

Output and Prices in UK Agriculture, 1867–1914, and the Great Agricultural Depression Reconsidered*

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Abstract

This article is based on the late J R Bellerby's United Kingdom agricultural output series. It does not use his published series, but rather it employs his unpublished manuscript originals. The published series was presented in undifferentiated terms whereas the manuscripts present a full product differentiation, as well as individual price series for those products. The article proceeds to use this material in three ways. It establishes the output estimates as a credible source by comparison with other estimates; it constructs a composite agricultural price index using that series; and finally the index is used to illustrate different ways to understand the transformation of UK agriculture in the late Victorian and Edwardian period.

IN economic history we find it difficult at times to make meaningful analyses about movements and adjustments in economies without involving prices. These may be individual commodity prices, or composite industrial or other sector prices. We can manipulate such series and talk about terms of trade and intersectoral movements, and inter-country adjustments. Price indexes are fundamental to these issues. They are our primary data, but also they are our deflators, inflators and so on. Patrick O'Brien has made us question the role of agriculture in eighteenth-century British economic growth through his construction of a composite agricultural price index, a comparable industrial prices index, and the interaction of the two in a terms of

trade index.¹ Some years ago W B Rothenberg, in outlining the pivotal role played by agriculture within the overall sectoral adjustments in the Massachusetts economy of the late eighteenth and nineteenth century, reviewed the price indexes available to help her isolate those adjustments. She argued very strongly that she '[did] not have a price index relevant to that population, composed on the farm products characteristic of that agriculture, constructed from the prices received by those farmers, and weighted by the relative importance of each of those products to those farmers.'² What did she do? She constructed one. For Irish agriculture, in that crucial period of Irish development after the Famine, I have constructed a composite prices index.³

But what of Britain in the comparable time period, after the Repeal of the Corn Laws, during the period of 'High Farm-

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¹ P K O'Brien, 'Agriculture and the Home Market for English Industry, 1660–1820', *Eng Hist Rev.* C, no 397, 1985, pp 773–800.

² W B Rothenberg, 'A Price Index for Rural Massachusetts', *Jul Econ Hist.* XXXIX, 1979, p 975.

³ Originally in M E Turner, 'Towards an Agricultural Prices Index for Ireland 1850–1914', *The Economic and Social Review*, 18, 1987, pp 123–36, now revised in 'Output and Productivity in Irish Agriculture from the Famine to the Great War', *Irish Economic and Social History*, XVII, 1990, especially pp 67–9.

ing', into the Great Depression, and out again and up to the Great War? This was a period which blossomed with fact-finding missions by Parliamentary Select Committees; it provoked wide debates on the Depression itself and related issues, such as contagious diseases. And within the period, in 1866, the annual agricultural census or June Returns was begun. The comparable Irish returns date from 1847. In many ways they are fuller than the British census returns. For example, returns of crop yields in Britain were not made until 1884, but they had been a mainstay of the Irish returns for a long while. This Irish aside has significance in view of what previous historians of output have done because yields are an important element in estimating production and output. Historians of output in this period, or at least for that part of the period before the 1880s, all had to perform heroics of assumption and extrapolation to complete their series of output estimates, and that extrapolation was often dependent on deriving a British or UK estimate but based on Irish crop yields.⁴ And the problem of collating data did not end with crop yields, there were also problems regarding the sizes of milk yields, wool clips, and carcass weights.⁵

But even if the data could be found and manipulated there is more than one

definition of output. Ultimately we seek measurements of gross output after deducting for seed retained, for animal mortality, and for the recycling of crops as animal feed, and also after deductions for the recycling of milk for consumption by pigs and calves, and any other parts of agricultural output which were recycled and which should be deducted from total production to produce gross production. This gross production becomes sales off farm, *but* including farmers' own consumption.⁶ Rothenberg referred to this output as 'net', while most historians use the term 'gross'. The term 'net' is more usually reserved to define final output after deducting inputs.

This is not the place, however, to rehearse definitions and the problems involved in constructing agricultural output series.⁷ Instead we take a UK agricultural output series, in the main unadjusted, and do three things with it: we establish the series as a credible source, or at least no more incredible than the ones already at our disposal; we construct a composite agricultural price index using that series; and finally we use the index to suggest a different way to understand the transformation of UK agriculture in the late Victorian and Edwardian period.

I

Ultimately the improvement to our understanding of the period may come with the construction of a composite agri-

⁴ E M Ojala, *Agriculture and Economic Progress*, Oxford, 1952, especially pp 191-217; J R Bellerby, 'The Distribution of Farm Income in the UK 1867-1938', reprinted and revised in W E Minchinton, ed, *Essays in Agrarian History*, II, Newton Abbot, 1968, pp 261-79; and T W Fletcher, 'The Great Depression of English Agriculture 1873-1896', reprinted and revised in Minchinton, *Idem*, pp 241-57.

⁵ For example see D Taylor, 'The English Dairy Industry, 1860-1930', *Econ Hist Rev*, 2nd ser, XXIX, 1976, pp 585-601. See also a critique of the availability and usage of milk yield data in T W Fletcher, 'The Economic Development of Agriculture in East Lancashire, 1870-1939', MSc Leeds University, 1954, Appendix III. For contemporary debate and estimates on milk yields, carcass sizes and wool clips see P G Craigie, 'Statistics of Agricultural Production', *JRSS*, XLVI, 1883, pp 26-30; for a discussion of carcass weights see R H Rew, 'Production and Consumption of Meat and Milk: Second Report', *JRSS*, LXVII, 1904, pp 374-78; and for a discussion of milk yields see *Idem*, 'Production and Consumption of Meat and Milk: Third Report', in *Idem*, pp 385-93.

⁶ This is the standard procedure though P E Dewey expressly omits farmers' own supplies, P E Dewey, *British Agriculture in the First World War*, 1989, p 246. My thanks to Peter Dewey for confirming this.

⁷ There are many examples of the ways scholars have tackled this problem, for example, for Massachusetts see Rothenberg, 'A Price Index'; for the UK see Ojala, *Agriculture and Economic Progress*, pp 191-217; for Ireland see, amongst others, C Ó Gráda, 'Irish Agricultural Output Before and After the Famine', *J Eur Econ Hist*, 13, 1984, pp 149-65 but especially 159-65; and for Canada see R M McInnis, 'Output and Productivity in Canadian Agriculture, 1870-71 to 1926-27', in S L Engerman and R E Gallman, eds, *Long-Term Factors in American Economic Growth*, Chicago, 1986, pp 737-78, especially pp 763-8.

cultural price index. Before we proceed with that construction we linger awhile and discuss the indexes that are already available. Officially, agricultural price indexes were first published in 1913.⁸ Using weights for each commodity in the series, those weights based on the value of sales off farms for the period 1906–8, and in association with price relatives for those same commodities, a composite price index was made available for England and Wales from 1908. There were adjustments over time to reflect the changing face of agriculture as indicated in changes in the relative weights of the commodities. The Irish were one step ahead in the construction of their own agricultural price index which is available from 1881–1915.⁹ But what else is available? There are of course some well-known and well-used indexes. For example, the Rousseaux series includes separate indexes for vegetable and animal products as well as a total agricultural products' index for the period 1800–1913, and there is the Sauerbeck-Statist price index for the period 1846–1938.¹⁰ In general there are many individual product price series or raw prices.¹¹

The only relatively modern attempts to construct afresh a composite price index for the British agricultural sector (in fact for the wider UK) have been made by E M Ojala and J R Bellerby. The Ojala index gives just seven reference dates for the period 1867–1914, but the Bellerby index is annual.¹² Bellerby's work was based on the group research which he led at the Agricultural Economics Research

Institute at Oxford in the late 1940s and 1950s.¹³ He laboured many years to construct many series on agricultural farm income and related topics.¹⁴ It is the Bellerby output series on which the present study is based. We may criticize or highlight some of the problems he encountered – at stages he confesses to short cuts, guesses and intuition – nevertheless we take his raw data, unadjusted for criticism, and reconstruct a new agricultural price series. It would take a major research project to start afresh, such a project would face the same data and data limitations, and while it might wrinkle the edges and make marginal adjustments here and there,¹⁵ ultimately the method of construction would remain intact, and we hazard the guess that the results would remain closely the same.

II

Those familiar with Bellerby's work will know that he was more interested in aggregate farm incomes and not the component parts of that income (that is the contributions of individual crops and animals), and as such there is no statement in his published work of individual product outputs. Our earlier quotation from Rothenberg provided a list of the necessary items needed to construct a price series. Individual product outputs are essential. They establish a system of distributional weights for the final construction

⁸ MAFF, *A Century of Agricultural Statistics: Great Britain 1866–1966*, HMSO, 1968, pp 85–6.

⁹ Agricultural Statistics, Ireland 1915, 'Return of Prices of Crops, Livestock and Other Irish Agricultural Products', BPP, Cd 8452, 1917, pp 5–7.

¹⁰ B R Mitchell, *Abstract of British Historical Statistics*, Cambridge, 1962, pp 471–5.

¹¹ Mitchell, *Abstract*, pp 488–9 for wheat, barley and oats for the period 1771–1938.

¹² Ojala, *Agriculture and Economic Progress*, p 210; Bellerby, 'The Distribution of Farm Income', pp 276–7.

¹³ Bellerby's index was based on the Paasche formula for construction. C H Feinstein noted that this was an unusual procedure in the face of the more normal construction using the Laspeyres' formula. Others who construct price indexes of this sort generally employ the Laspeyres' formula. C H Feinstein, *National Income Expenditure and Output of the United Kingdom*, Cambridge, 1972, p 50.

¹⁴ The list of publications arising from this research team was large. They are too many to list but a flavour can be obtained from the pages of *The Farm Economist*, for the 1950s.

¹⁵ As Fletcher once did to the Ojala estimates, in Fletcher, 'The Great Depression', especially p 256, and also in his unpublished manuscripts, especially a typescript 'Notes on the Gross Output Estimates'. These manuscripts are in the custody of Dr Ian Blanchard of Edinburgh University. My thanks to him for permission to consult them.

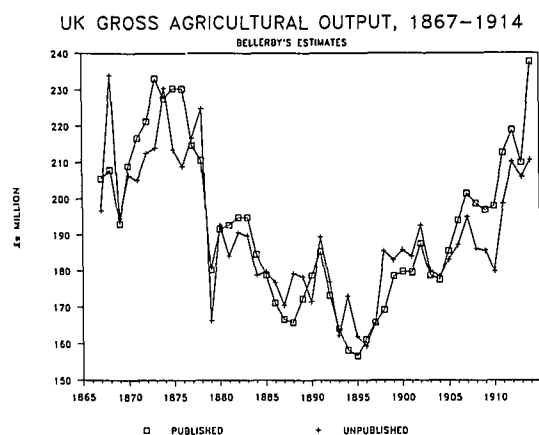


FIGURE I

of an index. Fortunately a version of Bellerby's product outputs has survived, in part, in his working papers which have been deposited at Reading University.¹⁶ Within them there are precise instructions as to how the outputs were derived with detailed schedules of the individual product outputs for the years 1867-1938. Therefore we can derive not only product weights at a particular moment in the chronology, but also we can see how those weights changed over time. The dating of some of these manuscripts is unclear though a postscript to a 1968 revision and reprint of a 1953 article indicates the rough and ready date.¹⁷ The manuscripts provide, therefore, a product differentiation as well as a final estimate of gross output.¹⁸ The gross output estimate from the unpublished manuscripts and also that from the final published version are compared in Figure I. Evi-

dently, revisions were made before the final estimate was presented in 1968, but what those revisions were remains obscure. However, the correlation coefficient between the two estimates is 0.88. For more years than not during the chronology the final published estimate is higher than the initial unpublished version, and always higher from 1905-14, and in general the amplitude of yearly fluctuations of the published estimate is smaller than the one observed in the original unpublished calculation. There are occasional discontinuities between the two estimates in the direction of the long-term trend. For example, there is a fall in the unpublished trend in 1874/5 but a rise in the published trend in the same years, a rise in the unpublished in 1894 but a fall in the published. There are other discontinuities, but in general both estimates tell the same story. There was a rise in the value of output to the mid-1870s, a savage fall to the mid-1890s and then a substantial recovery towards the Great War. This is not an unfamiliar tale.

How do these series compare with other estimates? Our comparison is necessarily limited. In 1912, in fulfilment of the Census of Production Act of 1906, there was published a report of *The Agricultural Output of Great Britain* based on the single year 1908. This employed a definition of output with which we are familiar – sales off farm and farmers' own consumption – but it was an assessment which was conducted separately for Britain and Ireland.¹⁹ Here we combine the two in the reasonable expectation that they were conducted in like manner. In addition, we can compare the Bellerby estimates with those produced by Ojala for groups of years, and also compare them with Fletcher's reworking of Ojala where he (Fletcher)

¹⁶ Bellerby MSS, Institute of Agricultural History, Museum of English Rural Life, Reading University, D/84/8/1-24, especially 17.

¹⁷ Bellerby, 'The Distribution of Farm Income', p 279.

¹⁸ In what turned out to be an unsuccessful attempt to trace the possible disaggregation of data according to country I have corresponded with a number of scholars who worked at the Agricultural Economics Research Institute at Oxford. My thanks to Dr E M Ojala in retirement in New Zealand, Emeritus Professor D K Britton who with K E Hunt was responsible for constructing, independently, gross output estimates for the period 1900-38, and also to Professor G H Peters of the International Development Centre of Oxford University.

¹⁹ Department of Agriculture and Technical Instruction for Ireland, *The Agricultural Output of Ireland, 1908*, HMSO, 1912, passim; and Board of Agriculture and Fisheries, *The Agricultural Output of Great Britain*, Cd 6277, 1912, especially p 25.

TABLE I
Different Estimates of Agricultural Output for the United Kingdom, 1867/69, 1870/76,
1894/1903 and 1908

	Crops	Animals	Total (All in £s Million)	Crops	Animals	Total
Source		1867-69			1870-76	
Ojala	104.2	125.7	229.8	95.0	152.2	247.2
Fletcher	104.2	126.8	230.9	95.0	154.9	249.9
Bellerby 1	103.0	105.5	208.4	93.2	119.9	213.0
Bellerby 2	103.0	117.8	220.7	93.2	132.4	225.5
		1894-1903			1908	
Ojala	49.8	133.0	182.8			
Fletcher	62.0	146.2	208.1			
Bellerby 1	64.0	113.1	177.1	57.9	128.3	186.2
Bellerby 2	64.0	124.4	188.4	57.9	141.1	199.0
Census of Production				58.3	138.1	196.4
Percent Differences		1867/9 to 1894/1903			1870/6 to 1894/1903	
Ojala	-52.2	5.8	-20.5	-47.6	-12.6	-26.1
Fletcher	-40.5	15.3	-9.9	-34.7	-5.6	-16.7
Bellerby 1	-37.9	7.2	-15.0	-31.3	-5.7	-16.9
Bellerby 2	-37.9	5.6	-14.6	-31.3	-6.0	-16.5

Note: Differences between Bellerby 1 and 2 explained in text.

Sources: E M Ojala, *Agriculture and Economic Progress*, Oxford, 1952, p 208;

T W Fletcher, 'The Great Depression of English Agriculture 1873-1896', reprinted in W E Minchinton, ed, *Essays in Agrarian History*, Volume II, Newton Abbot, 1968, p 256;

Bellerby Mss., D/84/8/17 and 24, and estimates described in this article;

Board of Agriculture and Fisheries, *The Agricultural Output of Great Britain*, Cd. 6277, 1912, p 25, and Department of Agriculture and Technical Instruction for Ireland, *The Agricultural Output of Ireland*, 1912, p 5.

made certain adjustments to the price material. The grouping of the years is determined by Ojala because there are no other annual series except those estimated by Bellerby and produced here. The comparisons are presented in Table I.

The differences between the two Bellerby estimates arises because he made two kinds of adjustments to his initial estimate. Originally it was priced at market prices or wholesale prices (Bellerby 1), but that which was farmer's own self-supplies, he said, should have been valued at rural retail prices. An adjustment to accommodate this necessarily raises the value of gross output. In addition he made adjustments for inventory changes.²⁰ In the main these two adjustments affected

animal products more than others (inventory changes were entirely calculated on the basis of livestock changes) and without precise guidance as to the distribution of these adjustments we have added them entirely to the animals sector. From Table I we see that the value of these adjustments was quite large (Bellerby 2), but certainly that proportion which was derived by revaluing farmers' own consumption are based on 'only very scanty data', and statistical manipulation thereafter. We may shy away from these estimates for their imprecision, but it has to be said that in the main other researchers have not always paid as much attention to detail as Bellerby clearly did.

Referring back to Table I we see for the 1860s a near perfect agreement between the various authorities on the size of crop output, a near perfect agreement

²⁰ See Bellerby MSS D84/8/17, pp 119-22 and 110-111 and also Bellerby, 'The Distribution of Farm Income', p 276; see also Feinstein, *National Income*, pp 40-41, who revalued farmers' own supplies back in terms of market prices.

between Ojala and Fletcher on animal output, but a smaller estimate from Bellerby on the size of the animal contribution. For the 1870s the crop estimates pretty well remain in agreement but the difference between Ojala/Fletcher and Bellerby over the size of the animal contribution widens. For Ojala the animal contribution increased by 21 per cent but for Bellerby the increase was only 12 per cent. For the turn of the century the separate estimates from Fletcher and Bellerby are very close in terms of the contribution of crops, and for animals Ojala and Bellerby 2 are not so very different. In all cases, in total output terms, Bellerby could not be accused of exaggeration. Finally, we can make a comparison with the estimates of the first Census of Production for the single year 1908. In this case we have aggregated the appropriate figures from two reports, the independently constructed estimates for Ireland and Great Britain.²¹ Bellerby should have been pleased and encouraged to see such a closeness of fit between his estimates and the official ones, but if he was, he made no mention of it in his writings.

We can make one other comparison. Working independently Peter Dewey and I (hereafter Turner) have also estimated agricultural output. In Dewey's case it was the annual average of 1909-13 for Great Britain, and for Turner it was for Ireland annually from 1850-1914.²² From Turner's estimates of Ireland and from Bellerby for the UK it is possible to rework output on annual averages for the years 1909-13 thus to conform with Dewey. Thus it should be possible to add Dewey and Turner to equal Bellerby. If we do this without any further adjustments we find the following:

	Crops (in £s Million)	Animals	Total
UK - Dewey plus Turner	69.0	145.0	214.0
UK - Bellerby 1	63.4	132.8	196.2
UK - Bellerby 2	63.4	141.7	205.1

In this case the difference between Bellerby 2 and Dewey and Turner combined is just four per cent for total output, with the difference between the crop estimates twice this size and for animals half this size. By casual statistical fit we have a close tolerance between these estimates. This may not be the correct comparison to make because neither Dewey or Turner adjusted the price paid for farmers' own consumption, and Dewey omitted farmers' own consumption altogether.²³ In addition, these three authorities did not all include the same products in their estimates. For example, Turner omitted some minor crops altogether. If we correct for some of these differences, and therefore as nearly as it is possible compare like with like, we find the following, and a difference of 6.5 per cent between the two estimates;

	Crops (in £s Million)	Animals	Total
UK - Dewey plus Turner	57.1	142.2	199.3
UK - Bellerby	48.5	138.6	187.1

On the one hand we may conclude that there are no reasonable estimates which we can use, but on the other we should face up to the fact that a completely fresh approach to the problem of estimating output will be no guarantee of better results; the same problems and essentially the same data would confront researchers. In addition, the reasons why economists and historians attempt to estimate output in the first place can be different. In Fletcher's case he was keen to revise Ojala. He did this for two reasons: simply for

²¹ cf note 19.

²² M E Turner, *After the Famine: Agricultural Structure, Output and Performance*, (Forthcoming), Chapters 4 and 5, and Dewey, *British Agriculture* p 247.

²³ *Ibid*, Appendix C, p 246.

the sake of it, which he does successfully in an upwards direction for the estimates at the end of century; but also because he had an eye on the nature and depth of the late nineteenth-century depression. He necessarily moderated the depth of that depression in his revisions, but he brought out clearly the bifurcation of the agricultural economy into the crop and livestock sectors where the suffering of the grain producers was a gain to the livestock farmers. This pointed to the complexity rather than the simplicity of the agrarian economy, and he clarified the language of unremitting depression which was in play in the literature.

Referring back to Table I, we see from Ojala's estimates that output fell by over 20 per cent from 1867/9 to 1894/1903, though according to Fletcher this was more modestly estimated at 10 per cent. He (Fletcher) was unhappy with 1867-9 as a base starting point since the peak of output was reckoned to be in the early 1870s.²⁴ In general, the estimates in Figure 1 agree with that. When Fletcher adjusted the base to 1870/76 his and Ojala's estimates necessarily increased the size of the base and therefore increased the size of the subsequent decline in output. All authorities accept the view that there was a decline, but from the Bellerby estimates we generally see a smaller decline. Fletcher achieves one of his principal objectives of moderating the depth of the depression for animal output, or even increasing that animal output according to which set of base years is employed. In a separate estimate for England alone Fletcher adjusted the two end periods to the annual averages of 1867/71 and 1894/8 and this resulted in a fall of 37 per cent in crop output, but a 10 per cent increase in animal output, and a final, relatively modest decrease of 13 per cent in total output. If we perform the same adjustments to the Bellerby esti-

mates we find that UK crop output decreased by 36 per cent, animal output declined by only 3 per cent, and total output declined by 18 per cent.

From these calculations and from certain of those in Table I we can certainly identify or confirm what F M L Thompson calls the 'Fletcher effect', though we are unable to turn the corner fully and see an actual improvement in the value of output of the animal sector.²⁵ This Fletcher effect can be seen as both a moderation in the extent, meaning depth, of the Great Depression, and also as an actual improvement in the fortunes of the livestock sector. Fletcher demonstrated it nationally in the calculations we have quoted, and he found a regional expression for it in Lancashire.²⁶ From independent calculations for England alone Thompson has demonstrated it on a wider basis, employing a county by county calculation of total output for the years 1873 and 1911. At the national level he found a 25 per cent decrease in total output from 1873-1911, within which the counties of Lancashire and Cheshire actually experienced increases in output and 10 other counties performed better than the national average. This was measured in current price terms. In constant (1911) price terms there was no change in the national output over the period 1873-1911 but now including seventeen counties where output actually improved. While we do not perform the same calculations in this article, nevertheless we will return to this point later and measure the 'real' movement in the value of agricultural output, but by a different method.

²⁴ Fletcher, *The Great Depression*, passim.

²⁵ F M L Thompson, 'An Anatomy of English Agriculture, 1870-1914', Chapter 11 of B A Holderness and M E Turner, eds, *Land, Labour and Agriculture, 1700-1920: Essays for Gordon Mingay*, 1991, pp 211-40.

²⁶ T W Fletcher, 'Lancashire Livestock Farming during the Great Depression', reprinted in P J Perry, ed, *British Agriculture 1875-1914*, 1973, pp 77-108.

III

Within the Bellerby manuscripts along with the meticulous calculations of output there exists, *pari passu*, the price material which went into the construction of the output series. As we have indicated already, the collation of the price material may sound a few notes of caution and criticism. In the main he used official product price series which exist from 1906, spliced to the Sauerbeck product price series before this date. The main weaknesses in his estimates, fortunately, involve those products which in weighting terms have the least influence over the composite price index. His estimate of the vegetable output was the most unreliable of all the estimates, derived as it was from an official vegetable price series from 1906 to 1938 spliced to an index of imported fruit(?) prices, which in turn was based on imported apple prices from 1882 to 1905, and imported orange and lemon prices from 1867 to 1881.²⁷

If Dewey's estimates for GB which we presented earlier are a better guide to the contribution of vegetables then we can certainly sound a note of caution. According to Dewey, for GB, the contribution of vegetables amounted to an annual average of £3.6 million for 1909-13 (peas, beans and cabbages) but for the UK from Bellerby they amounted to £7.5 million (for the same and a number of additional vegetables). Turner's estimates of Ireland, in keeping with other historians of that country, assumed that all vegetables, or rather non-garden root and green crops, were recycled as animal fodder and made their contribution to output through livestock. At the most, historians have assigned an arbitrary five per cent mark-up of all arable output to represent marketed vegetables. Table 2, for three specific years, demonstrates that at well under five per cent of output they are not an import-

ant feature of the agricultural economy (except as fodder) and their omission is not significant.²⁸ For several marginal products there were no price series available. These included rabbits and flowers. Bellerby made the assumption that they represented a constant proportion of total output. These 'other' products have been omitted from the remaining exercise and the gross output adjusted downwards accordingly.²⁹

Thus from the Bellerby manuscripts we can construct Table 2, the distribution of gross output for the three years 1870, 1895 and 1910. These distributions now form the weights to be attached to the individual product price series in the construction of a composite price series. Without necessarily being the precise years, these represent the essential features of the changing UK agricultural industry: near the end of 'High Farming'; at the bottom of the Depression; and on the eve of the Great War after a period of recovery. In product-comparative terms, the most dramatic change in UK agriculture was the demise of the corn sector, particularly wheat, but also barley. Conversely, there was the rise in the contribution of certain animal products, in particular cattle throughout the period, pigs during the depression, and milk and milk products after the depression. Crops represented one half of UK output in 1870 but only one third by 1910.

In Table 2 we also compare the product distributions derived from Bellerby for the UK with those we have derived by combining Dewey's GB estimates with Turner's Irish estimates. As explained earlier, there has necessarily been some adjustments of all three estimates to allow a

²⁷ Bellerby MSS D84/8/17, pp 37-8.

²⁸ Ojala faced similar problems with his estimate of vegetables, *Agriculture and Economic Progress*, pp 201-2, and these must be problems common to other estimators.

²⁹ It is a frequently used device to have what is often a vague allowance for 'other' crops and animals, often as a modest 5 per cent or so mark up of output. This is intended to account for items where data is incomplete or simply not available.

TABLE 2
Product Distribution in UK Agriculture

	1870 (1)	1895 (2)	1910 (3) (In Percentages)	1909/13 (4)	1909/13 (5)
<i>Crops</i>					
Wheat	12.7	2.3	4.5	5.2	4.0
Barley	7.9	4.5	3.5	4.1	2.5
Oats	4.3	3.5	3.7	4.1	3.5
Rye	0.01	0.01	0.01		
Potatoes	7.3	7.2	4.7	5.7	7.1
Hay	6.2	9.4	7.6	9.2	11.5
Straw	4.6	2.5	2.0		
Vegetables	1.6	3.0	3.6		
Fruit	0.5	1.7	3.0		
Hops	1.2	1.2	0.9		
Flax	0.9	0.2	0.2		
	47.2	35.5	33.7	28.3	28.6
<i>Livestock</i>					
Cattle	10.9	13.8	17.0	17.4	20.2
Sheep	6.3	6.9	7.1	7.3	12.2
Wool	4.1	3.4	2.8	2.9	2.9
Pigs	8.1	13.9	4.4	8.5	11.4
Milk and its products	19.2	19.4	26.4	28.0	18.0
Eggs	2.0	3.7	5.0	7.5	6.7
Poultry	0.7	1.3	2.0		
Horses	1.5	2.1	1.8		
	52.8	64.5	66.5	71.6	71.4

Subject to rounding errors.

Sources: Columns 1, 2, 3, and 4 derived from Bellerby Mss, Institute of Agricultural History, Museum of English Rural Life, Reading University, D/84/8/17 and 24.

Column 5, the addition of Irish estimates and estimates for Great Britain, derived from M E Turner, *After the Famine* Chapter 5, and P E Dewey, *British Agriculture* p 247.

precise comparison. The lower valued products have been omitted thus properly leaving those products which have the largest influence on the final composite price index. The main differences concern the sheep and milk products, especially the milk products. There is no sensible reason for this. As it happens, comparisons with the work of all other estimators who give product differentiation reveal other differences. It is perhaps fortuitous that these differences often cancel one another to some degree to produce the kinds of

reasonably close comparisons we have identified so far.

The index we produce from this data is reported in Table 3. We use price relatives for our products based on 1867-77 thus conforming with Bellerby's original estimates, and incidentally, and probably not accidentally, the same base as the Sauerbeck-Statist series.³⁰ We report Bellerby's original index alongside four new versions. In one case we use the 1870

³⁰ Mitchell, *Abstract*, pp 474-5.

TABLE 3
United Kingdom Agricultural Price Indexes, 1867-1914

Year	Yearly Weights (In all cases 1867-77=100)	1870 Weights	1895 Weights	1910 Weights	BELLERBY Index
1867	99.1	98.9	95.7	95.9	97.1
1868	101.3	99.4	95.6	96.7	93.7
1869	95.8	95.7	96.6	96.2	93.2
1870	93.1	93.1	94.4	94.0	94.8
1871	98.8	97.3	97.1	97.5	99.6
1872	102.4	100.9	100.5	100.5	103.3
1873	109.1	107.4	107.4	106.9	108.3
1874	104.6	104.0	104.1	104.3	100.1
1875	103.1	101.8	104.9	104.9	103.6
1876	101.0	100.1	103.0	101.5	102.9
1877	101.4	101.4	101.1	101.5	100.3
1878	99.0	97.5	98.9	98.0	94.0
1879	90.5	89.2	91.0	89.6	89.0
1880	95.5	94.2	96.9	95.3	91.9
1881	92.1	90.4	92.8	92.5	91.2
1882	96.1	93.6	96.4	96.3	92.0
1883	92.6	89.8	92.6	92.3	88.5
1884	87.3	84.3	88.3	88.7	83.7
1885	83.5	79.4	83.4	83.2	78.6
1886	80.9	77.2	81.3	80.4	77.4
1887	77.4	74.7	78.2	78.0	73.8
1888	79.9	76.5	79.8	80.0	75.1
1889	80.2	76.4	80.6	80.2	76.2
1890	81.0	77.2	80.4	80.1	76.2
1891	81.6	79.5	82.0	82.6	75.7
1892	81.5	77.0	81.8	81.2	75.8
1893	80.2	76.4	81.8	80.5	76.5
1894	79.0	72.5	78.2	77.7	73.0
1895	75.1	70.0	75.1	75.7	70.9
1896	71.9	68.0	71.7	73.0	68.6
1897	78.3	73.6	78.0	77.4	74.2
1898	81.2	76.9	80.6	79.4	70.9
1899	76.7	71.7	76.6	77.2	72.3
1900	81.9	76.0	81.5	81.6	76.5
1901	82.4	75.7	81.9	81.2	76.7
1902	87.6	78.8	85.1	85.0	78.3
1903	82.0	74.6	80.5	80.8	76.5
1904	80.4	75.1	79.6	79.9	75.2
1905	81.6	76.3	81.4	81.7	77.8
1906	85.6	78.2	84.7	85.5	80.9
1907	86.4	80.1	85.9	86.6	82.7
1908	82.9	76.3	81.0	83.1	79.6
1909	85.2	79.1	83.4	84.7	80.2
1910	87.5	80.2	87.2	87.4	83.1
1911	91.0	83.5	89.3	90.4	85.1
1912	96.3	89.6	95.3	96.1	89.8
1913	95.2	88.1	95.5	95.0	88.8
1914	94.9	85.9	92.2	93.6	94.8

Source: See Text.

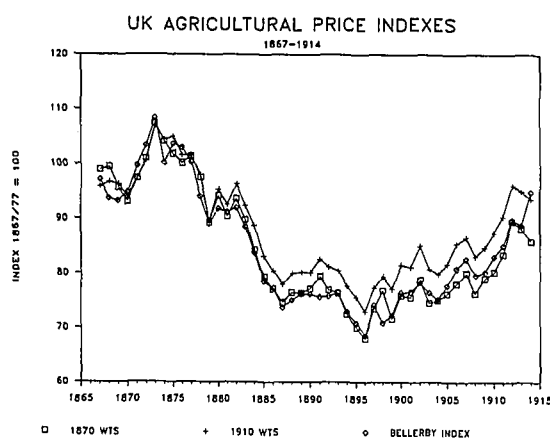


FIGURE 2

product weights, and in the others the product weights for 1895, 1910, and finally an index which uses annual product weights.³¹ The 1870 and 1910 versions, and the pre-existing Bellerby index are plotted in Figure 2.

IV

From Table 3 we see the essential difference between the weights for 1870 and 1910 as the product differentiation switched from crops to livestock. Yet those differences do not confuse an apparently straight-forward piece of history. This was essentially the decline in output we now call the Depression. The high point of Victorian price history is perfectly reproduced, as is the 1896 low point, followed by the recovery into Edwardian times. The choice of scales may exaggerate the trend but a more useful function of this price series is to use it in association with the estimates of the value of output. Referring back to Figure 1 and the general trend of output, this trend seems to be replicated in the price movements in Figure 2. But the eye can deceive. The general decline in the value of output

³¹ Such a method was originally employed in constructing my Irish series, on which occasion I expanded fully the equations which represent the various formulae, Turner, 'Towards an Agricultural Price Index', especially p 128.

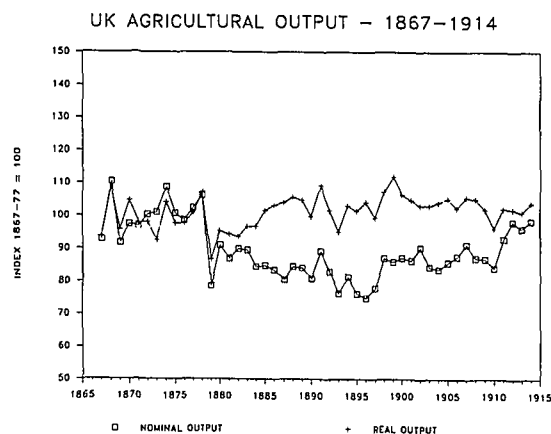


FIGURE 3

could have had at least two causes: an actual decline in the quantity produced or a decline in price; or indeed a combination of the two. On closer inspection we see that the real reason was a decline in prices.

Thus finally we use the price index as a deflator in association with the nominal output series. This is designed to adjust that output to test for price changes wholly within agriculture. What we produce is a real *volume* output series, as in Figure 3. Evidently there was a substantial downturn in nominal output from 1878/79 to 1895/6 (ignoring the upturn in 1891) – that is during the two decades of the Great Depression – but in real volume terms agriculture output actually increased, though with some reversal from 1888 to 1893. Conversely, after 1896 and the recovery in prices, while nominal output rose, the real volume of output continued to rise to 1899 but declined thereafter, or at best tended to level off. The recovery was a recovery of prices, but not necessarily an improvement of output in the agricultural industry.³²

There is some confirmation of these trends in earlier estimates. Leo Drescher's physical volume index produced in the 1930s, and calculated apparently by converting output into starch equivalents, cer-

³² See also the summary in Thompson, 'An Anatomy', pp 219-20.

tainly showed an almost continuous rise in livestock production from the late 1860s to 1914, but a somewhat erratic arable production index over the same period. In general, after smoothing the outstanding peaks and troughs in the arable index it trended downwards with an especially marked downturn in 1879. But there are serious doubts over both the completeness and the representativeness of the products Drescher included in his series.³³ O J Beilby's estimates of agricultural production for England and Wales based on calorific values showed an almost continuous rise in gross livestock production from 1885-1914, but a decline in crops from 1885-1904 before a small recovery in 1905-9 and then the resumption of decline.³⁴ This actually identifies what we have already shown with our changing product weights, the switch from arable production, or more accurately from grain production, to animal production.

We can improve on these historic measures and use the Bellerby material to construct separate price indexes for composite grain and composite animal production. The results are presented in Figures 4, 5, and 6. We have taken grain to mean wheat, barley and oats, and animal production to mean cattle, sheep, pigs, milk, wool, eggs and poultry. The products in the separate indexes represented about three-quarters of total output throughout the chronology. The major items excluded are potatoes and hay. In the sense that the depression is always characterized as a choice between the grains and certain (not necessarily all) livestock products we have captured the essence of that choice here.

Ignoring most short-term movements

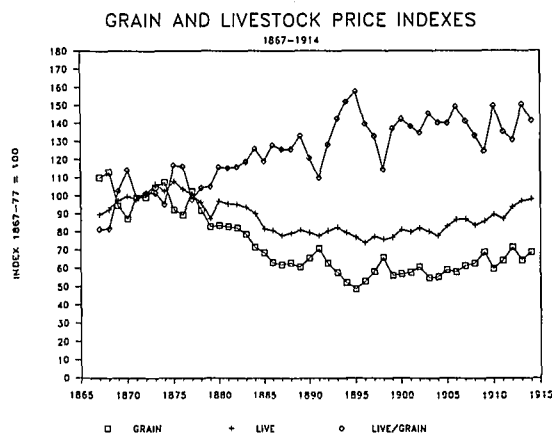


FIGURE 4

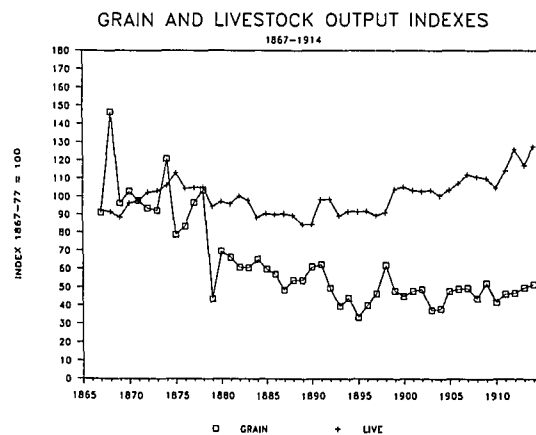


FIGURE 5

we see from Figure 4 the downturn in the two price indexes of both sectors of agriculture until the mid-1890s, but with a steeper trend for the grains. The resulting sectoral prices terms of trade therefore, in general, moved towards livestock farming. The main interruption in this trend was the see-saw motion from 1891-97, a motion which was provoked mainly by large fluctuations in grain prices. After the mid-decade, prices recovered. The reflection of this in nominal output terms is given in Figure 5. This shows (a) the steep decline in grain output down to the mid-1890s, with a marked fall at the end of the 1870s; and (b), when all the wrinkles are ironed out, the more or less flat output

³³ Originally published in German in 1935 and translated as L. Drescher, 'The Development of Agricultural Production in Great Britain and Ireland from the Early Nineteenth Century', *The Manchester School*, XXIII, 1955, pp 153-75, especially p 174, with a comment and critique by T W Fletcher, pp 176-83.

³⁴ O J Beilby, 'Changes in Agricultural Production in England and Wales', *JRASE*, 100, 1939, p 64 columns 2 and 4.

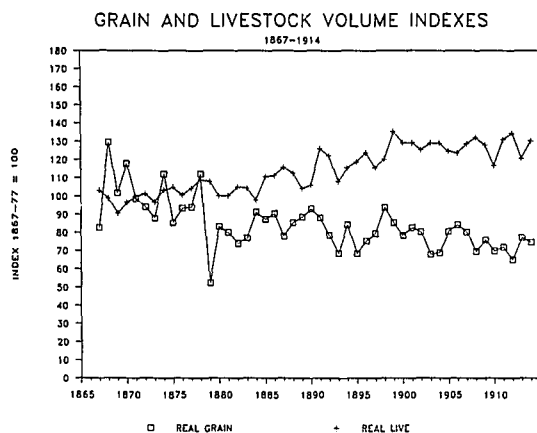


FIGURE 6

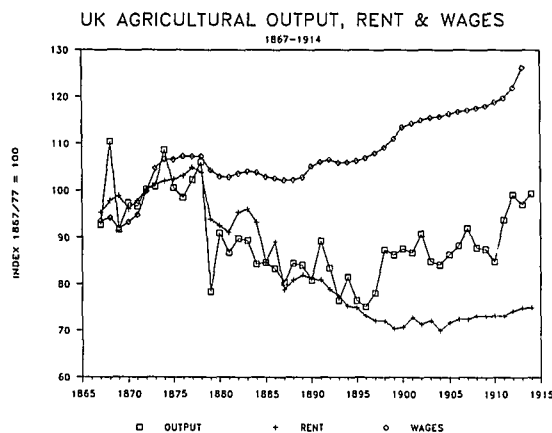


FIGURE 7

from livestock down to the mid-1890s. Thereafter both sectors of agriculture began to recover, the livestock output entirely, but the grains only marginally. We have in these two graphs the interaction of price effects on output. Figure 6 therefore is couched in real volume terms. If we ignore short-term movements we see the continuous expansion of livestock output, and conversely the decrease in grain output. Apart from short-term breaks there are now no obvious turning points in the trend apart from the massive and infamous decline in the fortunes of grain production in 1879. In the sense that last year's price history encourages this year's farming responses, more correctly we should introduce lagging effects into the analysis. This may more appropriately be a lag of two or more years. Given the overall history of the period and the clear switch from grain to animal production, such lagging adjustments, in fact, tell the same tale as we have identified, and point more to a long-term general movement than to short-term temporary changes.

The depression was real enough however, with clear regional implications for farming profits.³⁵ The equation which faced late nineteenth-century farmers, and

grain farmers in particular, was couched in terms of the decline in the value of their output relative to the movements in wages and rents. The history of rent arrears and abatements associated with the depression is well documented at the individual estate level.³⁶ The problem is easily demonstrated if we compare the new nominal agricultural output series with recently constructed nominal rent and wages series, as in Figure 7.³⁷ Wages more or less rose throughout the period, and while both rents and output fell down to the mid 1890s, the output fell more than rents down to the mid-1880s (this is more obvious if we smooth the series, even if only a three-year smooth). After the mid-1890s output rose but rents only modestly recovered. It seems strange that the recov-

³⁵ We have already alluded to this from evidence in Thompson, 'An Anatomy'.

³⁶ For example see R Perren, 'The Effects of Agricultural Depression on the English Estates of the Dukes of Sutherland, 1870-1900', PhD Nottingham University, 1967, especially pp 291-4, 298-301; G Rogers, 'Social and Economic Change on Lancashire Landed Estates during the Nineteenth Century with Special Reference to the Clifton Estate', PhD Lancaster University, 1981, p 390; D B Grigg, 'A Note on Agricultural Rent and Expenditure in Nineteenth Century England', *Ag Hist* 39, 1965, pp 147-54. See also 'Royal Commission on Agriculture 1893-6', BPP, C 8125, 1896.

³⁷ The rent index is a new composite UK index collated in association with Volume VII of the *Agrarian History*. The wages index is a splice of a UK index for 1880-1913 from the '17th Abstract of Labour Statistics', Volume LXI, BPP, Cd 7733, 1916, in conjunction with an England and Wales only index from G H Wood's unpublished *Rates of Wages and Hours of Labour in Various Industries in the UK for a Series of Years, 1907*, and kept in the library of the Royal Statistical Society, University College London.

ery in output which accrued to the farmers was not at least partially or more immediately enjoyed by the landlords as well.³⁸ At any rate, by this stage the damaging effects of relatively rising costs had helped to reshape British agriculture towards animal products, in particular towards milk and other dairy products.

³⁸ My thanks to Professor Patrick O'Brien for drawing my attention to the divergence of the output and rent series after the mid-1890s. The rent index employed here is new, but nevertheless it is heavily influenced by east of England estates. R J Thompson is an important source in constructing this index with his clear concentration on the eastern counties from Lincolnshire to Bedfordshire, 'An Enquiry into the Rent of Agricultural Land in England and Wales in England During the Nineteenth Century', originally published 1907, now reprinted in Minchinton, *Essays*, pp 57-86. Thompson was incorporated into H A Rhee's new rent index of 1946. Although he added to the Thompson index, Rhee's index was still dominated by Thompson. H A Rhee, *The Rent of Agricultural Land in England and Wales*, Central Landowners Association, 1946. The conclusion remains that the index is heavily weighted by the rents of the eastern corn-growing counties. See also Fletcher, 'The Great Depression', p 245n. The wage and output series, in contrast, are based on national estimates. The ESRC is supporting a project for B Afton, J V Beckett and M E Turner to construct a wholly new rent index. This will be more representative, geographically and agriculturally, of English, though not British or UK agriculture. It may yet lead to the revision of the divergent movement of output and rent after the mid-1890s. See A Offer, *The First World War: an Agrarian Interpretation*, Oxford, 1989, p 116 for the standard distribution of wages, rent and farm income, which in turn is based on Feinstein, *National Income*, table 23, p 160. Farm income is not the same as output, but the problem associated with the representativeness of the rent index still applies.

V

In conclusion we can make several important points. A more in-depth inquiry into agricultural output and price movements in the late nineteenth century more clearly exposes the sound logic of the British agricultural industry in adjusting its strategy away from grains and into livestock. Secondly, although there are clear enough turning points in the chronology of price movements it is perhaps too easy for us to adopt those turning point as an interpretation of agricultural production. The construction of a composite price index allows us to use that index as a deflator and assess the impact of price changes on the volume of agricultural output. In large measure the turning points disappear, grain output rhythmically decreased from the late 1860s while livestock output increased (Figure 6). The notion of a national depression is not entirely discredited by these findings, but it requires more sophisticated language than that which we have inherited largely unchanged from the Royal Commissions of the 1890s.