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Recent Findings of Research in Economic & Social History

In recent years new research has greatly improved our estimates of the pace of economic growth in Britain in the late eighteenth and early nineteenth centuries. This in turn has led to better understanding of the nature and causes of the changes which occurred in industry and agriculture, and of the effects of those changes. Prof. Crafts has been one of the leading contributors to this exciting new work, and here sets out its main features in clarifying the current interpretation of the first industrial revolution.

The Industrial Revolution: Nick Crafts *Economic Growth in Britain, 1700-1860*

The publication in 1962 of Deane and Cole's *British Economic Growth* [21] was of major significance to the economic history of the first industrial revolution. It offered new estimates of the overall rate of economic growth, and of changes in the structure of economic activity. These in turn provided a context for fresh investigation of a range of subjects of central importance, including the growth of individual industries, foreign trade, population change, crop yields and living standards.

New approaches

The fact that their work enabled scholars to quantify the structural changes in the economy also influenced critical aspects of the concept itself. By the 1960s this had normally come to be defined in terms of overall changes in the sectoral structure of the economy. For example, this approach was adopted in the classic study by David Landes [41], when he defined the industrial revolution in Britain as 'the first historical instance of the breakthrough from an agrarian, handicraft economy to one dominated by industry and machine manufacture'.

Much of the early use and discussion of Deane and Cole's work was related to the famous 'stages' theory of economic growth advanced in 1960 by Rostow [5], who put forward the proposition that the British economy had experienced a 'take-off into self-sustained growth' in the period 1783-1802. He saw the take-off as a 'decisive transition' involving sharp rises in the share of the country's resources allocated to investment, and the emergence of leading sectors (cotton and iron), which exerted a powerful influence over growth as a whole. Rostow also suggested that this British experience was the prototype for all other industrialised countries.

Deane and Cole's estimates did not give much support to Rostow's hypotheses. They suggested a much more gradualist interpretation of overall growth as a backdrop to

the dramatic, but not dominant, developments in cotton and iron production; and they indicated that the rise in investment had been quite modest relative to the increase in total output. This part of Deane and Cole's work was quickly adopted in the best introductory texts. For example, Flinn [3] sums up as follows: '... the lesson to be learnt from the statistics appears to be one of the superimposition upon a steadily growing economy of a small group of extremely dynamic sectors. Statistically they represented, even by the end of the century, a very small share of the national product, but the growth in them was sufficient to double the existing rate of overall growth in the economy.'

Subsequent work has refined and extended further aspects of Deane and Cole's pioneering study. Further studies have improved their original data-base; and estimates for other European countries have allowed Britain's experience to be studied in an international perspective. The implications for the growth of output per worker, and of agriculture's contribution to the process of industrialisation have been discussed in quantitative terms. Most recently, Crafts [1] has attempted to bring together the various strands in the literature, and to offer a new synthesis to measure, describe and explain British economic growth during the industrial revolution. As a result of this new work the Rostovian picture of a dramatic take-off has been decisively rejected, and the present evidence supports a more gradualist interpretation of the industrial revolution.

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Result of recent research

Crafts's new estimates of economic growth are presented in Table 1, together with those made earlier by Deane and Cole. It must be borne in mind that the underlying data for this period will never permit precise and definitive statements. The most that can be done is to make careful 'guesstimates' in the light of both the available sources and general economic and statistical reasoning.

Crafts's estimates thus build on the work of Deane and Cole and of many other scholars who have researched in this area in the past decade. To a large extent they rely on the same original sources such as tax returns and customs and excise records. The recent improvements in knowledge have come primarily not from new sources of information, but from the application of more sophisticated methods of data analysis. Examples of this in the demographic sphere are already well known to readers of this journal: see *ReFRESH*, 1 (Autumn 1985).

Table 1 Growth Rates of Real Output (Percent per year)

	Industrial Output		Whole Economy (GDP)	
	Crafts	Deane and Cole	Crafts	Deane and Cole
	(1)	(2)	(3)	(4)
1700-1760	0.7	1.6	0.7	0.7
1760-1780	1.5	0.5	0.7	0.5
1780-1801	2.1	3.4	1.3	2.1
1801-1831	3.0	4.4	2.0	3.1
1831-1860	1.3	3.0	0.3	2.1

Source: Coles (1) and (3); Crafts (1), pp. 32, 45, 81 and 84; (2) and (4): Deane and Cole (2), pp. 78, 166 and 170.

Note: Figures for 1700-1801 are for England and Wales; thereafter for Great Britain.

The new estimates of the growth of industrial output between 1780 and 1830 show substantially lower rates of increase in most periods, (compare columns 1 and 2 of Table 1). The differences are particularly large in the 'classic period of the industrial revolution, 1780-1830. From 1781 to 1801 the old estimate of 3.4% per year is reduced to on 2.1% per year, and for 1801-31 the rate is cut sharply from 4.4% to 3.0% per year. The same is true for growth in the economy as a whole, including agriculture and services (see columns 3 and 4 of Table 1). The picture which now emerges is thus one of steady growth, rather than a 'take-off' or spectacular acceleration.

It is true that growth in a few very dynamic industries was very rapid, and far outstripped the expansion of industrial output as a whole. Thus the production of cotton textiles grew at a rate of 9.7% per year from 1780 to 1801, and of 5.6% per year from 1801 to 1831. Iron production grew at rates of 5.1% and 4.6% per year over the same periods. However, even by 1831 cotton accounted for little more than a fifth of total industrial output, and iron for less than one tenth. Much of 'industry' was still composed of traditional, handicraft activity. Even by 1831 only about one in ten of all workers were employed in the modern 'manufacturing' sector of the economy, compared with almost three times as many working in other forms of industry.

Investment and productivity

We also have new information about the factors of production employed to manufacture this output. There are new series for the growth of the labour force; for the level of capital investment (i.e. of spending on the construction or purchase of long-lasting productive assets such as machinery, mills, mines, warehouses, canals and ships),

and about the total stock of such fixed capital built up over time. These series can be combined with the revised output estimates in order to analyse how this expansion of output was achieved. In particular, we can ask to what extent increased output was obtained simply by using more labour and capital, and to what extent by greater efficiency in the use of these resources. The latter result might, for example, be achieved by getting more output from an unchanged level of labour and capital inputs. The name given this measure of the relationship between output and the use of all inputs combined is total factor productivity (see the box on p.4).

Table 2 Investment as a Percentage of National Income

Period	Investment as a Percentage of National Income
1700-1760	5.0
1760-1780	5.0
1780-1801	10.0
1801-1830	11.3

Source: Crafts (1), p. 81

A first step towards answering these questions is taken in Table 2. This shows the trend over time in the investment ratio, i.e. in the proportion of the country's national income allocated to acquisition of long-lasting capital assets which could be used to produce future goods and services, rather than to current consumption, government expenditure (mainly on wars) or net exports. We see that the proportion devoted to investment did increase over time - from about 7% at the end of the eighteenth century to over 11% in 1831-60; and by that period the British economy was adding to its stock of capital assets at a rate which was extremely high by the standard of any previous period. But there was no take-off, no period in which there was a sudden acceleration in the investment ratio.

The second and more direct step towards an answer to our question about the sources of economic growth is taken in Table 3. This shows the rate of growth of labour and capital in columns (1) and (2), and combines them to get a measure of the growth of total factor inputs in column (3). The rate of growth of output is shown in column (4), and the difference between output and inputs represents the growth of total factor productivity. A consequence of the downward revisions to the growth estimates noted above is that the rate of growth of total factor productivity (column 5) now appears markedly lower than previous writers believed. Once again the notion of a spectacular 'take-off' is rejected by the evidence now available. Nevertheless, it should be appreciated that by the second quarter of the nineteenth century the economy had achieved a rate of growth of total factor productivity which would previously have been inconceivable: as column 5 of Table 3 shows the rate had accelerated from 0.3% per year to 1.0% per year.

Table 3 Sources of Economic Growth
Growth rates, per cent per year

Period	Labour	Capital	Total Factor Inputs	Output	Total Factor Productivity
	(1)	(2)	(3)	(4)	(5)
1700-1760	0.7	0.7	1.4	0.7	0.3
1760-1780	1.5	0.5	2.0	1.5	0.5
1780-1801	2.1	1.3	3.4	2.1	0.3
1801-1831	3.0	2.0	5.0	3.0	1.0
1831-1860	1.3	0.3	1.6	1.3	0.3

Source: Crafts (1), p. 81. Note: Land is not shown separately, but is included in (1).

These were important which eventually allowed the famous Malthusian threat to living standards from rising population to be overcome. Prior to about 1830, however, the growth of total real output did not exceed population growth by much, and real wages were growing at only a little over 0.5% per year.

With the idea of an industrial revolution in mind it is also interesting to delve a little further into the growth of output per worker (labour productivity) in different parts of the economy. A tentative classification suggests the following. First, the growth of productivity in agriculture was somewhat faster than that in industry. Second, within industry were to be found the few sectors where productivity growth was really fast; most notably in textiles, with its radical changes in technology. But alongside these famous industries were a large set of traditional activities, including building, and the food, brewing and leather industries, where there was virtually no advance in productivity.

Structural change

Changes in the structure of output and employment are the focus of Table 4, which relates directly to the notion of the industrial revolution mentioned above as defined, for example, by Landes [4]. This table reports not only the results of recent research on Britain, but also permits comparison with European experience. The 'European norms' shown in the table can be thought of as a measure of the average experience of Western

European countries at the point in time when they eventually reached the level of income per head which Britain had attained in the year stated. Take, for example, the figures for 1840 in rows 1 and 2: row 1 says that in 1840 Britain had 47.3% of its male labour force in industry. Row 2 tells us that the corresponding proportion for the European countries - calculated at the dates at which each subsequently reached the per capita income level which Britain had enjoyed in 1840 - averaged only 25.3%.

Table 4 reflects the enormous change in economic structure in Britain between 1760 and 1840: the expansion of the share of labour and output devoted to industry (rows 1 and 5), and the decline of the share of agriculture (rows 3 and 7). It also shows vividly how different this transformation was from the general European experience. The British economy in 1840 had a much lower proportion of its labour force in agriculture than the European countries at the corresponding stage in their development (28.6% against 54.9%); but a much higher degree of industrialisation (compare rows 1 and 2, or 5 and 6) and of urbanisation (rows 9 and 10).

Britain was *not* the prototype for other countries. They followed a different, less industrialised, path in their economic development.

The key implications

The term 'industrial revolution' is, of course, a metaphor and, as has long been recognised, it is in some ways a misleading one. The notion can now be more fully clarified in the light of the recent research summarised above.

i) There was a revolutionary change in the 'structure' of employment. In the late eighteenth and early nineteenth

centuries the proportion of the labour force employed in industry increased, and the proportion employed in agriculture fell very rapidly.

ii) Much of the employment in industry continued to be in small-scale, handicraft activities producing for local markets. These traditional industries were barely affected by technological advance, and so experienced little or no increase in output per worker.

iii) The acceleration in the overall pace of economic growth was perceptible, but relatively modest. There was no great leap forward for the economy as a whole, or even for the whole of industry, despite the spectacular growth of cotton textile production.

iv) The rate of economic growth increased as more was invested in fixed capital, and productivity growth quickened. There were deservedly famous technological advances such as Crompton's mule and Watt's steam engine. These developments aided Britain's exports of manufactures. However, in most of the economy, productivity growth remained painfully slow in the first half of the nineteenth century.

v) Mid-nineteenth century Britain is often labelled the 'workshop of the world', and the advance of productivity in a few industries did indeed enable Britain to sell around half of all world trade in manufactures. However, this should not blind one to the key implication of Tables 3 and 4: the main feature of British industrialisation involved getting a lot of workers into the industrial sector, not getting a high level of output per worker from them once they were there.

Table 4. Comparison of British and European Changes in Employment Structure (per cent)

	1760	1840	1840 European norm
Male labour force in industry	28.6	47.3	25.3
Female labour force in industry	10.0	15.0	10.0
Male labour force in agriculture	54.9	28.6	54.9
Female labour force in agriculture	40.0	20.0	40.0
Male labour force in services	16.5	24.1	24.7
Female labour force in services	45.0	65.0	45.0
Male labour force in urban areas	10.0	40.0	10.0
Female labour force in urban areas	10.0	40.0	10.0
Male labour force in rural areas	90.0	60.0	90.0
Female labour force in rural areas	90.0	60.0	90.0
Male labour force in manufacturing	10.0	20.0	10.0
Female labour force in manufacturing	10.0	20.0	10.0
Male labour force in construction	10.0	20.0	10.0
Female labour force in construction	10.0	20.0	10.0
Male labour force in commerce	10.0	20.0	10.0
Female labour force in commerce	10.0	20.0	10.0
Male labour force in transport	10.0	20.0	10.0
Female labour force in transport	10.0	20.0	10.0
Male labour force in education	10.0	20.0	10.0
Female labour force in education	10.0	20.0	10.0
Male labour force in health	10.0	20.0	10.0
Female labour force in health	10.0	20.0	10.0
Male labour force in leisure	10.0	20.0	10.0
Female labour force in leisure	10.0	20.0	10.0

Source: Crafts [1], pp. 42-3. Note: The labour force estimates in rows 1-4 are for 1840. The primary sector in rows 5-6 is manufacturing and construction as well as agriculture.

Co-existing with the cotton and the other famous export sectors were many low productivity, low-paid and non-exporting industries.

The role of agriculture

The unusually low share of employment in agriculture in Britain (as compared to Europe) by the early nineteenth century prompts the question: how did this happen? At one level it is quite easy to explain. By international standards labour productivity in British agriculture was very high (in 1840, for example, output per worker in French agriculture was only about 60% of the British level), and it had grown

significantly from the sixteenth century on. From 1750 to 1850 the number of jobs in agriculture rose only very slowly, while the number of non-farm workers who could be fed by the output of each farm worker rose more than 2.5 times. Productivity increases were achieved by better crop yields from rotations involving legumes and fodder crops, by increases in farm size and by investment in livestock, drainage and implements. (For further discussion of these and related changes in agriculture see the two articles in REFRESH 3, Autumn 1986). As a result of these advances in agricultural techniques during the period of the industrial revolution, the growth in total factor productivity in the economy as a whole exceeded that in the industrial sector, though not that in factory industry alone. These important agricultural improvements after 1750 should always be remembered so that the phrase 'industrial revolution' does not mislead.

At the same time the very success of agriculture makes its declining relative importance a bit puzzling. If we were so good at farming why did we come to rely so much on imported food (over a fifth of our consumption by 1840)? This problem has only recently begun to receive serious attention, and the answer is not yet fully understood. It seems likely that one reason is to be found in Britain's even greater superiority in producing textiles for export. (This phenomenon was bad news for farmers in the same way that North Sea oil exports over the past decade have aid for imports of manufactured goods at the expense of domestic manufacturing.) Another possible reason is the strong impact of income growth on the demand for services and handicrafts in both town and country.

Productivity is the term used for the relationship between output and one or more of the factors of production (land, labour, capital). Changes over time tell us about changes in the efficiency with which the factors are used to produce goods and services. The most common use of the term is in relation to *labour productivity*, which measures the change in output per worker. Another familiar measure is *the productivity of land*, for example of farm output per acre. Both of these measure efficiency in relation to a single factor. In the case of labour productivity this means that we have no way of judging how much of any increase is the result of, say, harder work on the part of the labour force, and how much is the result of more capital equipment. To get round this problem it is necessary to find a way to measure the growth of the combined inputs of land, labour and capital, and when this is done we can measure changes in the efficiency of all inputs taken together. This is called *total factor productivity*.

Standards of living

The impact of early industrialisation on workers' living standards has, of course, long been controversial. The view of economic growth presented above offers some useful perspectives on this debate. The new, lower, estimates of growth in the economy as a whole suggest that the slow growth of real wages came from low productivity growth and very modest increases in the amount of capital equipment per worker, rather than from a massive increase in profits at the expense of wages, as had seemed possible on Deane and Cole's evidence. Over the period 1780-1850 real wages and real national income per head probably grew at the same rate. [Crafts (1) p.103]

The finding that relatively little employment initially was in sectors experiencing rapid productivity growth also has important implications for the distribution of the gains from economic growth. The modernised sectors were concentrated in the North of England, where wage rates

became much higher than in the South. This differential was not eliminated by internal migration. It is possible that a majority of workers experienced no gain in real earnings before the 1830s [Crafts (1) p. 105-61], but much more research is needed on the regional details of prices and wages before this can be verified.

However, since economic growth is now seen to be slower than was previously thought, the effect of changes in the *quality of life* assumes a particularly important part in questions of movements in living standards; and the new estimates do not shed any light on these developments. Whilst not all such changes were for the worse - for example, life expectancy as a whole increased - many adverse factors did come into play. These included reductions in leisure time, deterioration in the environment, and, arguably, new forms of class relationship.

Later economic performance

The picture of economic growth during the industrial revolution sketched above can be elaborated to make greater sense of Britain's relative decline later on in the nineteenth century. It is certainly true that Britain in 1850 had the highest income level in the world, and accounted for perhaps a third of total world industrial production. Nevertheless, some aspects of our development to that point were not impressive and did not hold out promise of subsequent rapid growth.

* Our exports were dominated by textiles, and increasingly sold to the low income countries rather than to those already industrialised.

* Productivity advance was not spectacular across the economy as a whole. Equally importantly, it was based neither on research and Development investment, nor on investment in education, and it was thus unlike the advances in productivity to come after 1880 [Crafts (1) ch.8].

* The development of the economy before 1860 was based neither on very high levels of home investment, nor on modern financial institutions. As a result, the capital market was ill-suited to ensuring an efficient use of investible funds.

* Finally, by the mid-nineteenth century Britain's early start and considerable wealth led naturally to the development of a substantial stream of investment abroad, reaching around 5% of national income by the end of the 1860s. The profits from this foreign investment perhaps inhibited subsequent investment in home manufacturing through their effects on the balance of external payments [Crafts (1) p. 163].

While it is useful to see how many of the roots of Britain's problems in the late nineteenth century reach back to the pattern of development in the earlier period, this does not detract from the importance of the first industrial revolution. Even if we now believe that it proceeded at a relatively modest pace, and that the really revolutionary changes were for long confined to a limited part of the whole economy, it remains true that Britain had brought about a remarkable transformation in the way a society provided itself with material goods. This will always be seen as an event of the greatest historical significance.

References

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