

Recent Findings of Research in Economic & Social History

Was the agriculture of the mid-nineteenth century really a 'Golden Age?' And to what extent, and for what reasons, could the efficiency and productivity of the agriculture of the ensuing 'Great Depression' be called into question? Here E. J. T. Collins provides a judicious assessment of recent work.

Did Mid-Victorian Agriculture Fail? output, productivity and technological change in nineteenth century farming

Of the traditional industries, agriculture was the first major casualty of economic progress. During the century of industrialisation, its share of national income and employment fell from one third to less than one tenth, and of national capital from three quarters to a third. Agricultural output doubled whilst population trebled, so that by the early 1900s, Britain was importing over three quarters of its bread grain and nearly one half of all its temperate foodstuffs, where a century before she had been almost self-sufficient.

This does not mean that nineteenth century agriculture failed, nor that it was inefficient. Earlier, historians held the view that agricultural performance was in the main very impressive in the third quarter of the century, and far from disastrous even in the Great Depression that followed. A rather less rosy picture is now emerging, however. Sentiment has turned negative to the point where it can be argued, albeit speculatively, that in a number of important respects, nineteenth century agriculture failed, not just in the Great Depression, but in the prior 'Golden Age'.

Agriculture output in the High Farming period

Conventional wisdom describes agricultural output growing rapidly during the early and mid-nineteenth century, accelerating during the third quarter, slowing down in the wet years of the later 1870s, and declining in the Great Depression. The High Farming period, 1850-73, is depicted as one of unprecedented technical progress, in which agriculture, in common with most other industries, enjoyed a generation of tranquillity and prosperity. The basis of that prosperity is analysed as a shift within mixed farming from grains to livestock. This occurred in response to changes in relative prices due to the rising

demand for meat and dairy produce. Here was the high water mark of the 'Agricultural Revolution', when output and productivity were propelled to new heights by large and growing expenditures on manures, feeding stuffs, and barn and harvesting machinery, and by a better understanding of crop and animal nutrition based on the theoretical work of Liebig and the practical experiments of Lawes and Gilbert at Rothamsted. According to one estimate, by the 1870s the value of all purchased inputs equalled about a quarter of gross output at current prices.

The possibility that, for all its much acclaimed technical achievements, this 'Second Agricultural Revolution' of the mid-nineteenth century may have failed to live up to expectations, was raised by its creator, F M L Thompson, in his seminal article of 1968.[1] 'Whether', he concluded, 'the low returns enjoyed by landlords was a special consequence of their trailing role, or whether tenants also only obtained low rates of return on their growing investment, are questions which can only be answered when it is possible to relate the increased inputs to estimates of agricultural output'. Recent research is now suggesting that agricultural growth rates were significantly higher in the second quarter of the century under the Corn Laws than in the third quarter, the Golden Age, suggesting that after an impressive start, the Second Agricultural Revolution and its new scientific husbandry quickly lost momentum. The trend is similar to that inferred from the national accounts,

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with one estimate suggesting an average annual growth rate of upwards of 1.5 per cent between the 1830s and 1850s, falling to 0.5 - 0.7 per cent over the following two decades, and another more recent one, a mere 0.2 per cent between 1856 and 1873, compared with 2.0 per cent for the whole economy.

This suggestion of a dramatic slowing down in the growth of physical output has to be reconciled with increased usage of fertilisers and feeding stuffs, and improved management.

HIGH FARMING: Intensive farming leading to high production through the use of the most advanced methods of drainage, fertilizing, rotation, feeding and farm organisation and the employment of the most efficient techniques, machinery and farm buildings. It involved high capital outlays and the application of the most advanced knowledge.

Either Thompson's input estimates are too high, or in the third quarter, large sections of British agriculture were operating under diminishing marginal, or possibly diminishing average returns. The second alternative seems likely when set within the broader context of productivity growth in the longer run. According to Collins, the underlying problem was that, with the notable exception of milk, the unit output of which rose by upwards of one third, there was only a slight improvement in average national yields between 1860 and the Second World War. [2,5] As indicated in the Table, after a strong performance in the second quarter, wheat yields levelled off from the later 1850s, and declined slightly between 1868 and 1880. Yields of fodder roots tailed off about 1880. Hay yields were static, averaging probably no more than 1.2 - 1.4 tons per acre throughout. The regional picture is complex; on the one hand, in the advanced parts of East Anglia, grain yields were already flat in the 1830s, whereas in the backward parts of Wales and south west England, they continued to improve, eventually catching up with the national average in the early twentieth century.

Not just the arable sector but, surprisingly, especially in view of its assumed critical contribution to output and profits, also the livestock sector appears to have underperformed. Indeed, the agricultural evidence suggests only a modest improvement in meat output, of at best one per cent per annum, and between the early 1850s and later 1860s only a fraction of that. But for the massive influx of Irish cattle, mainland Britain would probably have experienced a severe meat shortage prior to the development of refrigeration and subsequent growth in imports. The impending 'meat famine' had become a major talking point by the late 1860s, leading to suggestions for the establishment of large-scale intensive meat production units along the lines of the modern American 'feed-lot' and, as an antidote, the uptake of vegetarianism. Reliable witnesses testify also to a lack of progress in dairy farming, it being observed that (apart from in a few favoured districts, such as Cheshire and Somerset), standards of output were little higher in the 1860s than 30 years earlier. Indicatively, between

the 1840s and 1860s, rents in the arable counties rose more quickly than in the pastoral counties, reflecting differences in profitability, and probably growth rates. The increase in livestock prices during the Golden Age, normally attributed to burgeoning demand, may have been due as much or even more, to the failure of supply.

By this reading, the 'Second Agricultural Revolution', would appear to have run out of steam long before the onset of the Great Depression. Agricultural growth rates between 1850 and 1875 averaged, according to Collins, 0.8 per cent per annum at most; substantially lower than in the previous quarter century, but not dramatically higher than growth rates in the Great Depression. The reason, Collins contends, was not so much economic as technical; the fact that for two generations, up to the Second World War, large sections of British agriculture, were trapped on a technological plateau, and were caught up in a vicious circle of diminishing returns, static out-put and low profits. [2, 5] The technical limitations of the new husbandry were already apparent by the 1860s. In an important new study, A. D. M. Phillips concludes that under- drainage, the most capital-intensive and apparently amongst the most successful of Victorian land improvements, failed to work a revolution in the agricultural systems of the heavy soils after 1840. The efficient removal of surplus water raised cereal yields by 10-15 per cent, more than enough to cover capital and interest. But less than half the land requiring drainage was in fact drained, the shortfall being much greater in the arable south and east than in the pastoral north and midlands. [3]

The sluggish growth in meat output can be partly explained by the inelastic supply and high cost of home grown feeds.

Table I Yields per acre of selected crops 1750-1958 (in tons)

	A Wheat	B Turnips & Swedes	C Hay	D Physical productivity index (10 crops) 1886-89 = 100
1750-70	.48			
1790s	.52	8.0		
c1836	.58	10.0	1.2	
c1850	.74	10.0	1.2	
c1860	.78	10.5	1.3	
c1870	.80	11.0	1.3	
1870s	.73	11.5	1.4	
1885-94	.82	11.7	1.4	
1905-09	.91	13.9	1.3	102 (1886-95)
1935-39	.89	11.5	1.0	103
1945-49	.96	12.5	1.2	103
1955-58	1.30	15.5	1.3	111

Sources: A, B & C *A Century of Agricultural Statistics, Great Britain 1866-1966*, HMSO, (London, 1968); J.V. Beckett, *The Agricultural Revolution*, (Oxford, 1990), pp. 56-57; E.J.T. Collins, ed., *Agrarian History of England and Wales, VII, 1850-1914* (forthcoming); B.A. Holderness, 'Prices productivity and output', in G.E. Mingay, ed., *Agrarian History of England of Wales, VI, 1750-1850*, (Cambridge, 1959); R.J.P. Kain, *An Atlas and Index of the Tithe Files of Mid-nineteenth Century England and Wales* (Cambridge, 1986).

Indeed meat production based on liberal feeding with roots, grains and oil cake was costly and wasteful and, in the case of beef, seldom very profitable. Moreover, there was little general tendency to switch from corn to grass. But a more fundamental

mental reason was the relative inefficiency of sheep and cattle as converters of feed calories into meat. Energy conversion rates in beef and mutton production normally averaged about 5 per cent, as against 10 per cent for pork, 15-20 per cent for poultry meat, and 25-30 per cent for milk. Slow growth in Britain, with its high proportion of sheep and cattle, can be contrasted with the higher growth rates of continental Europe with its larger numbers of pigs, poultry and dairy cows.

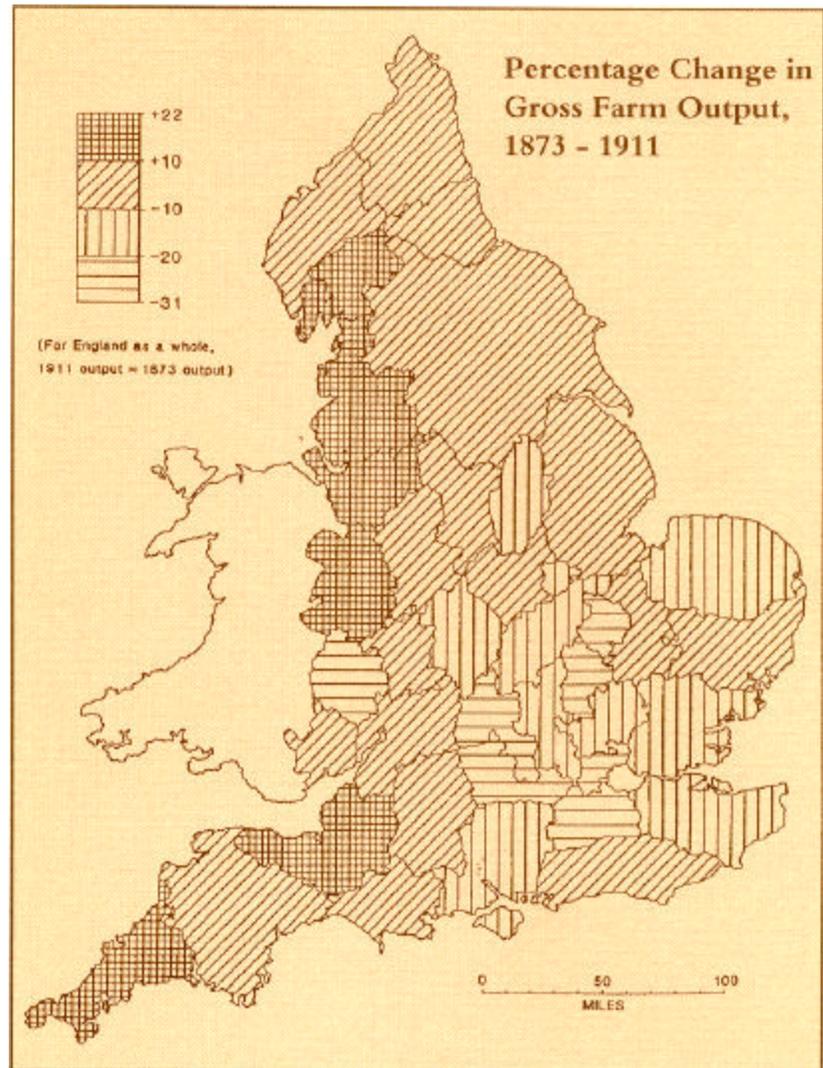
The principal constraint on higher output, however, was the limited biological potential of nineteenth century plant varieties. Farmers were soon confirming in the field what the Pothamsted experiments had already demonstrated on trial plots. Above quite modest levels of yield, most crops proved unresponsive to marginal additions of manure, especially nitrogen. The trouble was that nineteenth century cereal varieties were very long-strawed. Nitrogen increased the yield of straw more than that of grain, causing the plant to collapse, a problem only resolved after World War 11 with the breeding of short-strawed varieties. By the 1850s or before it had become unusual for farmyard manure, still less chemical fertilisers, to be applied directly to the corn crop, for fear of 'lodg- ing'. Of the new fertilisers the most effective were the phosphates, especially superphosphate of lime. This was the first true chemical fer-tiliser, and was available from the early 1840s. It made for a signif- icant improvement in the yields of the fodder roots. Chemical fertilisers were little used on pas- ture until the modern period when pure stands of rye grass for silage-making replaced the traditional mixed sward. From the late nineteenth century yields generally - oats and potatoes being the prin- cipal exceptions - were affected adversely by an increase in soil acidity due to the neglect of Timing. This was partly because of the expense, and partly in the mistaken belief that artificial manures were an effective substitute.

The Great Depression

Most modern accounts of the Great Depression derive very largely from T W Fletcher's re-interpretation of the early 1960s. This asserted that there was no general depression in British agriculture during the late nineteenth century, and that foreign competition affected mainly the corn growers, and the livestock sector, (especially milk producers), little if at all. [4]

Research in recent years has provided a much clearer idea of the anatomy of the depression. A separate price, output and income series for England and Wales has been created. [5] Our knowledge and understanding of agricultural change at the local level is greatly enhanced by F M L Thompson's painstaking and ingenious recent work on trends in rent, output, and income in the English counties. [6] Gross agricultural output, he estimates, declined by about 5 per cent between 1873 and 1894, and was approximately the same in 1914 as at the end of the High Fanning period. Nonetheless, there were clear winners and losers. The former were to be found mainly in the rearing and dairying counties of the north and west, and the latter in the predominantly arable counties of the east and

south. Between 1873 and 1894, 13 English counties recorded an increase, and 28 a reduction in real output, some by as much as 20 per cent. (See Map) Between 1873 and 1911 gross income fell in line with prices, but by less than 25 per cent in I I counties and by more than 40 per cent in 14, the greatest falls being in Bedfordshire and Huntingdon. In many respects the most interesting and certainly the bravest part of the investigation, is his attempt at measuring returns to factors



Source: F. M. L. Thompson, 'An Anatomy of English Agriculture, 1870-1914', in B. A. Holderness and M. Turner, eds., *Land, Labour and Agriculture, 1700-1920* (1991).

of production. Farmers were less interested in total farm output than in the distribution of the proceeds between landlords, farm workers, and tenants. The shift of income to farmers, and their perceptions of the impact of the depression on themselves, was not directly correlated with changes in output or gross income.

English agriculture, Thompson concludes, was neither dynamic nor terminally ill, but static and ailing. Yet it is the case, nonetheless, that agricultural growth rates in the late nineteenth century were much lower than in either the inter-war or post-Napoleonic War agricultural depressions. Between 1875 and 1914 agriculture's contribution to the national product fell from 14 per cent to 6 per cent, while the real measure of farmers' prosperity - the ratio of farm to non- farm incentive income - declined from about 70 to 40 per

cent. The underlying reason was not so much the decline in com, which was to be expected, as the lacklustre performance of the livestock sector which, in spite of an advantageous shift in relative costs and prices, grew during this period by only 0.5 per cent per annum.

Efficiency and productivity

Historians continue to debate how much the decline in output and profits was due to falling prices and how much to other factors, such as poor entrepreneurship, failure to co-operate, or technical inertia. As has been suggested, a major reason was that the potential for further gains in land and labour productivity was very largely exhausted by 1880, yields having already levelled off and many farm operations having been already mechanised. Inertia was reinforced by a lack of interest in agricultural education and research, especially in the developing fields of microbiology and plant and animal nutrition. In a recent comparative study, it has been suggested that one reason why Britain lagged behind most of the rest of Europe was that land-saving inputs, such as fertilisers and feeding stuffs, were much better adapted to small family farms specialising in milk, pigs and labour-intensive crops, than large capitalist farms specialising in meat and grains. [7]

Yet, according to another interpretation, the principal reason for agriculture's poor showing in the Great Depression was neither technical nor economic, but institutional. In an important book on the agrarian origins of the First World War, the fault is seen as lying with the 'estate system' of large landowners and large tenant farms which historically is assumed to have played a central and beneficial role in British agricultural development. British farmers were unable to compete with New World producers because an excessively large share of net farm income was allocated to rent to support the social and administrative institutions of the élite landowning class. British agriculture, it is argued, was held back on the one hand by high land prices and high rents, and, on the other, by class divisions, poor labour relations and middle-class farmers' aversion to manual work. British farms were thus too large for farmers to use their hands, but too small for them to have to use their heads. The root difference between the British and American systems was not so much technical or environmental as cultural - the genteel conservatism of the 'manor house' versus the industriousness and capacity for self-exploitation of the prairie 'sod house'. [8]

If, in the nineteenth century, British agriculture was not especially productive, does this mean it was also inefficient? Efficiency is determined by the allocation of resources within and between industries. Although farm incomes were in the main much lower than non-farm incomes, resources need not necessarily have been misallocated to agriculture. In economic theory efficiency required that marginal returns between different sectors of the economy were equalised, not average returns. The best indicator of efficiency is not land or labour productivity but a measurement of the efficiency of all the inputs taken together - land, labour and capital - which is called total factor productivity. [9] Total factor productivity growth in agriculture was higher than in industry between 1801 and 1860, lower in 1856-99, and higher again in 1899-1913. A detailed calculation for 1841 suggests a value of about 1.1 per cent. This was higher than in mining and manufacturing generally, but lower than in distribution, utilities, and housing.

Conclusions

By this measure agriculture performed moderately efficiently compared with other industries. To what extent the growth in output and total factor productivity in the 1830s and 1840s was due to increased technical efficiency, and how much to the distorting effects of the Corn Laws, is a different question. Equally conjectural is the effect on output and efficiency had a similar system of agricultural protection been re-introduced in the late nineteenth century. What is clear is that after 1850, rising labour productivity due to the construction of the agricultural workforce and increased use of machinery, was a more potent source of efficiency gain than higher outputs per acre. By the early twentieth century almost all western European countries were treading the same stony path as Britain. Breaking out from the technological impasse to achieve a further significant rise in yields awaited the revolution in plant and animal genetics, inorganic chemistry, and agricultural production systems that occurred in the modern post-war period. The price paid by Britain for its agrarian precociousness in the seventeenth and eighteenth centuries was, it seems, stagnation for a large part of the nineteenth and early twentieth.

Reference

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