81	90	95
Cattle & Sheep (L.U.) per 100 Actual Acres	20	19	13	10
Number of Breeding Ewes per 100 Actual Acres	49	52	42	41

Bearing in mind the relationships referred to in the first paragraph, it is not difficult to think of the reasons for these rather unexpected results. The better performance of ewes and lambs is achieved on smaller farms, where density of stocking is heaviest because of the higher standard of management or degree of individual attention which can be achieved with a smaller acreage and a smaller flock. It is suggested that the smaller flockmaster on the smaller hill farm can pay more attention to his flock than can the larger, on occasions such as lambing when a high

CHART XVII

(Y) Density of Stocking with Sheep in Relation to Size of Farm

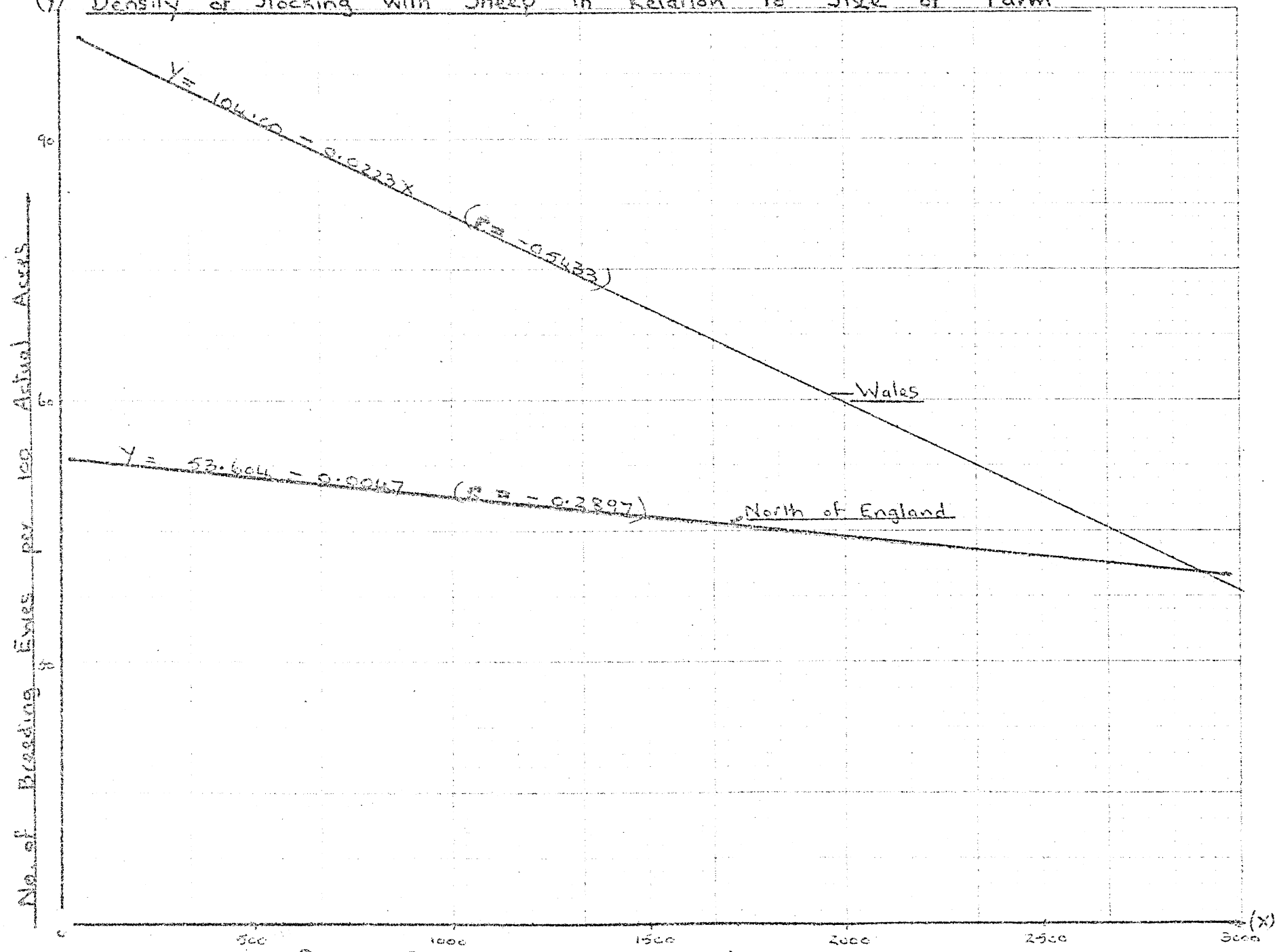


CHART XXIII

(Y) Density of Stocking - Cattle and Sheep (L.U.) per 100 Actual Acres in Relation to Size of Hill Flock

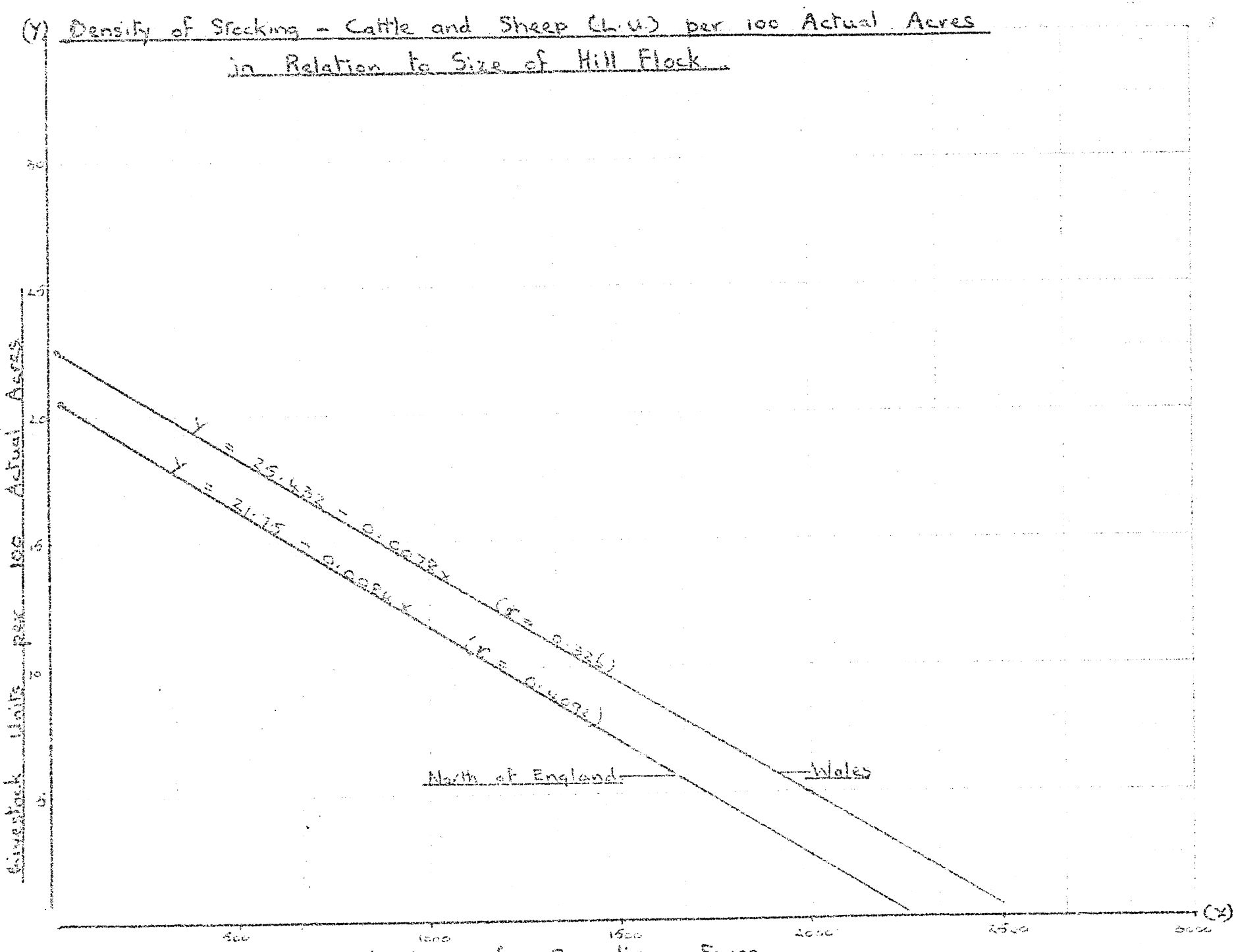
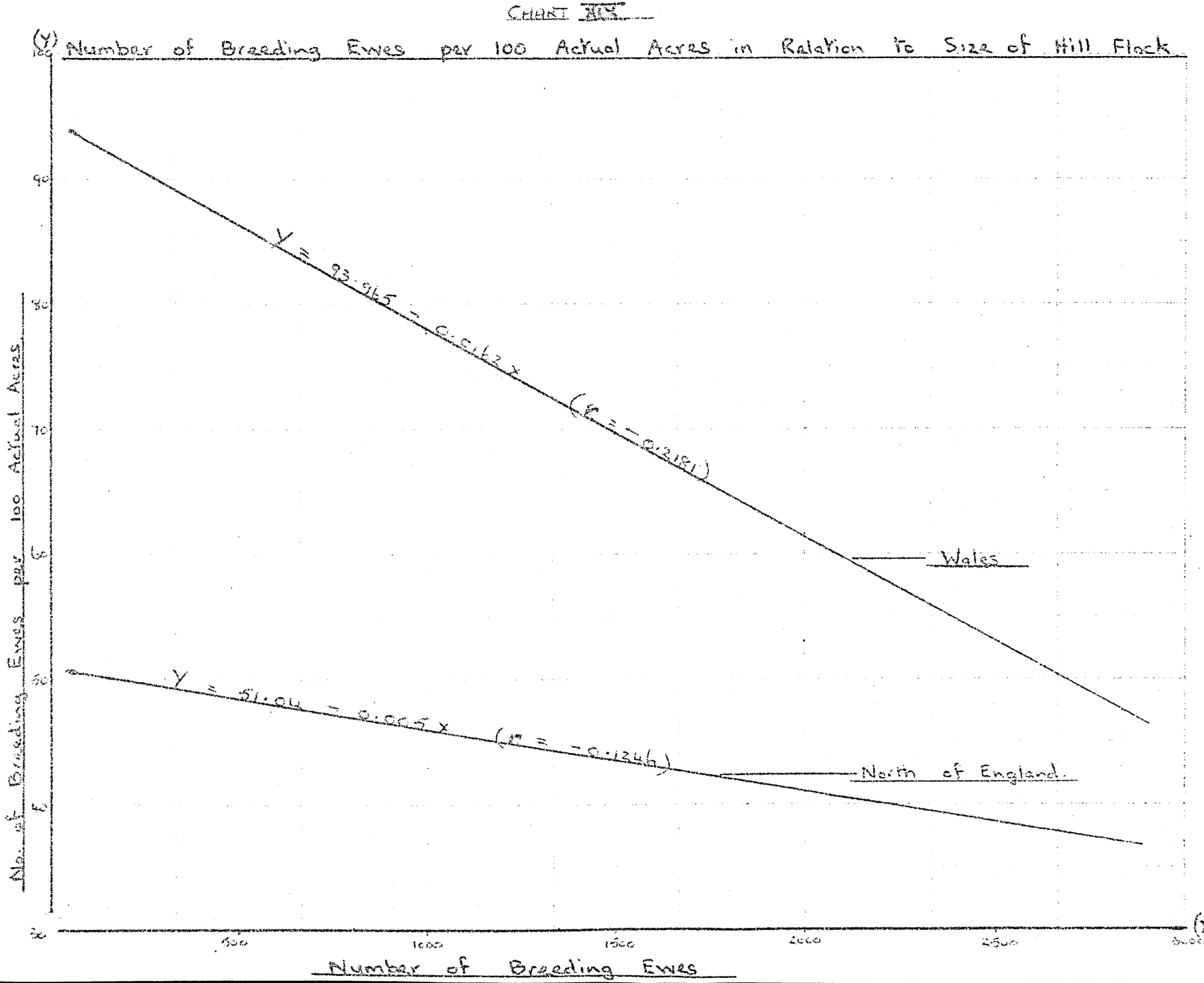


CHART [illegible]


(Y)
Number of Breeding Ewes per 100 Actual Acres in Relation to Size of Hill Flock
No. of Breeding Ewes per 100 Actual Acres
100
90
80
70
60
50
40
30
Y = 93.945 - 0.5142 X (r = -0.2181)
Wales
Y = 51.04 - 0.005 X (r = -0.1246)
North of England.
500
1000
1500
2000
2500
3000
(X)
Number of Breeding Ewes

degree of individual attention has highly significant economic consequences. The quality or degree of management seems to completely mask any adverse effects that high density of stocking has on the individual performance of ewes and lambs.

The suggestion that the quality of management or the degree of individual attention is the overriding influence on individual performance of ewes and lambs is substantially supported by the figures in Table XXXI. In this table each size group of Welsh flocks is further subdivided according yo density

Table XXXI

Lambing Percentage, Gross Output and Gross Margin per 100 Breeding Ewes According to Density of Stocking, Welsh Hill Flocks 1969-70

L.U. (Cattle & Sheep) per 100 Actual Acs.	Density of Stocking: No. of Farms	Average L.U. (Cattle & Sheep) per 100 Act. Acres	Average No. of Breeding ewes per 100 Act. Acres	Per 100 Breeding Ewes: Lambs Born	Gross Output	Gross Margin
	A. Flocks of up to 400 Breeding Ewes				£	£
Up to 20	5	15.8	63	94.6	564	455
21 - 30	6	23.0	86	94.6	523	423
31 and over	4	36.8	126	100.1	628	552
	B. Flocks of 401-800 Breeding Ewes					
Up to 15	5	11.8	55	96.2	500	391
16 - 20	10	17.0	71	92.8	500	387
21 and over	7	27.0	110	98.5	559	430
	C. Flocks of 801 Breeding Ewes and Over					
Up to 15	8	10.9	55	85.8	402	294
16 - 20	4	17.3	80	91.2	460	372
21 and over	4	25.9	99	88.6	511	392

of stocking; and these figures again indicate that farms with the highest density of stocking, whether measured in terms of cattle and sheep or of sheep only, are the ones showing the best individual performance. These relationships also suggest that the better managed flocks may also be carried on the better quality land. Although the figures in this table relate to Welsh hill flocks in 1969-70 only, similar trends were found for these flocks in 1968-69 and also for hill flocks in the North of England in both years.

CHART XXI

(1) Individual Performance by Density of Stocking (Cattle and Sheep.)

Welsh Hill Flocks 1969-70

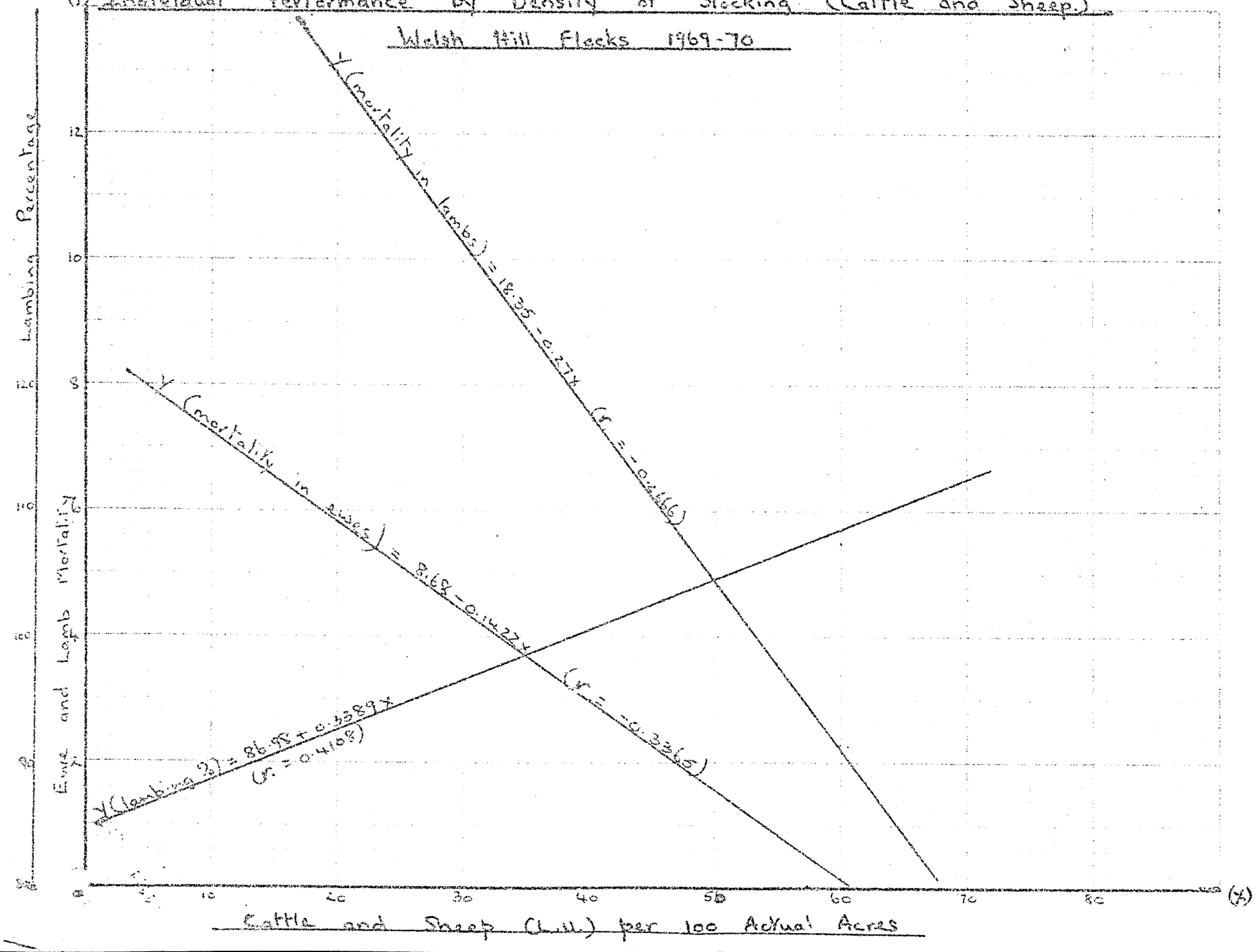
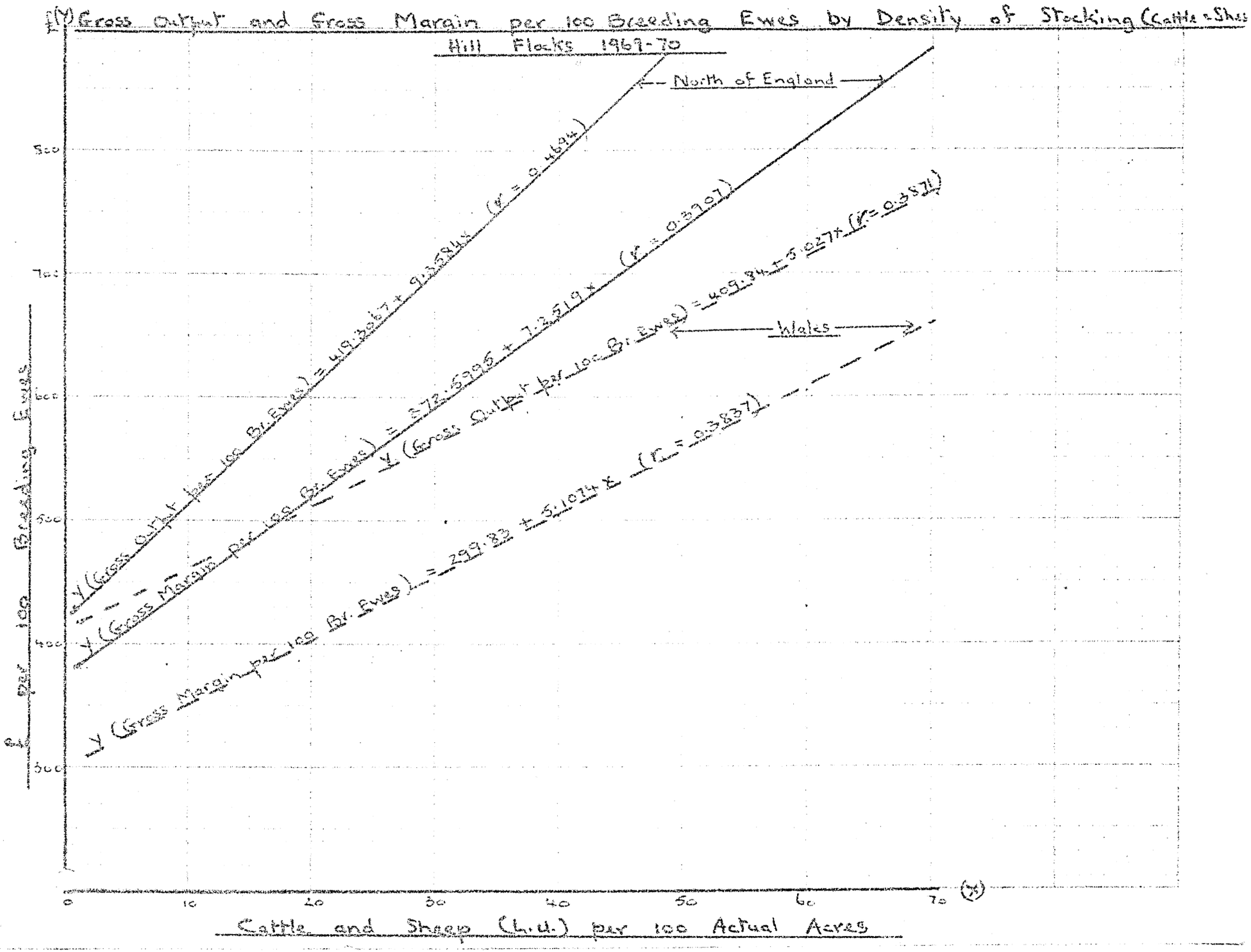


CHART XXXI

Gross output and Gross Margin per 100 Breeding Ewes by Density of Stocking (Cattle + Sheep) Hill Flocks 1969-70



Y (Gross output per 100 Br. Ewes) = 419.2067 + 9.2584x (r = 0.4694)

Y (Gross Margin per 100 Br. Ewes) = 372.5996 + 7.3519x (r = 0.3707)

Y (Gross Output per 100 Br. Ewes) = 409.84 + 5.0271x (r = 0.3871)

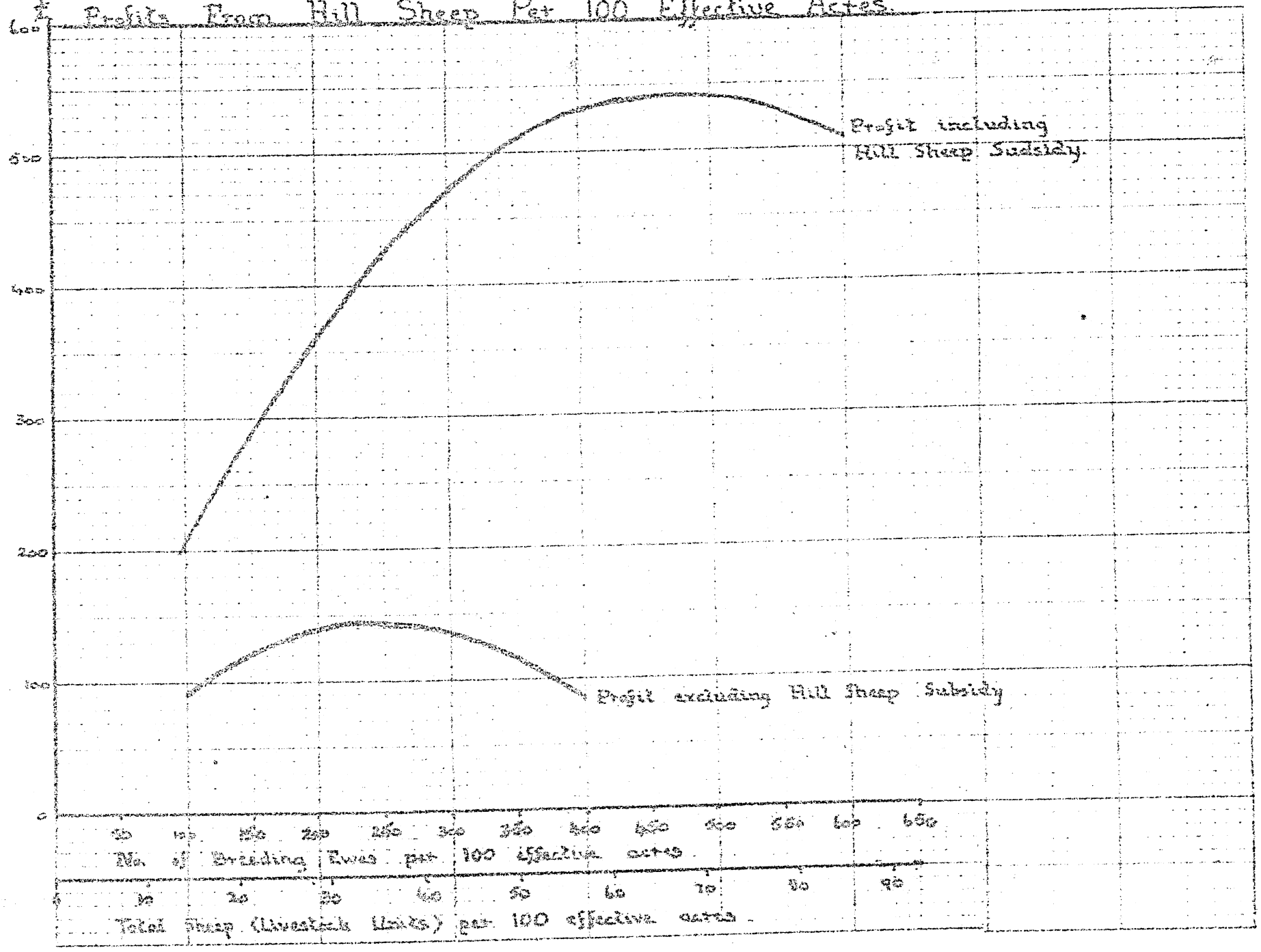
Y (Gross Margin per 100 Br. Ewes) = 299.82 + 5.1074x (r = 0.3837)

Given a certain standard of management, where the stocking rate is low increasing the number of sheep to some extent need not affect the individual performance of the ewes and lambs. However, sooner or later, a point must be reached on the density of stocking scale beyond which individual performance, as reflected in the lambing percentage, mortality in ewes and lambs, and in the gross margin and profit *per ewe*.must progressively deteriorate. Evenso, the effect of the additional number of ewes may more than compensate for this, and the total profit per flock and per 100 acres may well continue to increase albeit at a declining rate. However, sooner or later, the gross margin and profit per flock and per 100 acres simply must begin to deteriorate.

As already observed the results obtained from this particular survey, conducted in 1968-69 and 1969-70, whether the density of stocking was expressed per 100 actual acres or per 100 effective acres, did not indicate the expected trend in individual performance. However, the results for a comparable sample of farms in 1967-68, the rough grazings for which were converted into effective acres on a somewhat different basis than were those for the 1968-70 sample, did in fact suggest that both the lambing percentage and the profit per 100 effective acres increased with the density of stocking up to a certain point and then declined. Chart XXII,showing the profit per 100 effective acres, was prepared on the basis of this information. The rising section of the curves can be explained by (a) an improving performance of ewes and lambs coupled with the rising density of stocking with sheep, followed by (b) the rising density of stocking more than compensating for the declining individual performance. The declining sections of the curves result from the declining individual performance not being compensated for by the increasing stocking rate. It is not claimed that the curves are highly authentic and that they represent the actual situation on the majority of Welsh hill farms. However, they are of academic interest and they *illustrate* an important point, namely that it pays to increase the stocking rate only up to a certain point i.e. there is an *optimum stocking rate*, for hill sheep. The optimum stocking rate must obviously vary from farm to farm according to the quality of land and of management, factors which determine the level of nutrition and degree of attention afforded the ewe flock and growing lambs.

The highest profit, *including* hill sheep subsidy, per 100 effective acres, or the optimum stocking rate with sheep, seemed to be at about 4.5 Welsh ewes per effective acre, which is about one ewe per acre of hill land. It is noteworthy that, on the basis of profit, *excluding* the hill sheep subsidy, the optimum stocking rate with sheep was at a much lower level of only about 2.25 ewes per acre of hill land or about 1 ewe for every two acres. It is logical to think, therefore, that the payment of hill sheep subsidy at the current high rates and on a per ewe basis, *encourages* hill farmers to carry twice the

Chart XXII


£
Profits From Hill Sheep Per 100 Effective Acres.
600
500
400
300
200
100
0
Profit including Hill Sheep Subsidy.
Profit excluding Hill Sheep Subsidy
No. of Breeding Ewes per 100 effective acres.
Total Sheep (Livestock Units) per 100 effective acres.

number of sheep they would otherwise carry.

It is not possible to assess how many Welsh hill farmers are in fact overstocked with sheep. The 'estimated' optimum of 1 ewe per acre is an average based on a relatively small sample of hill farms, which included hill land of widely varying quality. Of the 53 identical hill sheep farms co-operating in the Hill Sheep Survey of 1968-69 and 1969-70, 23 and 26 per cent respectively carried more than one ewe to the acre of hill land, and about 12 per cent carried more than 1.25 to the acre. It is possible that these relatively heavily stocked farms had the better quality land capable of carrying this number of stock.

It is as well for hill farmers in general, and especially those who are very heavily stocked to bear in mind the adverse effects overstocking has on the size, performance, and quality of both ewes and lambs, and on their profits; the same or an even larger output and profit per unit of land may well be achieved from a lower stocking rate* and the receipt of less total subsidy. It is on stocked farms that the payment of hill sheep subsidy at high rates, rather than helping to maintain a reasonable level of output and standard of living, in the long run results in waste of resources. Furthermore, if payment of the subsidy on a per ewe basis encourages overstocking and, works against the long term interest of hill farmers, then why cannot the subsidy be paid on a per lamb basis ? One answer to this question is that hill farmers would suffer badly on those occasions when severe weather conditions result in low lambing rates.

Marginal increases in the output of hill sheep depend on individual performance as much as, if not more than, on the number of ewes carried. All the better if a higher output can be achieved from both a larger number of ewes and a better performance of ewes and lambs. However, on a large number of hill farms, these two factors are compatible only if substantial areas of their land are improved so as to permit the carrying of more as well as better quality stock. The payment of hill sheep subsidy on the basis of livestock performance, therefore, could well have the added advantage of encouraging more widespread hill land improvements, a practice which is in the long term interest of hill farmers.

Land Improvement

Even poor Molinia hill pastures can be improved substantially simply by relatively inexpensive surface treatment, involving some discing, seeding and fertilising. The deeper, better quality, hill soils can be improved either by surface treatment, or by more drastic treatment including ploughing,

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* *An experiment at Pwllpeiran, the ADAS Experimental Hill Farm in Wales (Farm Guide and Report 1968), showed that the overall profit from sheep in fact increased by reducing the number of ewes from 2,000 to 1,900. The resulting improvements in lambing percentage, weight of lambs, weight of fleece etc. were substantial.*

discing, fertilizing and reseeding. Whilst the surface treatment costs from about £22 per acre gross (but only £10 - £12 net to the farmer), the latter costs about £35 to £50 gross (about £18 - £35 net).

Obviously, the worthwhileness of such improvement schemes depends upon the additional net income generated by the extra stock carried and the better performance of the ewes and lambs, and also upon the 'life' of the improvement.

Estimates were made by the author of the net cost of surface treating 30 acres of hill land, of ploughing and reseeding 15 acres of "ffridd", together with the cost of fencing and of maintaining both areas.* The total cost came to £1,260 or assuming a 10 year life for the improvement, £126 per annum. It was assumed that, apart from an increase in stocking rate, the improved pasture resulted in certain improvements in the individual performance of both ewes and lambs. Thus it was assumed that the percentage of lambs weaned increased from 75 to 90; that the lambs put on weight faster and were sold sooner, but at heavier weights, thereby securing a better price per lb . On Welsh hill farms in general, about 60 per cent of the lambs weaned are sold off the farm, about half of which are fat and half in store condition. It was also assumed that the draft ewes fetched price and that heavier fleeces were produced.

Assuming that the gross margin is (for Welsh hill ewes in 1970) £3.50 per ewe, the increases in gross margin per ewe are roughly as follows -

		£
(a)	heavier lambs sold at a better price per lb	
	30 lb lambs x £0.175 x 0.90 x 0.6 =	2.835
	26 " " x £0.165 x 0.75 x 0.6 =	1.901
(b)	additional price for draft ewes	
	£0.75 x 0.25 (25% ewes sold)	0.188
(c)	a heavier fleece, 1 lb.	0.200
	Total additional gross margin per ewe	1.322

Taking into account the additional draft ewes or lambs sold as a result of the higher lambing percentage, this additional gross margin can well be increased to £1.35 per ewe, representing an overall increase in gross margin of 28 per cent. Therefore, the gross margin per ewe after improvement is £3.5 + £1.35 = £4.85.

This is an hypothetical case. Assumed that the initial stocking rate was, hill land - one ewe per acre; ffridd - 2 ewes plus ¼ cow per acre.

With the additional gross margin from the existing 30 ewes at £1.35 x 30 = £40.5, the additional number of ewes required to cover the net annual cost of improvement of £126 - £40.5 = £85.5 is $\frac{£85.5}{4.85}$ = 17 or 18 ewes. This is an increase in stocking rate *on the improved land* of 58 per cent*, assuming that the initial stocking rate was 1 ewe per acre. This is the situation, assuming that only the number of sheep are increased. It is very likely that one or two breeding cows, each providing an additional gross margin of at least £50**, could be carried on the improved ffridd.

The important question is, what additional total gross margin is required to provide an adequate return on the cost of land improvement, assuming that the additional gross margin is achieved partly by better individual ewe and lamb performance and partly by an increased stocking rate. These two factors are related, positively in the initial stages of increased stocking, but inversely after a certain stocking rate has been reached. To measure the relationship between stocking density and individual performance calls for a detailed study of flocks on lands of varying quality. It is because of the lack of such information that in making the previous estimates*** of gross margins certain levels of improvement in individual performance were assumed.

A problem facing many hill farmers contemplating land improvement is that of making their hills accessible to heavy vehicles carrying supplies of fertilizer, fencing material etc. The construction of a road capable of carrying heavy loads costs about £4,000 per mile gross or £2,000 net of subsidy. When considering the worthwhileness of road construction the significant figures are the length of road, the area of land to be improved, the improvement in individual performance of ewes and lambs, and in the stocking rate resulting from the improvement. The larger the area of improvable hill land in relation to the length of road the less the cost of road construction per acre, and the less the additional gross margin per acre required to cover this cost. A road costing a total of £1,000 (net) costs only £5 per acre if 200 acres are improved, but £20 if only 50 acres are treated. Such a large item, in addition to the cost of the improvement to land, places a severe limitation on the prospects from land improvement on many hill farms.

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* *Allowing a small charge for additional (casual) labour hardly affects this figure.*

** *The figure is now much higher than this.*

*** *Based largely on the experience of a hill farm adviser in ADAS and some information obtained from trials carried out at Pwllpeiran.*

What level of return on capital will satisfy individual hill farmers ? Certainly if they borrow the capital it will be something well above the interest rate of about 10 per cent which they have to pay. If they use their own capital, then the return should be at least as much as they can earn by investing for instance, in equities, which would be about 9 or 10 per cent compound interest. Chart XXIII shows the increase in the number of hill ewes required to provide returns, before tax, of 10 and 15 per cent on marginal capital (invested in hill land improvement and additional livestock) at varying capital costs per acre assuming an initial stocking rate (before improvement) of one ewe per acre. These figures were arrived at using the Discounted Yield Method for assessing the additional gross margin necessary to cover the initial investment and to provide the 'necessary' returns of 10 and 15 per cent on capital*.

The net capital cost of improvement on any farm should include the cost of the additional ewes and that of road construction, if any. With a net capital cost of as little as £20 per acre the *improved* land must carry an *additional* 0.7 ewes per acre to yield a return on capital of from 10 to 15 per cent. On the other hand if the net capital cost amounts to £70 per acre, which might well include the cost of constructing a road, then the ewe population on the improved land must be *increased* by 2.25 ewes per acre to yield a 10 per cent return and by 2.5 ewes per acre to provide a return of 15 per cent on all the additional capital.

There are large tracts of hill land with thin soil which lend themselves only to surface treatment at relatively low cost; there are also large areas with deeper better quality soil- which can be ploughed and reseeded at about double or treble the cost of surface treatment. However it is the better performance of and/or the additional stock that the improved land will carry in relation to the cost of improvement that determines the worthwhileness of the investment. In this respect, assuming a substantial improvement in individual performance, an increase in stocking of from 2 to 2.5 ewes per acre on the better land will probably be more often achieved than an increase of from 0.5 to 1 ewe per acre on the poorer land.

The cost of the improvement, the response in terms of better livestock performance and a higher stocking rate and hence the worthwhileness of any scheme for land improvement obviously varies from farm to farm. The response can only be guaged on the basis of the operator's past experience or by experts in this particular field. If the improvement can be carried out without

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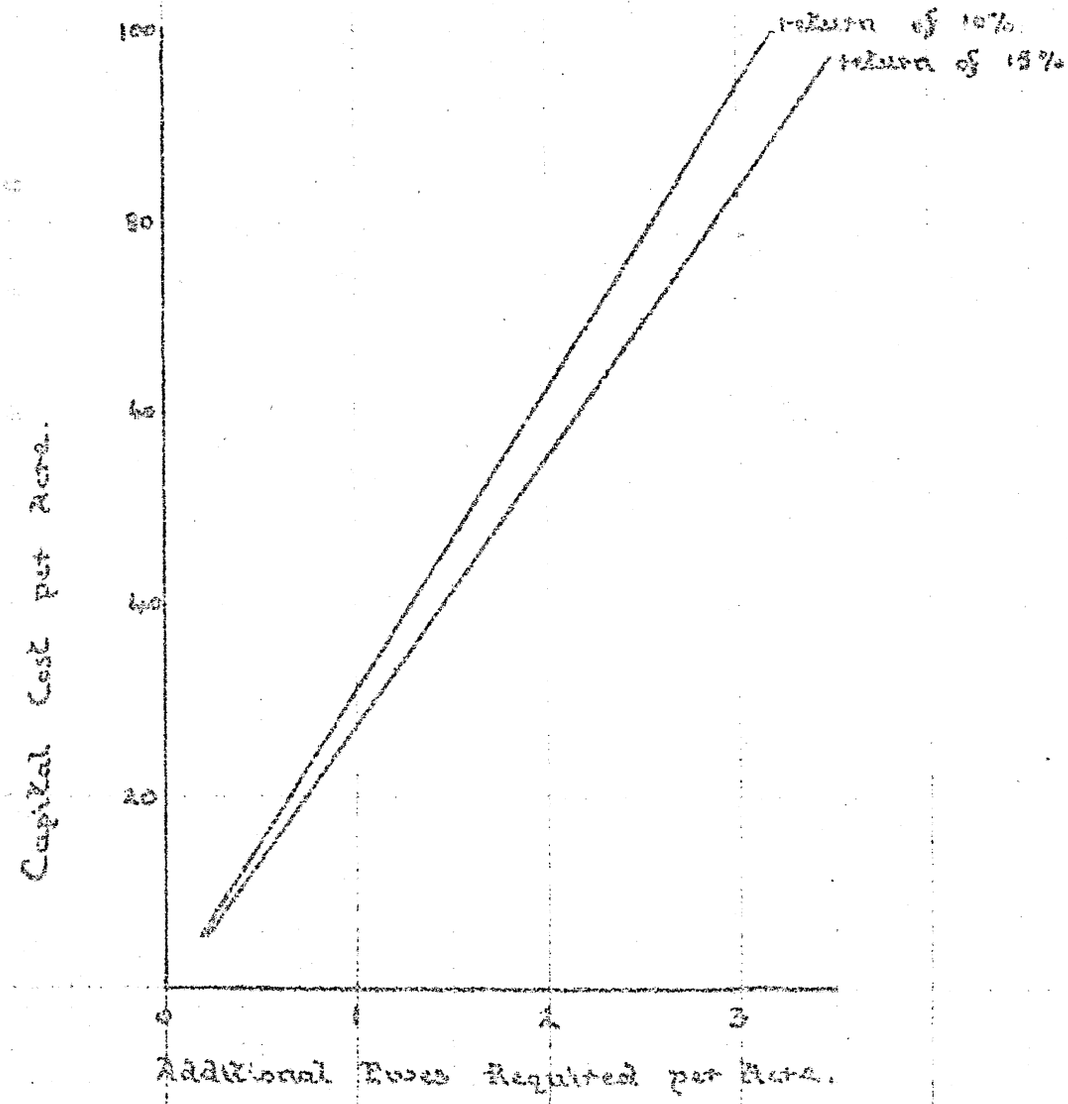
* *Allowance being made for the additional gross margin for the initial number of ewes carried.*

Chart XXIII

Number of Additional Hill Ewes Required to Provide Returns of 10% and 15% on Capital in Land Improvement.



the need for road construction, then there can be no doubt that there are still large tracts of our hill land which can justify the cost of improvement. On the other hand, if it necessitates road construction, the heavy capital expenditure may well be beyond the means of many farmers and possibly cannot be justified by the expected response. These farmers should consider the possibility of joint schemes of road construction in association with neighbouring hill farmers and/or the Forestry Commission. The latter may well be prepared to share the cost of construction and the use of a road passing through or to improvable land, but leading to another area suitable for tree planting. On the larger farms, selling an area of hill land to the Commission would help to reduce the over-all cost of improvement.

In the assessments made above, the response to hill land improvement has, for convenience, been measured in terms both of better livestock performance and of higher stocking rates. However, the farmer may well prefer to cash in on the improvement not only by increasing the stocking to some extent but in other ways as well; for instance, some or all ewes may be kept on the hills for longer periods, thereby permitting heavier stocking of the lower land with cattle; or some or all the ewe lambs may be wintered at home rather than away; or more winter fodder can be produced on the farm. The use made of the improved land will obviously depend on the circumstances of the individual farms.

VI SUMMARY AND CONCLUSIONS

Average net farm incomes on hill farms generally, although they fluctuated considerably, showed a general increase in the sixties. However, this general increase was not sufficient to keep pace with the rising cost of living, especially on the smaller farms and on the larger ones with a very high proportion of rough grazings, both of which, in real terms, were worse off at the end of the decade than at the beginning. The small ones, on average, appeared to be earning much less than was necessary to provide even a satisfactory living, despite increasing government assistance since the middle sixties. During the period 1967-70, government grants and subsidies amounted to one and three quarter times the net farm income on the small farms, and accounted for very nearly all the average net farm income for all hill farms in our Farm Management Survey. Although in the first two years of the seventies, net incomes on this type of farm in general at least doubled, the situation on the smaller ones is still not satisfactory.

The sixties was a period when the total sheep population of the United Kingdom declined. The situation in Wales was different in this respect; it was the only country in the United Kingdom to show an increase. In both England and Wales the number of hill and upland ewes increased whilst the lowland ewes dropped appreciably in number.

This report presents an analysis of the financial results and efficiency factors un hill sheep farming and is based on samples of hill sheep flocks in both the North of England and Wales. The larger proportion, almost 80 per cent, of the North of England flocks were in the smaller size groups, with under 600 ewes, whilst the sample for Wales was more evenly distributed between the different size groups.

The average gross margin per ewe was generally higher for the North of England than for Wales (about £4.4 per ewe compared with about £3.65) - due largely to the higher gross output from the larger North of England ewe and the much higher cost of agistment in Wales. On the other hand fixed costs (labour, grazing and forage in particular) per ewe were much higher for the North of England flocks.

The most important factors affecting efficiency in hill sheep production are these -

(1) The lambing percentage and per cent lambs weaned. The higher are these the more lambs for sale and the higher the gross output. Every 5 per cent rise in lambing percentage resulted in an additional 35 pence and well over 50 pence gross output per ewe for the North of England and for the Welsh flocks respectively.

(2) Mortality in ewes and lambs obviously affects the lambing percentage, the number of lambs weaned, and hence the gross output per breeding ewe. It also affects both variable costs, especially the cost of flock replacement, and fixed costs per breeding ewe.

(3) The culling and replacement policy, together with the rate of mortality in ewes, and the relative prices of in-going and out-going ewes, affect the cost of flock replacement. Due largely to a higher mortality rate in ewes, and a much greater difference in price of in-going and out-going ewes, but despite a longer flock life, the average cost of flock replacement was much higher for North of England than for Welsh flocks. Estimates of costs of replacement, assuming varying lengths of flock life and mortality rates in ewes, indicate that, because of a smaller difference between prices of in-going and out-going ewes and a generally lower flock mortality rate, a shorter flock life is more economical than a longer one in this respect.

(4) Proportion of lambs sold fat Although it was not possible to assess the effect of the relative proportions of lambs sold in fat as opposed to store condition on the gross margins and profits, it is nevertheless evident that the higher the proportion sold fat the higher the gross margin per 100 breeding ewes and, if they are fattened off grass alone or rape, the higher the gross margin. The only doubt as to the profitability of fat lambs is when they are fed rather heavily on concentrates. There is no single answer to the question whether selling fat lambs early in July and August is more or less profitable than selling them later . On hill farms, Welsh ones in particular, it is commonly the case that the production of heavier fat lambs off rape (as opposed to lighter fat or store lambs earlier in the season) is a useful by-product of a system of improving hill pastures in order to maintain or increase the level of stocking.

The cost of agistment is a very heavy item in Welsh hill flocks , accounting for well over half the variable costs. It was a much smaller item in the North of England flocks, but they were fed rather more concentrates. Obviously the wintering of sheep is still a serious problem on hill farms, Welsh ones in particular. There is little evidence as yet to show that in-wintering of ewes and ewe lambs is a satisfactory answer on purely economic grounds.

Considerable economy in labour usage is exhibited by increasing *size of flock*. This was more evident for the North of England than for Wales, because of the heavier usage of labour on small flocks in the former region. There was also a reduction in the grazing and forage costs per 100 breeding ewes, due no doubt to the larger flocks being situated on larger farms, which apply less fertilizer per acre than do the smaller.

Gross output per 100 breeding ewes declines with flock size, moreso for the Welsh farms because of the declining individual performance of the ewes and lambs incumbent on the declining quality of the grazings and the lesser individual attention paid to them. In general the smaller flocks showed the larger gross margins per 100 acres.

The larger flocks are carried on the larger farms, which are less densely stocked with both cattle and sheep than are the smaller ones. The individual performance of the ewes and lambs was the more favourable for the smaller than larger flocks, despite the fact that the former were carried on the more densely stocked smaller farms.

It was apparent almost throughout the analysis that the *quality of management*, a term which covers both technical proficiency and degree of individual attention, plays a

dominant role in determining the standard of performance and economic efficiency of the flocks. Unfortunately it is a factor which is largely immeasurable, apart possibly from the time element reflecting the degree of attention afforded to the flocks.

For a certain standard of management, land quality, and type of ewe, there is an optimum stocking rate at which the profit per flock and per unit of land is at a maximum. However, because of the variation in these factors it is difficult to assess even the average optimum stocking rate for a sample of farms. What information is available, suggests that for a sample of Welsh hill flocks, the *average* optimum stocking rate is in the region of 1 ewe per acre of hill land. Naturally it varies widely from farm to farm according to the quality of land and of management. Thus those farms in the sample which, according to this standard, were above average, may be ones possessing relativel high quality rough grazings and /or management. Overstocking is a factor which hill farmers must avoid because it is against both their short and long term interests.

Because of the increasing economic pressures of the sixties a large number of hill farmers have attempted to increase their stocking capacity by improving some of their rough grazings. The cost varies appreciably according to the method of improvement used. The response too varies according to the method employed and the quality of the soil. Judging from assessments of increases in stocking required to provide an adequate return on the capital cost of improvement, it would seem that hill land improvement schemes, judiciously planned, are likely to be paying propositions on many farms. With the improvement which has recently occurred in the economic climate for hill farms, hill farmers may be tempted to extend the practice of hill land improvement,with long term benefits to themselves.

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