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VARIATIONS IN THE NUMBERS OF LIVE STOCK AND IN THE
PRODUCTION OF MEAT IN THE UNITED KINGDOM DURING
THE WAR.

By J. B. GUILD, M.B.E., M.A.

[Read before the Royal Statistical Society, May 18, 1920.

Mr. A. W. WATERLOW KING, Vice-President, in the Chair.]

I.—INTRODUCTION.

DURING the five agricultural years immediately preceding the outbreak of the war, the consumption requirements of the United Kingdom represented about 2,640,000 tons of meat and meat products (including bacon and lard), that is, 131 lb. per head per annum, or $2\frac{1}{2}$ lb. per head per week. As a meat-eating country the United Kingdom thus stood half-way between such countries as Australia or New Zealand with a rate of 4 to 5 lb. per head on the one hand, and on the other hand the greater part of Southern Europe with a rate of about 1 lb. per week. In spite of the downward tendency in the United States, the rate in that country was still nearly a pound per week higher than here; but of Continental countries, that with the highest rate, viz., Germany, showed a rate about a third of a pound per week below the level of consumption in this country. Of the annual total for the United Kingdom, home supplies provided 1,520,000 tons, or under 58 per cent.

On June 4, 1914, the returns collected by the Boards of Agriculture for the different parts of the United Kingdom showed that the number of cattle in the country was the highest on record, and that of pigs was over the average of the preceding ten years. As regards the number of sheep, we were just at the turning point

after one of those depressions which had appeared in earlier years, and seem to be connected with the position of sheep rearing in this country as a secondary or subsidiary industry to that of cattle rearing. For about three years after the outbreak of war the livestock position remained comparatively normal, and home supplies continued to provide an average of little less than $1\frac{1}{2}$ lb. per head per week. In the meantime the growing demands of the Allied Armies on the Continent absorbed more and more of the total supplies of refrigerated meat, which were also beginning to suffer from the stringency in the shipping position. In 1917 the amount available for consumption by the civilian population and troops stationed in the United Kingdom was only 375,000 tons, or half the pre-war supplies of such meat. This was bound to put a strain upon our livestock resources, while at the same time the scarcity of feeding stuffs suitable for fattening livestock began seriously to affect the carcase yield of the animals slaughtered, so that the maintenance of an equal supply of meat involved a heavier drain on our herds and flocks. For these and other reasons discussed later, the position subsequent to the middle of 1917 at times gave rise to a certain amount of anxiety. The chief losses, both in numbers of livestock and in yield of meat, occurred in the case of pigs, and in a less degree in sheep, while the numbers of cattle in 1919 actually showed an increase since 1914, though for the present their meat-producing capacity was reduced. On the whole, as Sir Henry Rew has said in his recent book on "Food Supplies in Peace and War," "The steadfastness with which the herds and flocks were maintained throughout all the vicissitudes and difficulties of the war period is a record upon which British stock-owners may fairly be congratulated."

II.—VARIATIONS IN THE NUMBERS OF LIVESTOCK.

(A) *Cattle.*

TABLE I.—*Number of cattle on June 4 of each year.*

(The numbers are given in thousands, i.e., 000's omitted.)

Year.	Great Britain.			Ireland.			United Kingdom.		
	Dairy herd.	Other cattle.	Total.	Dairy herd.	Other cattle.	Total.	Dairy herd.	Other cattle.	Total.
1914	2,938	4,155	7,093	1,639	3,413	5,052	4,595	7,590	12,185
1915	2,884	4,404	7,288	1,593	3,251	4,844	4,495	7,676	12,171
1916	2,870	4,572	7,442	1,612	3,358	4,970	4,500	7,952	12,452
1917	2,907	4,530	7,437	1,592	3,317	4,909	4,515	7,867	12,382
1918	3,030	4,380	7,410	1,557	3,306	4,863	4,604	7,707	12,311
1919	3,009	4,415	7,424	1,562	3,467	5,029	4,588	7,903	12,491

An examination of the results of the annual returns of livestock made at the beginning of June (Table I) shows throughout the war very little movement in the total number of cattle in the country, and further, if these totals are analysed into the age groups shown in the returns, the composition of these totals shows little variation beyond what is to be expected from differences of the season in successive years. The only movement in the total is a slight upward movement up to 1916, followed by a still slighter check in 1917 and 1918, and a recovery in 1919, leaving the total in the last year about $2\frac{1}{2}$ per cent. above that of 1914. But these records, applying to one fixed date in each year, really conceal movements at other seasons, which at the time threatened to produce much less favourable results. In the report of the Departmental Committee on Livestock and Meat Production, appointed by the President of the Board of Agriculture, there are given monthly estimates of the numbers of livestock in Great Britain over the latter part of the war, and corresponding figures at two-monthly intervals for Ireland. These estimates were based upon returns of livestock from sample areas distributed all over the country, revised by the Committee in the light of other information available as to the rate of slaughter and movements of cattle between different parts of the country. The comparison of the estimate for June 4, made before the Census results were available, with these results shows that while the Committee went somewhat astray in grouping the animals, tending, for example, to over-estimate calves at the expense of the older age groups, its estimates of the total were very accurate, and suggest that the figures for the intervening months may be taken as a reasonably safe guide to the actual seasonal variations in the total number of cattle. To bring out these variations more clearly, I have expressed the monthly figures for each year as a percentage of the actual numbers returned on the census on June 4 at the beginning of each agricultural year. (Tables IIa and IIb.)

This is, I think, the first time we have had such data for ascertaining seasonal variations in the number of cattle, and so we have no standard ready-made whereby to appreciate the significance of the figures for the two years 1917-18 and 1918-19; with the exception of the estimate for December, 1916, for Great Britain, all the estimates apply to a period when the seasonal distribution of slaughter, if not the annual total slaughter, had already become abnormal. I have tried indirectly to provide such a standard of normal seasonal variation for the United Kingdom as a whole. First, from data as to slaughter and exports, I have inserted estimates for Ireland in those months for which no returns are available,

TABLE IIa.—*Indices illustrating seasonal variations of the number of cattle in Great Britain.*

Date.	Dairy herd.			Beef cattle.		
	1916-17.	1917-18.	1918-19.	1916-17.	1917-18.	1918-19.
June 4 (Census)	100	100	100	100	100	100
July 4	—	*100	100·5	—	*98·0	100·1
August 4	—	*99·2	101·2	—	*93·7	99·1
September 4	—	*99·6	102·3	—	*87·8	97·2
October 4	—	*99·3	103·0	—	*83·4	95·7
November 4	—	†100·3	103·0	—	†82·6	92·8
December 4....	108	103·2	103·6	87·3	80·8	89·4
January 4	—	103·2	104·0	—	79·1	87·7
February 4	—	103·9	103·6	—	80·0	88·7
March 4	—	103·2	103·3	—	80·8	89·0
April 4	—	102·9	102·6	—	85·5	91·2
May 4	—	102·5	101·0	—	88·9	95·4
June 4 (estimate)	—	102·5	100·7	—	94·3	99·6
June 4 (Census)	101·3	104·2	99·3	99·7	96·1	104·2

Date.	Calves.			Total.		
	1916-17.	1917-18.	1918-19.	1916-17.	1917-18.	1918-19.
June 4 (Census)	100	100	100	100	100	100
July 4	—	*105	103·5	—	*100·1	101·0
August 4	—	*107·5	104	—	*98·6	101·0
September 4	—	*107	104·5	—	*96·2	100·8
October 4	—	*107·5	104·5	—	*94·4	100·5
November 4	—	†107	104·5	—	†94·3	99·3
December 4....	100·5	102·5	102·5	98·1	94·1	98·0
January 4	—	99·5	101·5	—	92·8	97·2
February 4	—	98	100	—	93·0	97·2
March 4	—	99·5	100	—	93·5	97·2
April 4	—	102·5	101	—	95·9	97·8
May 4	—	104·5	101	—	97·5	98·8
June 4 (estimate)	—	106·5	99·5	—	100·0	100·0
June 4 (Census)	97·9	98·0	94·7	99·9	99·6	100·2

* Estimate for England and Wales only, prepared by the Board of Agriculture for England and Wales.

† Estimate for Great Britain prepared by the Boards of Agriculture for England and Wales and for Scotland, but not revised by the Committee.

and have then combined the estimates for Great Britain and Ireland so as to give a measure of the actual seasonal variation in the United Kingdom for the two years. From estimates of slaughter extending over a considerable number of years, we can tell pretty well what a normal slaughter in any year would be on a given herd, and further, by an examination of returns of stock at markets, public slaughter-

TABLE IIb.—*Indices illustrating seasonal variations of the number of cattle in Ireland.*

Date.	Dairy herd.		Beef cattle.		Calves.		Total.	
	1917-18.	1918-19.	1917-18.	1918-19.	1917-18.	1918-19.	1917-18.	1918-19.
June 1 (Census)	100	100	100	100	100	100	100	100
August 1	—	100	—	96	—	105	—	99·5
October 1	—	99	—	91	—	106	—	97·0
December 1	—	99	—	87	—	107	—	95·7
February 1	100	101	86	83	89	109	91·2	95·0
April 1	99	100	96	94	96	106	96·8	98·9
June 1 (estimate)....	97	—	103	—	96	—	99·2	—
June 1 (Census)	97·8	100·3	102·8	103·3	94·2	107·9	99·1	103·4

house returns, and supplies of home beef at the chief wholesale markets, I have prepared an index of the normal seasonal distribution of this slaughter. We are now in a position to make allowance for abnormal movements in monthly slaughtering, and so arrive at a measure of the normal seasonal variation of the herds. This assumes that the rates of births and deaths in these two years were the same as in earlier years, and there is nothing to suggest that this was not substantially true. The principal figures are given in Table III.

TABLE III.—*Normal seasonal variation in the number of cattle in the United Kingdom.*

Month.	Estimated actual slaughter of cattle and calves in United Kingdom. (Number in 000's.)		Estimated normal slaughter of cattle and calves in United Kingdom. (Number in 000's.)		Estimated actual variation in number of livestock at the beginning of the month. (Index.)		Estimated normal variation in number of livestock at the beginning of the month. (Index.)	
	1917-18.	1918-19.	1917-18.	1918-19.	1917-18.	1918-19.	1917-18.	1918-19.
June	263	157	233	233	100	100	100	100
July	280	184	223	223	99·4	100·5	99·6	100
August	319	211	242	242	97·6	100·4	98·3	99·6
September	335	266	276	277	95·4	99·9	96·7	98·9
October	385	307	314	313	93·8	99·2	95·5	98·1
November	367	294	316	316	93·6	98·2	95·9	97·2
December	316	260	289	289	93·4	97·2	96·0	96·0
January	249	259	303	303	92·1	96·4	95·0	95·0
February	251	285	295	294	92·3	96·4	94·7	94·7
March	296	349	356	356	93·0	96·5	95·0	94·8
April	279	344	344	345	96·2	98·3	97·8	96·6
May	208	319	299	299	97·6	99·3	98·6	97·8
June	—	—	—	—	99·4	101·5	100	100

Of course, had our data been complete and accurate, the normal seasonal variation should have been the same for the two years. As a matter of fact the data as to numbers of livestock, up to and including November, 1917, are extremely scanty, but after that month it will be observed that the two index numbers closely agree. I think, then, we may take the index number based on 1918-19 as giving a fair measure of normal seasonal variations. It will be seen that the heavy slaughter in the autumn of 1917 gave rise to a depletion of the herds, which stood at about 2 per cent. by the beginning of August, and reached nearly $4\frac{1}{2}$ per cent. by the beginning of October. The shortage of the supplies of home-killed beef which appeared to the public with somewhat startling suddenness in the third week of December, 1917, will readily be recalled, and it was followed by the institution of control at the end of that month. By the beginning of March the depletion had fallen to less than 2 per cent., and at the June census it appeared as a reduction of only one-half per cent. on the herds of a year before. Throughout the year 1918-19, on the other hand, the actual numbers of the herd remained consistently above the normal level. The increasing scale of prices fixed by the Ministry of Food tended to check any rush of slaughter at the end of the grass season, and supplies throughout were limited by the scarcity of feeding stuffs and the powers of the officers of the Ministry to reject immature beasts. The seasonal surplus of livestock rose steadily till it reached $1\frac{3}{4}$ per cent. in the second and third months of 1919, and it left at the end of the agricultural year an addition of $1\frac{1}{2}$ per cent. to our herds.

By the courtesy of the Ministry of Agriculture, I have been enabled to use further material collected by the Departmental Committee on Livestock and Meat Production which illustrates the seasonal movement of livestock as between different parts of England and Wales. The figures for cattle of all kinds show roughly a slight swing as between the eastern root-growing areas in winter and the western grass areas in summer. When the totals are analysed, it is found that the distribution of the dairy herd and of the younger groups remains fairly constant, and that the movement in the total is practically entirely due to changes in the distribution of beef cattle two years old and over. For the present purpose, I have arranged the divisions employed by the Ministry of Agriculture in presenting their local statistics into four large groups as follows :—

(1) The East, North-East and South-East Divisions, covering Yorkshire (East Riding), Lincoln, Norfolk, Cambridge, Isle of Ely, Huntingdon, Bedford, Suffolk, Essex, Hertford, Middlesex, London, Berkshire, Surrey, Kent, Sussex, Hampshire, and the Isle of Wight.

(2) The East Midland, West Midland, and South-West Divisions, covering Nottingham, Leicester, Rutland, Northampton, Soke of Peterborough, Buckingham, Oxford, Warwick, Worcester, Salop, Gloucester, Hereford, Monmouth, Wiltshire, Somerset, Dorset, Devon and Cornwall.

(3) The North and North-West Divisions, covering Northumberland, Durham, Cumberland, Westmorland, Yorkshire (North and West Ridings), Lancashire, Cheshire, Derby, and Stafford.

(4) North Wales and South Wales Divisions.

The distribution of the total number of beef cattle two years old and over in England and Wales as between these four groups of counties at different seasons of the year is shown in Table IV. From this it is seen that the first group, covering a large eastern area, which at the June census accounts for only 22 to 23 per cent. of the total of this class, accounts for anything up to 32 per cent. of the total in the first two months of the year when we become dependent on stall-fed supplies. The second group of Midland and Western counties, on the other hand, where 42 per cent. of these beef cattle are found at the June census, accounts for a much smaller percentage in the winter months, though probably the distribution during the winter of 1917-18 was somewhat abnormal. The proportion found in the third and fourth groups, *i.e.* the Northern and the Welsh counties, remains much steadier throughout the year, with a tendency, if any, to lose during the winter months to the gain of the eastern root-feeding areas.

TABLE IV.—*Seasonal distribution of beef cattle (2 years old and over) in England and Wales.*

Date.	Group 1.		Group 2.	
	1917-18.	1918-19.	1917-18.	1918-19.
	Per cent.	Per cent.	Per cent.	Per cent.
June 4 (census)	22·2	23·1	42·4	43·7
July 4	21·6	22·3	42·3	44·1
August 4	22·1	22·8	42·0	44·3
September 4	22·7	22·7	42·4	44·4
October 4	24·6	25·2	41·0	43·0
November 4	28·2	27·2	39·7	41·9
December 4	31·5	30·9	37·0	39·3
January 4	32·3	32·0	34·7	38·9
February 4	32·3	32·2	35·0	39·0
March 4	29·4	31·1	36·6	39·4
April 4	26·7	29·5	38·1	40·1
May 4	24·2	26·8	39·2	42·4
June 4 (estimate)	22·5	24·1	40·4	42·2
June 4 (census)	23·1	22·9	43·7	41·7

TABLE IV.—*Seasonal distribution of beef cattle—Contd.*

Date.	Group 3.		Group 4.		Total.
	1917-18.	1918-19.	1917-18.	1918-19.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
June 4 (census)	27·8	26·1	7·6	7·1	100
July 4	29·3	26·6	6·8	7·0	100
August 4	28·6	26·3	7·3	6·6	100
September 4	27·7	25·9	7·2	7·0	100
October 4	27·3	24·8	7·1	7·0	100
November 4	26·2	23·7	5·9	7·2	100
December 4	26·6	22·8	4·9	7·0	100
January 4	26·8	22·1	6·2	7·0	100
February 4	26·5	21·4	6·2	7·4	100
March 4	27·4	22·3	6·6	7·2	100
April 4	27·6	22·9	7·6	7·5	100
May 4	29·7	23·8	6·9	7·0	100
June 4 (estimate)	29·7	26·0	7·4	7·7	100
June 4 (census)	26·1	26·4	7·1	9·0	100

The figures for the inter-censal months are of course estimates based on the sample monthly returns already referred to, but the comparison of the estimates for June with the actual results of the census is sufficiently close to justify us in accepting the other figures as a fair measure of the position throughout the agricultural year.

(B) *Sheep.*

As I have already said, at the outbreak of war our flocks of sheep were just beginning to recover from one of those periodical depressions which have marked the records of the past forty years. It was suggested to me some years ago by Professor T. B. Wood of Cambridge that these fluctuations in the flocks were closely connected with changes in the margin between the price of home-grown mutton and that of home-grown beef; in other words, sheep-rearing over the country as a whole is regarded as subsidiary to cattle-rearing, and fluctuates according to the relative profit obtainable. The data for England from the beginning of the present century certainly support this suggested relation, with a lag of about three years between the two movements. Thus an upward movement in the differential price culminating in 1906 was followed by a corresponding increase in the flocks culminating in 1909. A downward movement in the differential price between 1906 and 1909 was followed by a decrease of the flocks which extended to 1913, and, as I have said, in 1914 we seemed on the point of recovery of the flocks following upon the stimulus of higher differential prices prevailing in the preceding three or four years.

TABLE V.—*Number of sheep on June 4 of each year.*

(The numbers are given in thousands, i.e., 000's omitted.)

Year.	Great Britain.		
	Breeding ewes.	Other sheep.	Total sheep.
1909	10,810	16,808	27,618
1914	9,814	14,472	24,286
1915	9,876	14,722	24,598
1916	10,066	14,941	25,007
1917	9,899	14,144	24,043
1918	9,501	13,852	23,353
1919	8,590	12,944	21,534

Year.	Ireland.		
	Breeding ewes.	Other sheep.	Total sheep.
1909	1,637	2,495	4,132
1914	1,408	2,193	3,601
1915	1,432	2,168	3,600
1916	1,504	2,260	3,764
1917	1,511	2,233	3,744
1918	1,449	2,178	3,627
1919	1,407	2,106	3,513

Year.	United Kingdom.		
	Breeding ewes.	Other sheep.	Total sheep.
1909	12,485	19,354	31,839
1914	11,256	16,708	27,964
1915	11,342	16,934	28,276
1916	11,604	17,246	28,850
1917	11,445	16,422	27,867
1918	10,986	16,077	27,063
1919	10,029	15,090	25,119

As a matter of fact, the flocks of the United Kingdom increased during the year 1914-15 (1·2 per cent.) and further during 1915-16 (2·1 per cent.), and the net decrease for the five years 1914 to 1919, viz., 10·2 per cent., was less than the decrease during the five years preceding the war, viz., 12·1 per cent. What renders the war-time loss in our flocks significant is that it fell upon flocks already reduced, and secondly, that it involved a reduction of breeding ewes (10·9 per cent.) heavier than the reduction in the total flocks and heavier

than the corresponding reduction in the preceding five years (9·8 per cent.). The decrease of 3·4 per cent. in the year 1916–17 may be attributed partly, at least, to the bad lambing season in that year, but this was followed by a decrease of 2·9 per cent. in the next year in spite of a very good lambing season, and by the great fall of 7·2 per cent. in 1918–19. As to the general causes of the decrease in the later years of the war, it is understood from farmers that the relative controlled prices fixed for beef and mutton were not such as to encourage the production of the latter; in any case the flat price fixed for all sheep offered a temptation to the farmers to sell for slaughter ewes which had formerly brought a lower price than other kinds of sheep. Further, with the pressure on the available agricultural labour, and the extension of arable, the reduction of sheep-rearing offered less disturbance than that of cattle-rearing to the general scheme of farming in practice in the country as a whole.

If the suggested causes of the decrease are true, one would expect to find it greatest in those areas the chief activity of which in the sheep industry lies in preparing the animals for the market; in such areas the effects of prices would be first and most acutely felt, and the reduction of numbers would involve the least disturbance of skilled labour and farming operations generally. The greatest reductions actually occurred in those divisions of the Ministry of Agriculture's local statistics, viz., the East, North-East, and South-East Divisions, which I have described as Group 1 in Table IV. It may be of interest to set out the actual facts, which are as follows:—

TABLE VI.—*Local decrease in the number of sheep.*

Period.	Breeding ewes.		Total sheep.	
	Great Britain.	E., N.E. and S.E. divisions.	Great Britain.	E., N.E. and S.E. divisions.
	Percentage change.	Percentage change.	Percentage change.	Percentage change.
1909–14	— 9·2	— 19·8	— 12·1	— 22·5
1914–15	+ 0·7	— 4·9	+ 1·3	— 4·0
1915–16	— 1·9	— 0·4	+ 1·7	+ 0·9
1916–17	— 1·7	— 4·3	— 3·9	— 5·0
1917–18	— 4·0	— 5·8	— 2·9	— 4·5
1918–19	— 9·6	— 12·5	— 7·8	— 6·9
1914–1919	— 12·5	— 25·3	— 11·3	— 18·2

These figures show that under the adverse circumstances existing in the five years before the war the rate of decrease in these three

divisions was double that for Great Britain as a whole, and it persisted in the first year of the war when elsewhere it had turned ; during 1916-17 and 1917-18 the decrease went on at a greater rate than elsewhere, but fell off relatively to the rest of the country in 1918-19. This last fact is not surprising when it is recalled that by June, 1919, the number of sheep in the three divisions was only 63 per cent. of the number in 1909, and a certain number of sheep are essential for the consumption of the local root crops and for the benefit of the arable land. In Scotland, on the other hand, which is a breeding area, exporting store sheep and presenting greater difficulties to the substitution of other forms of agricultural activity, the decrease of sheep in the five years before the war amounted only to 4.1 per cent., and that during the five war years to 8.8 per cent., or a total decrease of 12.5 per cent. in the ten years.

(C) *Pigs.*

The following are the numbers of pigs in the country as returned by the annual census taken by the various Departments of Agriculture in the United Kingdom :—

TABLE VII.—*Number of pigs on June 4 of each year (exclusive of cottagers' pigs).*

(The numbers are given in thousands, *i.e.*, 000's omitted.)

Year.	Great Britain.		
	Breeding sows.	Other pigs.	Total pigs.
1914	360	2,274	2,634
1915	316	2,263	2,579
1916	300	2,014	2,314
1917	269	1,782	2,051
1918	306	1,519	1,825
1919	266	1,670	1,936

Year.	Ireland.		
	Breeding sows.	Other pigs.	Total pigs.
1914	133	1,173	1,306
1915	122	1,083	1,205
1916	132	1,158	1,290
1917	104	843	947
1918	105	869	974
1919	97	881	978

TABLE VII.—*Number of pigs on June 4 of each year—Contd.*
(The numbers are given in thousands, i.e., 000's omitted.)

Year.	United Kingdom.		
	Breeding sows.	Other pigs.	Total pigs.
1914	495	3,458	3,953
1915	439	3,356	3,795
1916	435	3,181	3,616
1917	374	2,634	3,008
1918	412	2,397	2,809
1919	364	2,561	2,925

These figures are less complete than the corresponding figures for other classes of livestock, because the exclusion from them of stock held by cottagers affects pigs to a very much greater degree. We may arrive at an estimate of the numbers concerned by comparison of the figure given above for Great Britain on June 4, 1918, with the figure given in a census taken by the Ministry of Food on the same date, inclusive of cottagers' pigs. The respective totals were 1,825,000 and 2,291,000, giving as the estimate of cottagers' pigs on that date 436,000. Less reliable estimates are available by comparison of the Ministry of Food returns made at the beginning of December, 1917, and December, 1918, with the estimates of the Departmental Committee on Livestock and Meat Production for these dates. This gives the number at the beginning of December, 1917, as 562,000, and at the beginning of December, 1918, as 775,000. Returns made at that time of the year would of course reflect a normal seasonal increase, and 560,000 for December, 1917, is probably not a bad estimate. As regards December, 1918, this return would reflect, in addition to the normal seasonal movement, the effects of the measures taken earlier in the year to modify the sanitary restrictions on pig-keeping, and the campaign to encourage this form of production associated with the name of Mr. Cautley, M.P., but I think the estimate is rather high. In any case, it is obvious that the omission of this class from the annual statistics is a serious one, and were it possible to include it throughout, it would probably make the total for June, 1918, and, to a less degree, that of 1919, compare more favourably with the immediately preceding years.

Before passing now to the annual figures available, we may pause to make one more general observation on a distinction between those figures and similar figures for other kinds of livestock. In the case of cattle and sheep, in discussing changes in livestock over

a short period, the primary cause will generally be found in changes in the rate of slaughter or in the rate of deaths (*e.g.* bad lambing season). But in the case of pigs, owing to their rapid rate of breeding, even in a short period changes in the herds may be due primarily to changes in the rate of breeding. Unfortunately, up to 1917, the only means we have of estimating changes in the annual slaughter of pigs in this country is based upon the assumption of a fixed birth-rate, so that we cannot disentangle the two causes.

Turning now to the annual figures given in Table VII we find that in Great Britain a decrease of 2 per cent. in the first year of the war was followed in the next three years by an annual decrease of 10 to 11 per cent., so that in June, 1918, the numbers stood nearly 31 per cent. below the 1914 level. By June, 1919, there had been a recovery of some 6 per cent. The movement in Irish stocks was much more irregular; a considerable loss of nearly 8 per cent. in the first year of the war was almost made good in the second year, but in 1916-17 Ireland lost over a quarter of her pigs. This marked the turning point, and the next two years saw a slow but steady recovery. There is no doubt that the fundamental cause of the reduction in all parts of the United Kingdom was the difficulty of obtaining an adequate supply of feeding-stuffs. The kinds commonly used for the feeding of pigs render this class of livestock much more than cattle or sheep a rival for supplies of potential human foodstuffs, and consequently when the war produced a stringency of supplies generally, this class of livestock was the first to suffer, and suffered most heavily. Ireland in this respect was not so badly off as the rest of the United Kingdom, except in the year 1916-17, when the disastrous failure of the potato crop was reflected in a serious reduction of the Irish herds. This shortage of feeding stuffs reacted upon the rate of breeding, and by the latter I do not mean merely a reduction in aggregate births corresponding to the reduction of the number of sows shown in Table VII, but a lower ratio of births to sows. Up to 1917 we have no statistical data for measuring this decrease, but by the help of monthly slaughter returns collected by the Ministry of Food I have tried to obtain a rough measure for Great Britain for the two years 1917-18 and 1918-19. The returns referred to were sufficiently large to give a reliable measure of variations in the rate of slaughter, but there being no other means of measuring the missing returns, I have had to assume that for the first year of the return (1916-17) the total slaughter may be estimated on the basis of the method adopted in the report on "*The Agricultural Output in Great Britain*," 1908 (Cd. 6277), which assumes an annual birth rate of 1,130 per cent.

of the sows returned as being kept for breeding on the preceding June 4. Whether the actual rate of breeding in 1916-17 was up to the pre-war standard is open to doubt, so that while the figures given below afford a measure of the decrease in 1917-18 and 1918-19 compared with 1916-17, they may represent an under-estimate of the total decrease compared with pre-war conditions. I have also modified the original method by taking as the basis for estimating the birth-rate the average of the number of sows at the beginning and at the end of the year. This, I think, is legitimate in view of the large changes in the number of sows from year to year at this time. I have made a similar modification in the basis of the death-rate. The details of the calculation are set out below :—

(The numbers are given in 000's.)

	1917-18.	1918-19.
Estimated slaughter of pigs	2,045	1,583
Deaths at 7 per cent. of average of total pigs returned on the census at the beginning and at the end of the year	136	132
Total slaughter and deaths	2,181	1,715
Less imports from Ireland	165	180
	2,016	1,535
Increase or decrease of total pigs returned at census at the beginning and end of the year	— 226	+ 111
Apparent births during year	1,790	1,646
Average of breeding sows returned at census at beginning and end of the year	287	286
Ratio of births to sows	Per cent. 624	Per cent. 576

These birth-rates of 624 and 576 per cent. of the numbers of breeding sows for 1917-18 and 1918-19 respectively compare with an assumed normal rate of 1,130 per cent. It may be said that we have not made any allowance for the increase of the cottagers' pigs, already suggested, in arriving at these figures, but, on the other hand, we have made no allowance for the abnormally high death-rate that undoubtedly prevailed in these years. The whole calculation is so uncertain that it is useless to try to attach any definite value to these opposing factors, and my object in introducing it was simply to give some idea of the order of magnitude of this factor of the birth-rate in considering variations in the number of pigs in the country in recent years.

Owing to the abnormal circumstances attending pig breeding in the second half of the war, little value can be attached to the figures of seasonal variations of numbers as a measure of the extent of normal seasonal movements. All we can deduce from the figures is that there is a seasonal movement having its maximum point in October and its minimum point about February or March, and further that the early months of 1918 were the most critical ones for the numbers of our herds, a fact which was already known from general observation. Table VIII shows in the form of indices the actual variations as estimated by the Committee on Livestock and Meat Production on the same basis as those already quoted for cattle.

TABLE VIII.—*Indices illustrating seasonal variations in the number of pigs.*

	Great Britain.			Ireland.	
	1916-17.	1917-18.	1918-19.	1917-18.	1918-19.
At the beginning of June (census)	100	100	100	100	100
July	—	101*	105	—	—
August	—	102*	108	—	107
September	—	103*	118	—	—
October	—	106*	124	—	116
November	—	103†	122	—	—
December	108	99	121	—	109
January	—	86	115	—	—
February	—	78	110	89	102
March	—	78	105	—	—
April	—	80	104	101	107
May	—	85	106	—	—
June (estimate)	—	92	108	105	—
June (census)	89	89	106	103	100

* † See notes on Table IIa.

III.—SLAUGHTER OF LIVESTOCK AND YIELD OF MEAT.

The table on page 548 summarises the estimates put forward in the subsequent paragraphs of the present paper.

(A) *Beef and veal.*

Prior to the end of 1917 the only method available for estimating the annual slaughter of cattle and calves in the United Kingdom is one based on certain rates of births and deaths combined with the annual returns of livestock. The rates used in the present paper represent certain modifications, approved by the

TABLE IX.—Variations in the slaughter of livestock and the yield of meat.
(All numbers, both of livestock and weight, are given in thousands, i.e., 000's omitted.)

Agricultural year.	Number of animals slaughtered.				Yield of meat.					
	Cattle.	Calves.	Sheep and lambs.	Pigs.	Beef.	Veal.	Mutton and lamb.	Pigmeat.	Offal.	All meat.
	Number.	Number.	Number.	Number.						
Average of five years, 1909-10 to 1913-14	2,361	941	11,770	5,420	708	41	320	385	65	1,519
1914-15	2,657	926	10,380	5,640	797	40	283	405	69	1,594
1915-16	2,389	812	10,335	5,500	717	32	282	395	64	1,490
1916-17	2,641	910	11,765	4,950	792	31	304	350	66	1,543
1917-18	2,527	1,002	11,940	3,120	695	26	281	205	54	1,261
1918-19	2,275	958	9,965	2,660	596	24	209	175	45	1,049
<i>Quarterly Estimate.</i>										
1916.										
January-March	650	285	2,312	1,610	195	10.5	70	116	17.5	409
April-June	570	259	2,452	1,140	171	10	72	82	15	350
July-September	615	164	3,650	1,090	185	6	87.5	77	16	371.5
October-December	765	190	2,734	1,850	229	7	74.5	130	20	460.5
1917.										
January-March	623	271	2,445	1,205	187	8.5	68.5	85	16	365
April-June	621	328	2,552	930	185	10	70	65	15	345
July-September	694	240	3,584	815	196	6	79	54	15	350
October-December	849	218	4,005	1,010	234	5.5	100.5	66	18	424
1918.										
January-March	512	284	2,011	690	131	7	49.5	44	10.5	242
April-June	395	249	1,779	465	101	6	43	29	8	187
July-September	519	141	3,348	460	138	3.5	65	29	10.5	246
October-December	669	193	2,952	765	173	5	60.5	48	13	299.5
1919.										
January-March	570	322	1,760	810	148	8	38.5	55	11	260.5
April-June	589	363	2,064	690	156	9	49.5	44	11.5	270

Ministry of Agriculture, of figures originally put forward by a Committee of this Society in a report presented to the Society on the Production and the Consumption of Meat and Milk. For Great Britain the birth rate has been taken at 90 per cent. of the number of cows and heifers on June 4, and the death rate at 3.5 per cent. of the whole cattle herd, or 0.5 per cent. for cattle over one year, and 5.7 per cent. for those under one year. For Ireland the birth rate has been taken at 88 per cent., and the death rate at $3\frac{1}{4}$ per cent. for all cattle (including calves) and $7\frac{1}{2}$ per cent. of the year's calves. Briefly the method of estimating the annual slaughter of cattle is to take it as being equal to the difference between the number of cattle returned as being one year and over at the beginning of the year, and the number returned as being two years and over at the end of the year, after allowance for deaths during the year. To arrive at the corresponding estimate of the slaughter of calves, to the number of calves returned at the beginning of the year we add the births during the year, and deduct the number returned at the end of the year as being one year old and under two, also the estimated deaths during the year. This method, of course, is open to criticism, *e.g.* an animal just under two years old slaughtered just before the date of the census would be included in the estimate of calves slaughtered, but the error arising from this is probably balanced by errors in the age classification of livestock at the census, for the description of a calf in agricultural practice does not always agree with that in the census, and it is quite probable that many animals ten and eleven months old are returned as yearlings. From November, 1916, the War Office, in connection with its control of leather supplies, collected returns of native hides purchased by tanners throughout the United Kingdom, to which was subsequently added a similar record of purchases of calf-skins. Thus for two agricultural years in the case of cattle, and for one year in the case of calves, we can set this actual record against the estimates based on the method described above. But even in these records the difficulty of the confusion of cattle and calves is not altogether absent, for tanners do not always classify skins from the agricultural point of view. For the year 1917-18 the method of estimating gives as the annual slaughter 2,566,000, as compared with the record of 2,527,000 hides collected, or a difference of only about 1 per cent. Next year, unfortunately, the discrepancy is much greater, for the estimate on the lines described gives 2,397,000 while the hides return accounts for only 2,275,000, and there is a similar difference in the case of calves, *viz.*, 1,000,000, as against 958,000. For the present purpose I have followed the

hides and skins returns when these are available, though perhaps it should be borne in mind that during the year 1918-19, under the method of livestock control, and particularly in connection with the method of collecting the Government rebate on the sale of hides, there was a growing inducement to illicit dealings. The distribution of the quarterly figures for 1916 given in Table IX is based on returns from public slaughter-houses in England and Wales, and from large abattoirs in Ireland, collected by the Board of Agriculture and the Department of Agriculture and Technical Instruction respectively.

Turning now to the estimates of slaughter themselves as given in Table IX, we find, as was to be expected from the stability of the annual census figures, nothing very startling in the annual figures of slaughter. In fact, the estimate for the first year of the war (1914-15), both for cattle alone and for cattle and calves together, is greater than that for any subsequent year. It is only when we get down to the seasonal figures that the influence of the circumstances of the war is really seen. Up to the middle of 1917, the seasonal movement of slaughter seems to have remained fairly normal, but in the second half of that year a variety of causes tended to disturb this. In the first place, the growing dependence of the civilian population on home supplies was bound to exercise an increasing strain upon our herds so long as individual consumption remained unrestricted. Secondly, the growing scarcity and the higher prices of feeding stuffs tended to upset the ordinary course of seasonal supplies owing to the increased cost of the winter production of beef. Thirdly, to meet Army requirements the War Office turned, temporarily at any rate, to home production to supplement imported supplies. And lastly, the agricultural community were uncertain as to how they would be affected by the measures of control which were already being anticipated. The combined results of these various causes was a very heavy slaughter of cattle off the grass in the second half of 1917, and at the end of December the public was faced for the first time with a serious shortage of meat supplies. In the first quarter of 1918, and still more in the second quarter, in the lean season before fresh supplies of grass-fed cattle were forthcoming, the number of cattle available for slaughter was very much below normal. In the year 1918-19, under the system of control by that time in full operation, an effort was made to steady supplies by fixing a scale of prices to meet the varying costs of production at different periods of the year, and as is shown by the figures given, the farmers generally responded to the appeal to spread supplies of fat cattle as evenly as possible,

though, of course, the numbers were limited in the second half of the agricultural year by the available supplies of feeding stuffs for fattening purposes.

A few words may be said of the figures as to the slaughter of calves. During the war a great deal was heard, on the one hand, of protests from certain sections of the public against the excessive slaughter of calves, and on the other hand, of Government regulations designed to restrict this slaughter. The estimates of the actual slaughter suggest that the former were exaggerated or misinformed, and that the latter were ineffective in reducing the level below that dictated by the economic factors of the situation. What probably impressed the public was the greater prominence given to this kind of slaughtering by its concentration in fewer centres, and also the reduction in the age at which the bulk of the calves have been killed in recent years. But as Sir Henry Rew has pointed out in his recent work already referred to, it is sometimes forgotten by the urban newspaper correspondent that the production of a calf is the necessary prelude to the production of milk, whereas the question whether it should be reared turns upon our capacity for the production of beef. Now the need for maintaining or even increasing the number of milch cows was insistent from the point of view of public health, especially that of children, at a time when the average yield of milk per cow fell 15 to 20 per cent. below the pre-war standard. On the other hand, our capacity for beef production was limited by the available supply of feeding stuffs, apart from questions of the land and labour available. In the distribution of the existing supplies of feeding stuffs among the Allied countries, precedence was given to the requirements of the dairy herd, and the maintenance of our total herds of cattle above their pre-war level was not looked upon with too friendly an eye by some of our Allies less happily placed.

Of the factors affecting the ultimate supply of beef, the one showing the most definite continuous movement was not the number of livestock or the rate of slaughter, but the average yield of beef from the dressed carcase. In the report on "The Agricultural Output of Great Britain" the average dressed carcase weight was taken at 672 lb. Since up to the middle of 1917 we have no reason to suspect any serious alteration on the pre-war standard, this figure has been retained up to that date. There is evidence, though only fragmentary, that in the heavy slaughter of the second half of 1917 a large proportion of lighter animals was included. The 76,000 cattle purchased by the War Office gave an average yield of 610 lb., but this must not be taken as representative, for these

cattle were specially selected to meet army requirements, and the average of the total slaughter was higher. The monthly averages tentatively arrived at work out at 633 lb. for the third quarter, and at 617 lb. for the fourth quarter of the year. From an early date in 1918 we have much more complete data in the records of live weights and dead weights collected under the system of meat control, and these are given in Table X. This shows the average live weight of a large proportion of the cattle passing through the markets of England and Wales, also the average live weight and dead weight of cattle returned as passing through the hands of Wholesale Meat Supply Associations all over the country. In the last column I have added the estimate of the average dead weight for the whole country, based on the preceding figures and arrived at by applying the ratio of dead weights to live weights in the second group to the live weights in the first group, and rounding off in an upward direction to allow for the generally inferior class of animals included in the second group.

TABLE X.—*Live weights and dead weights of cattle.*

Month.	Cattle passing through markets.		Cattle passing through hands of Wholesale Meat Supply Associations.				Estimated average dead weight.
	Number.	Average live weight.	Number.	Average live weight.	Average dead weight.	Ratio of dead weight to live weight.	
1918.		lb.		lb.	lb.	Per cent.	lb.
January	—	—	—	—	—	—	580
February	63,404	1,091	—	—	—	—	570
March	66,466	1,084	—	—	—	—	565
April	66,796	1,079	—	—	—	—	565
May	59,718	1,089	—	—	—	—	570
June	31,214	1,111	3,108	1,110	582	52·4	585
July	58,911	1,125	11,916	1,085	575	53·0	600
August	54,050	1,107	13,837	1,053	562	53·4	595
September	73,379	1,117	23,575	1,055	552	52·3	590
October	57,784	1,125	33,343	1,063	552	51·9	590
November	48,389	1,097	31,048	1,093	562	51·4	570
December	55,592	1,110	21,485	1,047	540	51·6	575
1919.							
January	46,740	1,118	20,844	998	513	51·4	575
February	56,909	1,131	15,067	1,075	554	51·5	585
March	55,906	1,131	14,738	1,081	563	52·1	590
April	68,405	1,124	19,679	1,063	554	52·1	590
May	70,019	1,133	23,078	1,082	569	52·6	600
June	66,427	1,125	13,490	1,072	556	51·9	590

The figures for live weights show at the beginning of 1918 the effect of the exhaustion of our fat-stock supplies at the end of the

preceding year, the recovery during the grass season of 1918, and the improvement in the first half of 1919 compared with the figures of a year before. In the absence of definite information for Ireland, I have applied the same weights to the whole of the United Kingdom. The resulting estimates of beef production show a reduction from 792,000 tons in the year 1916-17 to 695,000 tons in 1917-18, and to 596,000 tons in 1918-19; further, for the critical period of the first half of 1918, supplies were only 232,000 tons as compared with 366,000 tons and 372,000 tons for the corresponding periods of 1916 and 1917 respectively, and made a recovery to 304,000 tons in the first half of 1919.

Unfortunately no corresponding continuous record of the carcass yield of calves has been made. I have had the records of the Government slaughter-houses examined for particular weeks, some of these applying to a period when the slaughter of calves was restricted to such centres, and the results show an average carcass weight of 56 lb. This contrasts very strongly with the figure adopted in the report in "The Agricultural Output of Great Britain," viz., 98 lb., and if this figure is correct, the explanation of the enormous decrease must lie in the steady reduction of the age at which calves were slaughtered. I have accepted 98 lb. up to the end of 1915, the year which marked the first restriction imposed by the Board of Agriculture on the slaughter of young calves, and 56 lb. from the middle of 1917. For the intermediate period, the weights are purely conjectural, viz., 84 lb. for 1916 and 70 lb. for the first half of 1917. The resulting figures of veal production show a steady decrease during the war, from 40,000 tons in 1914-15 to 24,000 tons in 1918-19.

(B) *Mutton and lamb.*

As in the case of cattle, prior to the last two years of the period covered, the only method of estimating the annual slaughter of sheep and lambs was by means of birth-rates and death-rates taken in conjunction with the annual returns of livestock. The birth-rate assumed for Great Britain was 107 per cent. of the ewes on June 4, and the death-rate $5\frac{1}{2}$ per cent. of the total flock on the same date; for Ireland the corresponding rates were 120 per cent. and $4\frac{1}{2}$ per cent. Over a series of years under ordinary conditions this method may be quite reliable, but for any particular year the actual lambing results may vary so much from the normal as to introduce into the estimate of slaughter quite a considerable degree of error. For example, a very good crop of lambs, appearing in the census of the following June, makes the estimate of the annual slaughter too

low, while a bad lambing season produces an exaggerated estimate, including in fact as having been slaughtered the lambs which failed to survive at birth. Thus there is no doubt that the estimate of slaughter given for 1916–17 in Table IX is unduly high owing to the bad lambing season of 1917, but there are no means of measuring the error, so that all the annual figures up to 1917 must be read with this reservation. There is a further source of weakness in the method arising from the fact that the birth-rate is estimated on the number of ewes on June 4. No doubt in ordinary times little error would arise from this, but in times of rapid change in the size of the flocks, the ewe flock as finally made up may not bear the same relation to the number in June as in other years. This point is illustrated below in connection with the two years 1917–18 and 1918–19. For these two years we have the record of the purchases of sheep and lamb skins under the War Office in all parts of the country, so that we can check the results of the method described above. The results briefly are :—

		Estimate based on birth- and death-rates.	Based on returns of skins purchased.
	1917–18	11,655,000	11,640,000
	1918–19	12,325,000	9,965,000

The agreement of the results for 1917–18 is, I think, entirely fortuitous. The good lambing season of 1918 alone would tend to produce an under-estimate on the first method, but this has been counteracted by the other disturbing factor referred to above. The following statement summarises the data available as to movements of the ewe flock after June, the numbers at June 4 being taken as = 100 in each year.

	1916–17.	1917–18.	1918–19.
Numbers at June 4 (Census)	100	100	100
Numbers at December 4 (estimate by Live-stock and Meat Production Committee)	102·3	97	96·3
Numbers at December 4 (Ministry of Food Census)	—	92·4	92·3
Numbers at June 4 following (Committee's estimate)	—	93·4	92·6
Numbers at June 4 following (Census)	98·3	96·0	90·4

From this it appears that for the year 1916–17, when the downward annual movement was already in force, the ewe flock on

December 4 was estimated at 2·3 per cent. above that of June 4, so that we may assume in a normal year the increase between June and December would be greater than this. As against this we find for 1917–18 between these two months a *decrease* of 3 to 5 per cent. (the Committee's estimate should be corrected according to the error revealed in the following June), and for 1918–19 a similar decrease. It follows from this that in applying the birth-rate to the ewe flock on June 4 in the last two years we have over-estimated the births, and the estimate of slaughter should be correspondingly reduced. This explains part, at least, of the discrepancy of the two figures for 1918–19, though part of it may be due to omissions in the skin returns. I have, however, used the latter whenever they were available. The seasonal movements of supplies from 1916 onwards show departures from the normal pretty much on the same lines as those for cattle, and for approximately the same reasons.

The pre-war dressed carcase weights adopted for sheep and lambs were 67 lb. and 38 lb. respectively, giving on the proportion of the two classes assumed, an average annual weight of approximately 61 lb. The only data I found for later years was a monthly return of weights obtained by the Board of Agriculture from certain public slaughter-houses in 1918–19. On the basis of these I estimated the average annual weight for 1918 at $48\frac{1}{2}$ lb. By the help of the seasonal variation in the weight of sheep and lambs in the above return, and also by the help of a large number of skin returns for an earlier year which specified the proportion of sheep and lambs, I constructed for 1916 a seasonal variation of the average weight, giving as the annual average for that year the pre-war figure of 61 lb. For 1917 I then assumed monthly weights midway between those for 1916 and those for 1918, the average for the year on the distribution of slaughter in that year working out at $56\frac{1}{2}$ lb. The quarterly averages thus arrived at are shown below :—

TABLE XI.—*Estimated average dressed carcase-weights of sheep and lambs.*

				1916.	1917.	1918.	1919.
				lb.	lb.	lb.	lb.
January—March	....	....	....	$67\frac{1}{2}$	$62\frac{3}{4}$	$55\frac{1}{4}$	49
April—June	....	....	....	66	$61\frac{1}{2}$	54	$53\frac{3}{4}$
July—September	....	....	....	$53\frac{3}{4}$	$49\frac{1}{2}$	$43\frac{1}{2}$	—
October—December	....	....	....	61	$56\frac{1}{2}$	$45\frac{3}{4}$	—
Average for year	....	....	....	61	$56\frac{1}{2}$	$48\frac{1}{2}$	—

The resulting estimates of supplies of mutton and lamb show a steady decrease on the annual figures since the outbreak of war except for 1916–17, where we have seen there is reason to believe the estimate is excessive. As in the case of beef supplies, the opening of 1918 was marked by a sharp contraction, but unlike beef supplies, those of mutton and lamb in the first half of 1919 were still lower than the quantity for the first half of 1918.

(C) *Pigmeat.*

I have already indicated the method of estimating the annual slaughter of pigs in Great Britain up to 1916–17 and subsequently, and it will be remembered that this assumes up to 1916–17 the maintenance of a normal rate of breeding. For Ireland I have followed a similar method, substituting in the later years for the monthly slaughter return, a return of pigs purchased by the principal bacon curers. This return, collected by the Department of Agriculture and Technical Instruction, represents 75 to 80 per cent. of the total slaughter of pigs in Ireland. The total figures for the United Kingdom for the successive agricultural years of the war show a steady decrease for three years, followed by a sharp drop in 1917–18 and a further decrease in 1918–19, bringing the total in the last-named year to less than half the pre-war figure. When the estimates are arranged in calendar years, 1916 stands out with a heavy slaughter of nearly 5,700,000, and the most critical period is the year 1918, in no quarter of which did the figures rise above 43 per cent. of those of the corresponding quarter of 1916. The first half of 1919 shows a distinct recovery from the low level of 1918, but the figures were still little more than half those of 1916.

The average dressed carcase weight of pigs in pre-war years was taken at 160 lb. I have no adequate collection of data for Great Britain for later years, and the figures used were all based on the opinions of expert officers of the Ministry of Food. As compared with the pre-war weight of 14 to the ton, they are for 1917 15 to the ton, for 1918 17 to the ton, for 1919 16 to the ton, these weights representing an average of bacon pigs and butchers' pigs. In Ireland, where, as has been indicated, practically all the pigs are used for curing purposes, the information available indicates a decrease to 155 lb. in 1917, at which figure approximately it remained in subsequent years.

In connection with pig meat supplies, there arises the further problem of their disposal as between bacon and hams on the one hand and pork on the other, both groups including a certain margin for lard production. Under the Bacon and Ham Curers (Returns)

Order, 1917, the Ministry of Food obtained returns from all persons curing one ton and over per annum, except for domestic consumption. By means of this return I was enabled to revise an incomplete return for 1916 and obtain a corresponding estimate for that year. The return so begun has been continued, and during the winter of 1918-19, when an elaborate system of pig control was in force, we were able to obtain for Great Britain an estimate of the *total* number of pigs being used for the production of bacon. This showed an amount of domestic curing, taking place practically all in the winter months, which was estimated for the year at 20 per cent. of the recorded factory output. In Ireland an analysis of the regular returns showed that the proportion of small producers was only about half that found in Great Britain, so for Ireland I have assumed a domestic output of 10 per cent. of the factory output. The total bacon output of the United Kingdom was as follows:—

1916 ... 136,000 tons, representing $33\frac{1}{2}$ per cent. of the estimated supplies of raw pigmeat.

1917 ... 108,000 tons, representing 40 per cent. of the estimated supplies of raw pigmeat.

1918 ... 70,000 tons, representing $46\frac{1}{2}$ per cent. of the estimated supplies of raw pigmeat.

In the Census of Production year (1907) the recorded output was 111,000 tons; allowing a similar margin to that above for domestic output, total production for that year may be put at 125,000 tons, representing 32 per cent. of the estimated total supplies of pigmeat. It will be seen therefore that as the total supplies of pigmeat decreased, the proportion going into bacon and hams rose. On the basis of the proportions shown for 1907 and 1916 I have estimated the total production of bacon and hams in the United Kingdom at an annual average of 125,000 tons for the five calendar years 1909-13, at 120,000 tons for 1914, and 130,000 tons for 1915.

As regards the production of lard, for the years 1916-18, I estimated on the basis of 6 per cent. of the average dressed carcass weight of bacon pigs, and 5 per cent. of that of butchers' pigs. These proportions have been criticised as being too high, and probably they were based on an unduly favourable selection, but on the other hand, the output given for 1907 on the Census of Production (31,200 tons) represents 7.8 per cent. of the estimated total supply of pigmeat, whereas the estimates for 1916-18 represent only 5.2 to 5.3 per cent. of the corresponding totals. Of course, the production of lard would suffer most from any reduction in the total dressed carcass weight. I have taken 7 per cent. of the total supplies of pigmeat up to the end of 1914, 6 per cent. for 1915, and

the proportions already indicated for 1916–18. The estimates of the total production of lard in the United Kingdom thus arrived at are as follows:—

	Tons.		Tons.
1909–13 (average)	27,000	1916	21,000
1914	25,000	1917	14,000
1915	24,000	1918	8,000

Treating pork as the balance of the total supplies of pigmeat, and allowing 10 per cent. contraction between raw pigmeat and finished bacon, we can now show for the calendar years named the estimated disposal of our total supplies of pigmeat (Table XII):—

TABLE XII.—*Estimated utilisation of the total pigmeat supplies of the United Kingdom.*

(In thousands of tons.)

Year.	Bacon and hams.	Lard.	Pork.	Total raw pigmeat.
1909–13 (average)	125	27	224	390
1914	120	25	192	350
1915	130	24	227	395
1916	136	21	233	405
1917	108	14	136	270
1918	70	8	64	150

(D) *Edible offals.*

For edible meat offals, an addition of approximately $4\frac{1}{2}$ per cent. has been made to the total based on dressed carcase weights.

IV.—SUMMARY AND CONCLUSION.

Proceeding now to summarise the factors affecting the production of meat in the United Kingdom during the war, we may put these under three heads, viz., (a) variations in the number of livestock; (b) variations in the rate of slaughter, i.e., the proportion of animals slaughtered to the number of livestock at the beginning of the year; and (c) variations in the average dressed carcase weights of the animals slaughtered. These three factors may be studied from two points of view, that is to say, (1) the measurement of the variation of each factor in itself, and (2) the effect of the variation upon the final supplies of meat. The latter can be measured, of course, only on the assumption of a definite sequence in the three factors, e.g., if in any year as compared with the base period, the numbers of a particular kind of livestock, the rate of slaughter as defined above, and the average dressed carcase weight

are all down by 10 per cent., we should say the reduction in supplies is 27·1 per cent., and this is made up as follows: 10 per cent. due to reduced livestock, 9 per cent. due to the reduced slaughter-rate on the smaller herd, and 8·1 per cent. due to the reduced carcase yield on the smaller slaughter. Taking as the base period the five agricultural years ended May, 1914, I have summarised on these lines the various estimates given in the earlier parts of this paper. (Table XIII.) In the first four columns the data for each year are

TABLE XIII.—*Summary table illustrating variations in the numbers of livestock, the rate of slaughter, and the carcase yield; also the effect of these variations upon the supply of meat in the United Kingdom.*

Year ending May.	Indices of variations in				Percentage changes in the supply of meat.			
	Num- bers of live- stock.	Rate of slaugh- ter.	Carcase yield.	Pro- duction of meat.	As due to variations in			Total change in pro- duction of meat.
					Num- bers of live- stock.	Rate of slaugh- ter.	Carcase yield.	
Beef and veal—					Per cent.	Per cent.	Per cent.	Per cent.
1910-14	100	100	100	100	—	—	—	—
1915	103	105½	103	111½	+ 3	+ 5½	+ 3	+ 11½
1916	102½	94½	103	100	+ 2½	— 5½	+ 3	—
1917	105	102½	102½	110	+ 5	+ 2½	+ 2½	+ 10
1918	104½	102½	90	96½	+ 4½	+ 2½	— 10½	— 3½
1919	104	94½	84½	83	+ 4	— 6	— 15	— 17
Mutton and lamb—								
1910-14	100	100	100	100	—	—	—	—
1915	93½	94½	100	88½	— 6½	— 5	—	— 11½
1916	94	93½	100	88	— 6	— 6	—	— 12
1917	96	104	95	95	— 4	+ 4	— 5	— 5
1918	93	106½	88½	88	— 7	+ 6	— 11	— 12
1919	90	94	77	65	— 10	— 5½	— 19½	— 35
Pigmeat—								
1910-14	100	100	100	100	—	—	—	—
1915	106	98	100	104	+ 6	— 2	—	+ 4
1916	102	100	100	102	+ 2	—	—	+ 2
1917	97	94	100	91	— 3	— 6	—	— 9
1918	81	71	92	53	— 19	— 23	— 5	— 47
1919	75	65	92	45	— 25	— 26	— 4	— 55
Total meat—								
1910-14	100	100	100	100	—	—	—	—
1915	102	101	102	105	+ 2	+ 1	+ 2	+ 5
1916	101	96	102	98	+ 1	— 4	+ 1	— 2
1917	101	101	100	102	+ 1	+ 1	+ 0	+ 2
1918	96	95	90	83	— 4	— 4	— 9	— 17
1919	93	87	85	69	— 7	— 12	— 12	— 31

expressed as percentages of the corresponding data for the base period, in the last four columns the effect of the variation in each factor upon the ultimate supply of meat is shown. To arrive at the figures for "All meat" the data for each kind of meat have been weighted according to the relative size of the supplies of beef and veal, mutton and lamb, and pigmeat during the base period. It should be noted, further, that since for this purpose beef and veal must be taken together, the average carcase weight will depend upon the proportion of calves included in the total slaughter. This explains the increase in the index of the average carcase weight in the first three years of the war.

This table, I think, gives a fair bird's-eye view of the position throughout the war. It will be seen that on the total the greatest decrease occurred under the heading of the carcase yield, which is the one that can probably be most easily restored. Next in order of importance in the total comes the reduction in the rate of slaughter, which represents generally a higher proportion of animals not available for slaughter. To some extent this is due to causes similar to those of the reduced carcase yield, and to that extent it is equally capable of recovery. In the class in which the reduction was greatest, however, viz., pigs, the chief cause was the lower rate of breeding referred to earlier in the paper, for the ordinary annual slaughter of pigs includes a much larger proportion of animals which never appear in the annual returns of livestock. As regards the remaining factor, the numbers of livestock, the position in the middle of 1918, to which the latest figures given in the table refer, was very favourable for cattle, and less favourable for sheep and pigs. If we carry the figures down to the returns for June, 1919, we find a further slight improvement in cattle, a slight recovery in pigs, but a further heavy decrease in sheep: the indices for June, 1919, corresponding to those in the table are 105½ for cattle, 83½ for sheep, and 78½ for pigs, giving as a weighted index for the total 93½, i.e. slightly above that for the preceding year. The pig herds can quickly be built up again, and undoubtedly the most serious factor in the livestock position in the middle of 1919 was the reduction in the number of sheep, especially in that of breeding ewes, which stood at only about 84 per cent. of the average of the five years, 1909-13, or 80 per cent. of those of 1909, before the pre-war downward movement set in.

The significance of the general changes in the numbers of livestock in the United Kingdom may be best appreciated by a brief comparison with the corresponding changes in Continental countries, both belligerent and neutral. I have examined the estimates avail-

able for the principal European countries¹ for the dates approximately of the outbreak and the conclusion of the war. The only country showing an increase of cattle is the neutral state of Spain, and while the numbers in Switzerland showed little variation, there were serious losses in other countries, both neutral and belligerent, rising to over 20 per cent. for Sweden and Germany, and to about 50 per cent. for Belgium. The totals for the countries for which comparative data are available show an aggregate loss of approximately 13 per cent. As in this country, the heaviest losses occurred in the case of pigs. The only country with an increase was again Spain, and in two other countries only, viz., Italy and Norway, was the loss less than our own. The decrease on the total was approximately one-third, as against one-fourth in this country. In the case of sheep, while our two Allies, France and Italy, and especially the former, suffered more severely than we did during the war, other countries were generally more successful in maintaining their flocks, and the decrease for all the countries was about 12 per cent. The fact that the losses of the three chief Allied Powers in this class of livestock were greater than in other countries is largely a result of the blockade, which rendered the maintenance of the flocks a matter of prime necessity at any cost for countries directly or indirectly affected by it: they were compelled to depend on home supplies of wool for clothing their armies and their peoples, while we were free to draw on overseas supplies. Having regard to the proportion in which the different kinds of meat made up the total pre-war consumption of meat in the continental countries for which information is available, the reductions in livestock indicated above point to a loss of about one-fourth of their meat supplies from this cause alone, as against 7 per cent. in this country, and there is no reason to believe that the other causes leading to a reduction of supplies here were less active on the continent. Of the total reduction of meat-producing capacity as measured by numbers of livestock, both in this country and in the continental countries included, about one-third is attributable to the decrease in the numbers of pigs, that is, in the class where such loss can be most quickly made good, but the wide difference in the total illustrates how much less this country has suffered in this respect. This result was not entirely due to our superior facilities for obtaining imported supplies; it must be largely attributed to the policy initiated by Lord Rhondda at a critical period of the war, and loyally supported by the agricultural community. Nor was the choice of this policy an easy or obvious

¹ Viz., France, Italy, Belgium, Denmark, Holland, Norway, Sweden, Spain, Switzerland and Germany.

one ; there were critical periods at which, in the light of the information then available, it was by no means obvious whether the interests of the country would be better served by the maintenance of our livestock approximately at their pre-war level, or by such a reduction as would temporarily augment our home supplies of meat, thereby increasing the amount available for consumption, or relieving the strain upon our shipping resources involved in the import of foreign meat and feeding stuffs. The country owes a great debt of gratitude to all those who loyally supported a policy which refused to sacrifice to the pressing needs of the hour the future interests of home agricultural production.

APPENDIX.

During the period when the control of livestock was most fully developed there were facilities for ascertaining the local seasonal production of beef and mutton in Great Britain which had not been previously available. Returns were obtained which showed not only the numbers of fat stock stalled in each livestock area, but the number exported from or imported into any particular area, so that the local production could be ascertained. It was found difficult in places to distinguish Irish supplies of fat stock, so that the figures for the areas in which these supplies arrived were subject to greater error than those for the remaining parts of the country. The total of the returns as received at headquarters at the Ministry of Food never reached the figure indicated by the returns of hides and sheepskins. It was assumed that the percentage of omissions was equal throughout the country, and the local figures were raised in a ratio to make the total correspond with the estimate based upon the returns of hides and sheepskins for Great Britain less the imports of fat stock from Ireland for the particular period. The figures therefore are subject to the qualifications implied in this incompleteness of the data, but I think they do broadly represent the facts, and that their unique character warrants their reproduction.

The table on page 563 gives the estimated *weekly* rate of production of beef and mutton in each livestock area for each month of the year April, 1918, to March, 1919. In spite of certain abnormal features of the year under consideration, the total shows approximately the normal seasonal movement, with a well-defined minimum in June, marking the lean season between stall-fed and grass-fed supplies, and a maximum about October or November, marking the clearing-off of stock at the end of the grass season. The first three Northern areas and Scotland agree in their seasonal movement, which indeed dominates that for the whole country, representing as

Table illustrating the local seasonal production of beef and mutton in Great Britain.

(Weekly rates based on dressed carcase weights.)

Livestock Commissioner's area.	1918.											1919.		
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.		
North	Tons. 661	Tons. 510	Tons. 281	Tons. 591	Tons. 651	Tons. 930	Tons. 667	Tons. 956	Tons. 742	Tons. 826	Tons. 644	Tons. 807		
North-East	1,178	906	475	788	908	1,169	1,481	1,297	742	671	945	1,010		
North-West	836	582	553	740	864	1,163	1,249	1,260	849	1,008	1,014	960		
North-East Midlands	921	696	434	1,145	1,243	1,586	1,869	2,002	1,107	779	767	791		
South Midlands	883	967	721	834	958	1,166	1,238	1,210	917	922	1,062	1,098		
North Wales	131	173	264	492	650	652	337	833	508	398	434	454		
South Wales	246	220	346	433	457	620	796	792	657	526	506	490		
East	1,796	1,159	379	551	360	444	570	230	299	362	591	886		
London, North	311	334	231	368	376	459	551	506	346	350	272	278		
London, South	331	302	242	388	286	541	736	687	447	321	377	405		
South	266	205	173	273	227	286	389	373	331	263	283	285		
South-West	1,079	1,053	692	882	726	1,103	915	1,349	1,063	996	919	1,106		
England and Wales total	8,639	7,107	4,791	7,485	7,706	10,219	10,788	11,485	8,008	7,422	7,814	8,570		
Scotland total	2,371	1,871	1,238	1,632	2,510	2,942	3,287	2,620	2,263	2,191	2,722	2,417		
Great Britain total	11,010	8,978	6,029	9,117	10,216	13,161	14,075	14,105	10,271	9,613	10,536	10,987		

NOTE.—The counties included in the Livestock Commissioners' areas named are as follows:—

North.—The counties included in the Livestock Commissioners' areas named are as follows:—*North-East*.—Yorkshire.*North-West*.—Westmorland, Cumberland, Lancashire, Cheshire.*North-East Midlands*.—Derby, Leicester, Lincoln, Nottingham, Northampton, Rutland.*South Midlands*.—Stafford, Salop, Hereford, Warwick, Worcester.*North Wales*.—Anglesey, Carnarvon, Merioneth, Denbigh, Montgomery, Flint.*South Wales*.—Somerset, Gloucester, Dorset, Devon, Cornwall.*South-West*.—Somerset, Gloucester, Dorset, Devon, Cornwall.*South*.—Hampshire, Oxford, Berkshire, Wiltshire.*South-West*.—Somerset, Gloucester, Dorset, Devon, Cornwall.*South*.—Hampshire, Oxford, Berkshire, Wiltshire.*South-West*.—Somerset, Gloucester, Dorset, Devon, Cornwall.*South*.—Hampshire, Oxford, Berkshire, Wiltshire.*South-West*.—Somerset, Gloucester, Dorset, Devon, Cornwall.*South*.—Hampshire, Oxford, Berkshire, Wiltshire.*South-West*.—Somerset, Gloucester, Dorset, Devon, Cornwall.

it does nearly half of the total annual production. In the North-East Midlands area the same general movement is found in an exaggerated form. On the other hand, in Wales, and in the South Midlands, South and South-West areas, the depression in June is less marked owing to the large proportion of mutton and lamb included in the totals for these areas at that season. But the outstanding feature in the local variations is that found in the Eastern area. This is a great root-growing area devoted to the fattening of live-stock by stall feeding in the winter months. Consequently we find the maximum in the spring months March to May, and a very low minimum about November, thus reversing the movement of supplies found over the country as a whole.

DISCUSSION ON MR. GUILD'S PAPER.

SIR HENRY REW said he rose with special pleasure to propose a vote of thanks to Mr. Guild, on the occasion of his first appearance before the Society. When it fell to his lot early in 1917 to lay the foundation of the organisation of the Ministry of Food, his first impulse was to form a competent Statistical Section. He was very fortunate in enlisting the services of their colleagues, Mr. Yule, Dr. Bowley, and also Professor Gonner, and was especially fortunate in securing Mr. Guild to join them. Everyone who knew the valuable work which Mr. Guild had done since he became an officer of the Ministry of Food would realise that he had entirely justified his enlistment in the public service. He had another personal interest in the paper, because he happened to have been responsible for some of the calculations which were reviewed by the author. He would not attempt to discuss there and then with any deliberation the new points which had been raised and the new light which had been thrown upon calculations for which, in the first instance, this Society was responsible, and for which, in the second place, the Board of Agriculture, when he was associated with it, was responsible. The points that were mainly brought out, and on which new data were available were, first of all, the seasonal variations in the number of livestock existing in the country at different times of the year, in regard to which hitherto they had no information. The particulars which Mr. Guild had laid before them, as the result of the material collected by the Ministry of Food, threw important light upon that subject, though the figures required careful consideration in view of the fact that the data necessarily applied to an abnormal period. Whether or not the seasonal variations in

the number of livestock which occurred during the period for which material had been collected could be regarded as typical of ordinary seasons, required a good deal of consideration. The other, and perhaps even more valuable new material which Mr. Guild had referred to, was that relating to the average weight of carcase. As he had pointed out, the figures which had been accepted up to say 1916 or 1917 had, on the whole, not been seriously disturbed. The later information, and more particularly the information obtained from the Hides and Sheep Skins Returns did not, on the whole, suggest previous estimates had been very far out. He hoped that that material, which had been of such great value in providing definite information—on perhaps the most important point of all with regard to meat supplies—might in some form or other be continued in future, because in the absence of returns of such a nature, their estimates of carcase weight from year to year must depend upon a limited number of samples. He could only refer in a rather discursive manner to one or two points in the Paper because he had not had time to give it the study it deserved. Mr. Guild referred to a shortage of home-killed beef which appeared with startling suddenness in the third week of 1917, and his reference might rather suggest that the experience of that particular week was the immediate cause of the institution of control. He thought Mr. Guild had done his Department a little less than justice. They had had a good many instances (and he did not necessarily refer to the Ministry of Food) of action taken in a panic during the war, but he was quite sure that the Ministry of Food did not act only on a scare arising from the experience of one week. He was very much interested in the reference Mr. Guild had made to the effect of prices on the number of sheep. Acting on a suggestion by Professor T. B. Wood, Mr. Guild had made a comparison with a view of trying to show that the fluctuations in the number of sheep depended on the relation between the price of beef and mutton, and his examination of the returns from the beginning of the present century, rather led him to believe that this might be established. If so, it was an important contribution to a difficult problem; but he would like to examine the data before accepting it as the only, or even the main, cause of those fluctuations. The table of the number of sheep in different years might at first glance lead to an exaggeration of the position. In the particular year put at the head of that table, 1909, taking the Great Britain figures, the numbers were the highest since 1892, and, in point of fact, they had very rarely reached 27 millions since 1868, when the returns were first collected. He had already referred to the hide returns as the kind of material which he hoped would be continued; and he would make one reference to the question of calves, more particularly on the great difference shown between the carcase weight of 56 lbs. and the weight of 98 lbs. which was adopted in the Report on the Agricultural Output of Great Britain. Mr. Guild had suggested that that was due to the steady reduction of the age at which the calves were slaughtered.

He was not quite sure. There was some evidence to show that what in the North-West of the country was called a "slink" calf, that was a calf which was merely obtained for the purpose of milk supply and considered to be of no commercial value, and which, in the old days at any rate, did not live more than a day or two, had been during the war reared for a certain time and made its appearance in the slaughter-house returns. If that were so and there was any substantial number of such calves they would naturally tend to reduce the average weight. He only threw that suggestion out tentatively, because he was not at all sure it could be established as a possible explanation. Mr. Guild quite rightly mentioned at the outset of his conclusions that there were three main factors by which the production of meat in the United Kingdom was determined. There was one factor which was not mentioned, and that was the rate of mortality from natural causes. This was a factor which might from year to year cause some disturbance in calculations of the output. For example, if it happened that the ordinary mortality from natural causes among cattle and sheep were say 1 per cent., more or less, in a particular year, it would have quite an important bearing on the calculations. In the final paragraph of the Paper Mr. Guild referred very clearly to the problem with which the country was confronted, as to whether or not as a matter of carrying on and winning the war it was desirable to make a draft on their capital and deliberately reduce their livestock by a certain proportion, in the hope of making it up when peace was restored, or whether the sound policy was to do their utmost by every possible means to keep up their herds and flocks to the highest possible pitch. Mr. Guild rather suggested that that problem presented itself for the first time in June, 1917. But, as a matter of fact, it was considered from the very earliest weeks of the war. He remembered repeated discussions at the Board of Agriculture and in the Cabinet Committee on Food Supplies in the Autumn of 1914 and at subsequent periods, in which that problem was most carefully considered, and at which the decision was taken, rightly or wrongly, that the best line to take was to do their utmost by every possible means to maintain the livestock of the country. He remembered himself observing, in taking part in these discussions, that if the military authorities would give them the date at which the war would end, they would find it less difficult to express an opinion as to the policy to be adopted. But as that date seemed to be continually receding, the safest line to take seemed to be to do their utmost to keep their reserves of meat in this country up to the highest possible point. There was another small point in the Paper which concerned the Society. Mr. Guild said he had somewhat modified certain calculations in a report which was presented to the Society. He thought it would be of interest to place on record precisely what those modifications were. In conclusion he had very great pleasure in proposing the vote of thanks for Mr. Guild's most valuable Paper.

Mr. MACROSTY, in seconding the vote of thanks, said that with everything Sir Henry Rew had said he found himself in most cordial agreement. He thought the Ministry of Food were to be highly congratulated on having secured Mr. Guild as their Statistical Officer. Like Sir Henry, he had worked beside Mr. Guild on various Committees, and had observed his statistical methods, and he thought they were in about as good a position as anybody could be to estimate the value of Mr. Guild's work. He also was like Sir Henry in another respect, in that being over-burdened with work he had not been able to give this Paper the close analysis it deserved, and consequently he was compelled only to refer to a few detached points. The first one bore upon what Sir Henry had said with regard to the divergencies in Mr. Guild's Paper from the calculations which formed the basis of the original estimates in the Report presented, now many years ago, to that Society by the Committee of which Sir Henry was an active member. Both Mr. Guild and Sir Henry would remember that, in the course of the proceedings of the Cattle Statistics and Meat Production Committee, Mr. Ross and he, the speaker, worked over the data relative to the production of beef, and he thought they arrived at a figure which was slightly below that which resulted from the previous calculations. It depended on variations in the birth-rate and death-rate. He did not know whether those calculations were the ones to which Mr. Guild referred. (Mr. Guild agreed that they were.) They were on record and could be made available for publication in the Society's *Journal*, and he thought they ought to be published, particularly now that they had formed a part of a Paper read before the Society. The only other point with regard to the total production of meat turned upon the production of lard. Working on the figures given in the Agricultural Output of 1908, which formed part of the Census of Production, and taking into account the figures of loose fat from pigs, he could not get a figure for the home production of lard which would fit in with Mr. Guild's figures, nor would it fit in with the figures resulting from the returns collected by the Board of Trade for the Census of Production. He could only suggest that, apart from the lard from the loose fat, there was other lard produced from the shop fat, but that was already taken into account in the estimate of the production of pigmeat given in the Board of Agriculture's Report for 1913, and, consequently, could not be used as an addition to the total meat supply, including lard. The reduction from Mr. Guild's figures would only be small; but he thought it was a point which deserved some looking into, particularly as the Ministry of Food must have some more details even than those Mr. Guild had used. Another point he wished to draw attention to was the seasonal variations in the number of cattle in Great Britain referred to on page 536, which were based on figures calculated from a sample census which was taken by the three Boards of Agriculture, and which were worked up by that Committee to which Mr. Guild referred. Of course, when they came on towards the

annual census of each year, they found their figures were wrong. That meant, of course, that the whole of the error was not accumulated in their June forecast, but must have been distributed over the previous months. He thought it was intended, when they disbanded that Committee, that the Board of Agriculture should go over those figures and try and smooth the error out. He did not know whether they had been able to do that, but, at all events, there must be some slight modification of those index figures which Mr. Guild had used. Again, he thought the alteration could only be a small one. Then with regard to the last half of 1917 and the early killing of cattle, Sir Henry Rew was quite right in saying that it was not that week in December, 1917, which brought about control. Control had been in the air ever since July in that year, and if they took, as he had occasion to take at that time, the weekly Returns of Cattle going into the markets, and were to set aside a column for remarks and inscribe upon it what was the state of the administrative barometer with regard to control or no control, they would find it had a very remarkable effect on the way in which cattle were coming into the markets in that period. He thought it must have escaped Mr. Guild's eye that, in Part II of the Report of the Army Cattle Committee, with which he had something to do, figures were given as to the average weight of dressed carcasses of cattle in the quarter ending the middle of November of that year, and of the previous year. He remembered those were statistics he collected himself from some of the leading firms dealing in cattle. For those particular 11 weeks of 1916 about 34,000 cattle came under review. The average dressed weight of the carcase was 631 lbs. for that period. They must not take it as being the average for the year, which was bound to be quite different. 35,500 cattle which were slaughtered in 1917 for civilian consumption dressed out at only 573 lbs. per carcase, the reason being that all the old cows in Ireland were shipped over here in that period. All the slaughter of 76,000 Army cattle had not much effect in producing any scare on the part of even the newest of new Government Departments. They dressed out at 605 lbs., not 610 lbs. That was an additional piece of information which should be taken into account. Then with regard to the relation between the prices of mutton and beef and its effect upon the sheep flock, he remembered that at one period, he thought in 1917, he went into that question with a fair amount of elaboration and tried to work out by comparison over a considerable number of years what the relation was and how close it was. Beyond saying that there was a relation between the prices of the two, and that it probably had an effect upon the production of mutton, he thought it would be rather rash to attempt to relate the two articles any more closely than that. If they said the price of mutton was high and out of proportion to the price of beef, then they had to expect the farmer to do an 18 months or 2 years gamble as to whether he was going to increase his sheep flock or not, and a very large number of factors were bound to come into operation

during the interval. The farmer was much more likely to take a conservative view of things than an expansive view, and they would not find the relation anything like so close as, from some of the figures on paper, they might have expected would result. Those were all the points he had noted for comment, and they did not amount to very much when all was said and done. He felt rather a grievance against Mr. Guild in that he had not left him anything more important to say.

Mr. GOODSIR said he was concerned more particularly with the import meat trade and had always looked at agricultural statistics from the outside, and not from the inside. He was very pleased at hearing from such an authority as Mr. Guild appeared to be, how he arrived at the estimates of the home supplies. He was the more interested, because, as an outsider and as one of the largest handlers of imported meat, he had never been able to reconcile with the facts of the case the estimates put forward by the Board of Agriculture and the Ministry of Food as to home supplies. Mr. Guild's figures had been interesting and instructive; and he cordially thanked him for the insight he had given into the method of arriving at the basis of his calculations; and though he could not find fault with any single statement made nor with the deductions drawn from these statements, still he was not at all satisfied that the conclusions which Mr. Guild reached, as to there being a shortage in this country of home supplies, were correct. The evidence for and against that theory was to be found, not in any detailed argument, but in the broad results of the 18 months following the end of the war. In 1917 it had been conclusively proved, to the satisfaction of the Ministry of Food, that there was a shortage in this country and that rationing was necessary. Mr. Macrosty had said that the introducing of rationing at the end of 1917 and the beginning of 1918 was not altogether a "scare" action; but to the onlooker there did seem to be a good deal of panic legislation about it. The heavy supplies that had been marketed from July to October, 1917, were in excess of what would have been marketed in ordinary events. Farmers, fearing what was going to happen in 1918 under control, marketed more than they should have done, and the effect was a temporary shortage in the January, February, and March following. It was that severe temporary shortage which finally brought about, he believed, the introduction of rationing. It may have been "in the air" before, but that brought matters to a crisis. Within a very short time it became pretty evident there was no real shortage in English supplies. The reduction in marketings caused by the rationing figure, and the reduced consumption caused by higher prices, together had the effect of bringing the home supplies and the demand into line, and since that time there had never been any real scarcity of home supplies of meat. With regard to imported supplies, there had of course been a serious falling off; and if there had been any great reduction in home supplies, the simultaneous

reduction in imported supplies must inevitably have brought about a great scarcity of meat. But the country now found itself in possession of stocks of unwanted meat far beyond what it ever dreamed of holding in times of peace. There were 100,000 tons lying in the stores of this country. That particular result seemed to him to suggest there had been a good deal of unnecessary pessimism in the estimates of the Government as to the shortage of home supplies. He was quite prepared to admit that consumption had fallen off 25 per cent., but that was not the result so much of short supplies as it was the effect of high prices. The general opinion was that if there was any temporary tightness at present in the home supplies, it was only because stock was being held back awaiting the removal of control, when higher prices were hoped for by the farmers. To that extent they might be keeping stock off the market. The general evidence—he did not say specific evidence, which was very difficult to obtain—through the country was, that there were full supplies of home meat in the country. He would say with regard to the Government's policy in the matter, that although he criticised it from time to time when he had the opportunity, as being largely a political move rather than one based upon the economic position, it had this good result, which he was bound to admit, that the home herds and flocks had been wonderfully maintained during a time of great national stress; and it was a feather in the cap of those who aimed at that result—farmers and Government together. He felt that the shortage of home supplies was, fortunately, not so severe as was thought by the Government and as had been stated by Mr. Guild in his Paper.

The CHAIRMAN said he could offer no observations on the Paper, except as a member of the public. It had interested him exceedingly; but he was not competent to discuss it or criticise it in any detail.

A vote of thanks to the author was carried unanimously.

Mr. GUILD (in reply) said he thanked them for the vote of thanks which had been passed and for the kind words Sir Henry Rew and Mr. Macrosty had used. Referring to one or two of the points made, he said as regards the question of the inclusion of lard twice over, that did not arise, because in the total estimate he took the pigmeat in any form. The question of whether he had put too much or too little into lard was another question altogether. There was certainly no duplication. He was sorry if his form of words conveyed any aspersion on the Department, to the effect that the measures taken in 1918 were panic measures. As a matter of fact he had shown in another part of his Paper that those measures were being contemplated earlier in the year and that this was public property at the time. He said that was partly what governed the position throughout 1917, the fact that the public were well aware that the Ministry

were discussing measures of control, and the shortage which came in the third week of December provided the opportunity for putting into operation measures which had been prepared a considerable time before. As regards the error in the seasonal estimates of the Livestock Committee to which Mr. Macrosty had referred, he had made some attempt to distribute that throughout the year and correct the actual estimates before arriving at a normal seasonal variation. On the Paper in general, all he could say was that the lack of reference to authorities of the standing of Sir Henry Rew, Mr. Macrosty, and Mr. Hooker must not be taken as a sign of neglect, but was rather because he could not hope that his work, based on the little experience he had had, could stand on the same level as their work, which was the result of a lifetime of experience and knowledge. He wished to take that opportunity of expressing how much he was indebted for the little he knew to the opportunity of advice and consultation with Sir Henry Rew and Mr. Macrosty in his various official duties. In conclusion he wished also to make public acknowledgment to his Staff at the Ministry of Food for the assistance they had given him, and in particular to Mr. Terry, who had been in charge of the livestock statistics of the Ministry of Food for some time.

The following Candidates were elected Fellows of the Society :—

P. L. Bennet.	Sir Lynden Macassey, K.B.E., K.C.,
F. Eyles.	D.Sc.
H. P. Griffiths.	E. C. Ramsbottom.
Sir Lancelot Hare, K.C.S.I., K.C.E.	Frank Sandon.
H. G. Holmes.	F. Ogden Whiteley.
John Koren.	W. T. Williamson.
R. W. Lewis.	

Corporate Representatives.

Otto R. Eichel, M.D., *representing the New York State Department of Health.*
H. W. Spooner, *representing the British Petroleum Company, Ltd.*