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Stephen Broadberry and Bas van Leeuwen
(University of Warwick)

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BRITISH ECONOMIC GROWTH AND THE BUSINESS CYCLE, 1700-1870: ANNUAL ESTIMATES

Stephen Broadberry and Bas van Leeuwen

Department of Economics, University of Warwick, Coventry CV4 7AL, United Kingdom

S.N.Broadberry@warwick.ac.uk
Bas.vanleeuwen1@googlemail.com

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Abstract: This paper provides the first annual GDP series for Great Britain over the period 1700-1870. The series is constructed in real terms from the output side, using volume indicators and value added weights. Sectoral estimates are provided for agriculture, industry and services, and for a number of sub-sectors. Estimates of nominal GDP are also provided, based on a benchmark for 1841 and projected back to 1700 and forward to 1870 using the real output series and sectoral price indices. The new data are used to provide a consistent account of economic growth and the business cycle. The results are broadly consistent with the long run path of real output suggested by Crafts and Harley, although growth rates for sub-periods differ, largely as a result of changes in the growth of agriculture. Nominal GDP increased more rapidly than suggested by Lindert and Williamson during the eighteenth century, and more slowly than suggested by Deane and Cole during the first half of the nineteenth century, as a result of differences in the price indices. We also refine the business cycle chronologies of Ashton and Gayer, Rostow and Schwartz.

JEL classification: N13, E01, O52, E32
Key words: Economic growth, business cycle, Great Britain, annual data

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I. INTRODUCTION

This paper provides an annual series of gross domestic product for Great Britain over the period 1700-1870, built up from the output side. For the period 1700-1830, the estimates of Crafts and Harley (1992) provide observations of sectoral and aggregate output only for a small number of benchmark years, while for the period 1830-1870, Deane's (1968) annual estimates are available only by category of expenditure. Sectoral estimates are provided here for agriculture, industry and services, and also for a number of sub-sectors, built up using volume series available on an annual basis, and aggregated using value added weights. Estimates of nominal GDP are also constructed by combining the real output series with price indices to project backwards to 1700 and forwards to 1870 from an 1841 benchmark.

We use the new annual series to provide a consistent account of growth and the business cycle in Britain over this period. The results are broadly consistent with the long run path of real output suggested by Crafts and Harley (1992), although growth rates for sub-periods differ, largely as a result of changes in the growth of agriculture. Nominal GDP increased more rapidly than suggested by Lindert and Williamson (1982) during the eighteenth century, and more slowly than suggested by Deane and Cole (1967) during the first half of the nineteenth century, as a result of differences in the price indices. We also refine the business cycle chronologies of Ashton (1959) and Gayer, Rostow and Schwartz (1953). A sister paper by Broadberry et al (2010) provides annual estimates of GDP for England covering the period 1270-1700. The current paper thus forms a convenient link between this account of medieval and early modern economic growth and the more familiar accounts of British economic growth since 1870, based on the annual data of Feinstein (1972).

The paper proceeds as follows. Sections II to IV describe the procedures for estimating real output in agriculture, industry and services, respectively. For benchmark years, we demonstrate broad consistency of long run growth rates with the widely-accepted approach of Crafts and Harley (1992). For each of the main sectors, annual observations are graphed, while more information is also provided on the main sub-sectors within agriculture, industry and services. Section V presents annual estimates of GDP in current as well as constant prices. The constant price GDP series is combined with population in section VI to provide estimates of GDP per capita. Section VII conducts an analysis of the business cycle in aggregate GDP and compares it to previous business cycle chronologies. The conclusion is followed by a data appendix, setting out detailed data sources.

II. AGRICULTURE

1. Overview of sources and methods

Deane and Cole (1967) measured agricultural output by assuming constant corn consumption per capita and making a small adjustment for foreign trade. This was criticised by Crafts (1976), who regarded the assumption of constant per capita consumption of corn as indefensible while real incomes were rising and the relative price of corn was changing. Crafts (1985: 39-42) used a hybrid method to calculate the growth of agricultural output over the period 1700-1830. For the period 1700-60, he used the demand approach with an assumed income elasticity of demand of 0.7 and an iterative procedure for ensuring consistency between agricultural income and national income growth. For the period 1760-1801, and also for 1801-31, he allowed for relative price changes with an assumed price elasticity of demand of -0.8, and

checked the results against an alternative method of deflating agricultural incomes with an agricultural price index.

Allen (1994) showed that it was possible to construct estimates of agricultural output directly using volume and price data published in the *Agrarian History of England and Wales* by Chartres (1985), Bowden (1985), Holderness (1989) and John (1989). He also showed that for the period 1700-1850 as a whole, the volume method yields a similar increase in output between 1700 and 1850 as the demand-based and deflated value-added methods employed by Crafts. Allen (2005) provides alternative estimates for benchmark years covering the longer time span of 1300-1850, but with a somewhat slower output growth over the period 1700-1850 than suggested by Allen (1994).

The approach taken in this paper is the estimation of value added in agriculture on an annual basis, built up from quantity and price information for individual products. Results are presented for individual products and for the arable and pastoral sub-sectors, as well as for total agriculture. The data are taken largely from the Modern Farm Accounts Database assembled by Turner *et al.* (2001) and the Early Modern Probate Inventories Database of Overton, Whittle, Dean and Haan (2004), supplemented with additional information from Clark (2004), and the *Agrarian History of England and Wales*. For arable farming we have annual gross yields for all products for most years, although there are significant gaps for rye as it became less and less important over time.

For the pastoral sector, the data are drawn from the Early Modern Probate Inventories Database between 1700 and 1750. Animal stocking densities (the number of animals per sown acre) are multiplied with the sown acreage to yield estimates of the total numbers of animals in England. After 1750, benchmark estimates of the numbers of animals from John (1989) and Allen (2005) are interpolated with data on the sale of animals at Smithfield from Mitchell (1988: 708-709). Multiplying the resulting numbers of animals with the percentages of animals producing and the production per animal results in total production in the pastoral sector.

2. Arable farming

The starting point for any estimate of arable sector output must be the total sown acreage and its breakdown by crop, shown here in Table 1. The acreage by crop in benchmark years is taken from Holderness (1989: 145) and Chartres, (1985: 444), with the absolute level pinned down by Prince's (1989: 41) interpretation of the 1801 Crop Returns.

The next step is to estimate average grain yields per acre. Weighted national average yields per acre, gross of tithe and seed can be obtained from the Early Modern Probate Inventories Database and the Modern Farm Accounts Database. Each dataset has been divided into seven regional groupings and separate chronologies have been constructed fro each region before being combined into a single weighted master chronology for the country as a whole. Due to the discontinuous nature of much of the data, the regional chronologies are derived using regression analysis with dummy variables for each farm and for each year, as suggested by Clark (2004).

Grain yields gross of seed as well as tithe are shown in Figure 1 for wheat, rye, barley, oats and pulses. From these gross yields it is necessary to subtract grain used as seed to derive the net yields shown in Table 2 for all the major crops. From these gross yields it is necessary to subtract grain used as seed to derive the net yields shown in Table 2. Net yields increased strongly for all grains, with oats and wheat showing bigger increases than barley and rye.

In addition to making allowance for grain used as seed, the derivation of net output in arable farming requires the subtraction of grain used to feed working animals. For the first half of the eighteenth century, estimates of the numbers of working animals per sown acre can be obtained from the Early Modern probate inventories Database, which can be multiplied with the sown acreage to produce estimates of the numbers of working animals in Table 3. From the mid-eighteenth century, oxen numbers are assumed to decline steadily to zero by 1870, while horses are estimated from Allen (1994). Using assumptions about consumption of oats and pulses by mature and immature animals, it is possible to derive estimates of farm animal consumption, which are then subtracted from gross output to arrive at arable output net of seed and animal consumption in Table 4. The output of wheat, the principal bread grain, increased steadily until the mid-nineteenth century, while the output of rye, an inferior bread grain, declined in absolute as well as relative terms. Barley, the principal brewing grain saw a rapid growth from the mid-eighteenth century, while oats, which came to be used increasingly as horse fodder, fluctuated more erratically. The output of potatoes increased dramatically throughout the period, while the output of pulses increased much more gradually.

3. Pastoral farming

The starting point for the estimation of pastoral farming output is the numbers of non-working animals in Table 5. For the first half of the eighteenth century, these are derived from the stocking densities in the Early Modern Probate Inventories Database. For later years, estimates for benchmark years are derived from Allen (2005), John (1989), Mitchell (1988) and Turner (1998), and interpolated using data on annual sales at Smithfield and the \metropolitan Cattle market from Mitchell (1988: 708) and Perren (1975: 388). All animal types increased in number, leading to a substantial increase in livestock units per 100 acres.

The proportions of animals assumed to have been producing milk, meat and wool are set out in Table 6. A high proportion of cows are assumed to have produced milk and a high proportion of sheep to have yielded wool. Meat, however, was produced only by those animals that were slaughtered. Slaughter rates for 1700 and 1850 are derived from Holderness (1989) and Clark (1991). The next step in the calculation of pastoral output involves the estimation of yields of milk, meat and wool per animal, set out in Table 7. Data between benchmark years were interpolated using information on the relative prices of pastoral products and the animals from which they were derived. Table 8 then combines the information on numbers of animals, percentages producing and yields per animal to arrive at the estimates of total output in the pastoral farming sector.

Further assumptions are needed to derive output estimates for hay, hides and skins and dairy products. Hay output is derived from the numbers of non-farm horses, on the assumption that each horse consumed 2.4 tons of hay per year (Allen, 2005).

Output of hides and skins is derived from the numbers of working and non-working animals, using assumptions on the percentages of each animal producing and yields per animal from Clark (1991) and Clarkson (1989). In the dairy sector, output is split between cheese, butter and fresh milk using data from Holderness (1989).

4. Total agricultural output

Multiplying the output volumes by their prices yields the total value of net output. The price data are taken largely from Clark (2004), who synthesises the published data of Beveridge (1939), Thorold Rogers (1866-1902: volumes 1-30) and the multi-volume *Agrarian History of England and Wales*, as well as integrating new archival material. Output can be valued in both current prices and in constant 1700 prices.

Figure 2 plots arable, pastoral and total agricultural output in constant prices on a logarithmic scale. Pastoral output grew at a faster rate than arable output, particularly from the mid-eighteenth century. The pastoral sector thus increased its share of agricultural output in constant prices. In Table 9, we see that the share of pastoral products in current prices also increased substantially from the mid-eighteenth century, as relative prices changed only over relatively short periods.

One finding from Table 9 that is worth emphasising is the high share of the pastoral sector in agricultural value added, even at the beginning of the eighteenth century. Its subsequent growth meant that by the late nineteenth century, the pastoral sector accounted for nearly 60 per cent of agricultural output. This meant that although the British people did not have a particularly generous diet if viewed in

terms of kilocalories, it was a varied diet, with meat, dairy produce and ale to supplement the less highly processed grain products that made uo the bulk of the diet.

Table 10 presents the total agricultural output index from Figure 2 in growth rate for, using both annual data and 10-year averages to capture long run trends. Over the 1700-1830 period as a whole, our agricultural growth rate is very similar to that of Crafts (1985) and Crafts and Harley (1992), although there are considerable differences over shorter periods. In particular, in common with the volume indices calculated by Allen (1994: 102) and Overton (1996: 75), we do not find the marked slowdown in the third quarter of the eighteenth century suggested by Crafts and Harley.

III. INDUSTRY

1. Overview of sources and methods

Industry is the one sector for which data have previously been analysed at annual frequency, building on the pioneering work of Hoffmann (1955). However, as Crafts (1985) and Harley (1982) pointed out independently, Hoffmann (1955) inadvertently overstated the growth rate of industrial output during the Industrial Revolution as a result of his weighting procedures. The problem is that a few industrial branches, most notably cotton and iron, grew much more rapidly than the rest of industry, and these branches are included in Hoffmann's data set. However, the available time series cover only 56 per cent of industrial output, and the weights of these industries are increased proportionally to achieve 100 per cent coverage of industrial output. But this means that the unrepresentative, rapidly growing branches of cotton and iron effectively have their weights doubled. Harley (1982) and Crafts et al. (1989) propose

that only the weights of industries other than cotton and iron should be increased to arrive at 100 per cent coverage.

In addition to changing the weighting scheme, Harley (1982) and Crafts et al. (1989) also replaced some of the older series used by Hoffmann (1955), drawing on the latest scholarship. We use these series, together with some later additions, the most important of which are the new series of bar iron output from King (2005), Feinstein's (1988: 446) series of investment in total buildings and works for output of the building industry, and an index of new English language book titles derived from the English Short Title Catalogue and the British Library for the output of the printing industry. Our weighting scheme is very similar to that of Crafts et al. (1989), but modified to allow for the inclusion of the printing industry.

2. Results for total industry

Figure 3 presents our series for industrial output, together with the "revised best guess" series of Crafts and Harley (1992) and Hoffmann's (1955) original index for contrast. The biggest difference is between the Hoffmann index and the other two indices, as a result of the excessive weight given to cotton textiles and iron in the former. Our series shows slightly slower growth than the Crafts-Harley index during the early eighteenth century, largely as a result of the inclusion of new series, particularly King's (2005) data for the iron industry. From the mid-eighteenth century onwards, differences between the two series are relatively minor, and essentially confirm the picture originally presented in Crafts et al. (1989). Output growth accelerated from around 1740 to 1840 before tapering off. Again, there is quite a substantial cyclical dimension to industrial output. Table 12 presents the annual

growth rates of industrial output over the conventional sub-periods calculated using both the raw annual data and 10-year averages, together with the Crafts-Harley estimates for comparison.

3. Results for industrial sub-sectors

Part A of Figure 4 provides a breakdown of industrial production into manufacturing, building and mining. Both mining and building grew more rapidly than total manufacturing over the period as a whole. Part B of Figure 4, however, shows that total manufacturing output included some very rapidly growing branches. The most rapid growth was in metal production, driven by the iron industry. The next most rapid growth was in textiles, driven by the dramatically expanding cotton industry, but slowed down by the relative decline of the more traditional textile industries. Food drink and tobacco and other manufacturing grew more slowly.

IV. SERVICES

1. Overview of sources and methods

The service sector has received much less attention from economic historians than agriculture and industry, and there have been no previous attempts to provide annual frequency data. The first estimates for benchmark years were provided by Deane and Cole (1967), but have been revised downwards by Crafts (1985), particularly for the early nineteenth century. For the eighteenth century Deane and Cole (1967: 76-78) assumed that “commerce” grew at the same rate as industry, that “rent and miscellaneous services” increased in line with population, and that “government and defence” could be measured by real public expenditure. Crafts (1985: 35-37) made only minor changes here. For the nineteenth century, however, Deane and Cole (1967:

166) derived estimates of income in “trade and transport”, “domestic and personal”, “housing”, “government, professional and other services” and deflated them by the Rousseaux price index. Crafts (1985: 31) showed that this produces an implausibly high rate of growth for commerce, and assumed instead that commerce grew in line with national income, thus introducing an element of iteration into the estimates. Crafts (1985: 35-37) used employment growth for domestic and personal services and new estimates of the housing stock for housing. He also revised the growth rate of government using new data on employment growth.

Our estimates are broadly consistent with those of Crafts (1985), but make a few changes to reflect the need for annual data. The most important difference is in commerce, where we measure the growth of output using volume series covering distribution, transport, finance and other commerce. This produces results which are not far out of line with the Deane and Cole (1967) assumption for the eighteenth century, that commerce grew in line with industry. This also avoids the iterative element in the Crafts (1985) assumption that commerce grew in line with national income during 1801-30, and ensures consistency of treatment throughout the whole period.

For government, we use civil government and defence expenditure throughout the whole period, deflated using the Schumpeter-Gilboy and Rousseaux price indices from Mitchell (1988: 719-723). For housing, we use the stock estimates of Feinstein (1988: 389), using a regression relationship between housing stock and population to fill in gaps. Output of domestic and personal services is assumed to rise in line with population throughout the whole period, following Deane and Cole (1967) and Crafts

(1985). This inevitably produces a relatively stable path for output in domestic and personal services, which is consistent with most assessments of this sector.

2. Results for total services

Our annual index of service sector output is plotted in Figure 5. The trend pattern is of an increase in the growth rate from around 1780. As is usually the case, fluctuations in services were milder than in industry or agriculture. Table 13 presents the annual growth rates of services output over the conventional sub-periods calculated using both the raw annual data and 10-year averages, together with the Crafts-Harley estimates for comparison. Our growth rate estimates are very close to the Crafts-Harley data over both the whole period 1700-1830 and individual sub-periods, and using both annual data and 10-year averages.

3. Results for service sub-sectors

Figure 6 provides more detail on the service sector. Part A provides information on commerce, government, housing and domestic services, while Part B breaks down commerce into transport, distribution, finance and other commerce. In Part A, we see that government grew most rapidly during the eighteenth century, albeit in a sharply cyclical fashion as a result of warfare. During the nineteenth century, commerce was clearly the fastest growing sector. Housing and domestic services grew more slowly but more steadily than government or commerce. The former two series coincide in the chart because domestic services were assumed to grow in line with population, whilst we found a unit elasticity between housing and population. In Part B, we see that distribution and finance grew more rapidly than transport and other commerce,

with finance particularly dynamic during the eighteenth century, but distribution more dynamic during the nineteenth century.

V. GDP IN CONSTANT AND CURRENT PRICES

The next step is to construct an index of real GDP from the above output series for agriculture, industry and services, using an appropriate set of weights. Table 14 sets out the weighting scheme, derived from the reconstruction of nominal GDP by sector. Real output trends from the sectoral series described earlier in the paper are transformed into current price trends using sectoral price deflators, with absolute levels of GDP in current prices established using an input-output table for 1841, derived from Horrell et al. (1994), but adjusted from a United Kingdom to a Great Britain basis. 1700 weights are use for the period 1700-1740, 1759 weights for 1740-1780, 1801 weights for 1780-1820 and 1841 weights for 1820-1870. Details of the derivation of the sectoral weights are provided in Broadberry and van Leeuwen (2010).

Putting the three main sectors together using the weights from Table 14, we arrive at the annual index of real GDP shown in Figure 7 and presented in growth rate form in Table 15, together with the Crafts-Harley data for comparison. Our series shows much the same pattern of trend growth acceleration as the Crafts-Harley data, although there are some minor differences over shorter sub-periods, largely as a result of differences in agriculture. Figure 7 shows clearly that the fastest growth was in industry and the slowest growth in agriculture, with services exhibiting an intermediate growth rate.

These estimates of real GDP in index number form can be stated in constant prices simply by linking them to a benchmark estimate of GDP. We work with 1841 as the benchmark year, based on our reworking of the Horrell et al. (1994) input-output table. Current price GDP can be obtained by reflating the real output indices by sector-specific price indices. For agriculture we construct a price index based on a weighted average of price series for individual agricultural products, taken largely from Clark (2004). The price index for the industrial sector is based on a weighted average of price series for industrial products from Clark (2004) and Beveridge (1939). For service sector prices, the key data are wage rates and house rents from Clark (2004), with some limited information on transport prices from Harley (1988) and Bogart (2005), and with distribution prices derived as a weighted average of agricultural and industrial prices. Using the price series for agriculture, industry and services to reflate real output in each sector yields the values for current price GDP shown in Figure 8.

For comparison, we also show Deane and Cole's (1967) current price GDP estimates for benchmark years in the nineteenth century, together with Lindert and Williamson's (1982) benchmark figures for the eighteenth century. There is broad agreement over the long run trends, but our estimates suggest a higher nominal GDP in most years. A closer examination of the data for benchmark years in Table 2 reveals that during the nineteenth century our estimates of nominal GDP grow substantially more slowly than the Deane and Cole (1967) estimates between 1801 and 1851, but more rapidly after 1851. For the eighteenth century, our estimates grow substantially more rapidly than those of Lindert and Williamson (1982).

Figure 9 plots the price indices for the three main sectors together with the aggregate price index. Agricultural and service sector prices increased substantially during the second half of the eighteenth century, rising to a peak at the end of the Napoleonic Wars before falling back during the postwar deflation. By contrast, industrial prices increased much less during the eighteenth century and fell substantially more after 1815. Figure 10 therefore shows the expected pattern for the inter-sectoral terms of trade during the Industrial Revolution, with the relative price of agricultural goods increasing substantially, particularly from around 1780.

Figure 10 plots real and nominal GDP together with the aggregate price level over the period 1700-1870. Most of the increase in nominal GDP was the result of real growth, with only a modest increase in the price level. Although there was a period of substantial inflation during the French and Napoleonic Wars, this was followed by a period of postwar deflation.

VI. PER CAPITA INCOMES

To see what happened to per capita incomes, it is necessary to provide estimates of the total population of Great Britain. From 1801 onwards, annual data on the population of England, Wales and Scotland are available from Mitchell (1988: 9). For the period before 1801, the population of England has been reconstructed firmly by Wrigley and Schofield (1989) and Wrigley et al. (1997) for the period since the compulsory registration of births, marriages and deaths. Since less information is available for Wales and Scotland, we assume that the ratio of the population of Wales to England remained the same for the period 1700-1801. For Scotland, we have

population estimates for 1700 and 1750 (Schofield 1994: 93). Other years are interpolated using the population of England.

Combining the GDP series with the population data produces our estimates of per capita income in Figure 12. Table 17 presents the same material in growth rate form. The main findings are that per capita income growth accelerated considerably between 1780 and 1801, and then slowed down between 1801 and 1830, before accelerating again after 1830. For the period 1700-1870 as a whole, per capita income grew at an annual rate of 0.48 per cent using the 10-year average data.

VII. BUSINESS CYCLE CHRONOLOGY

The conventional business cycle chronology for the period 1700-1870 was established by Ashton (1959) for the eighteenth century and by Gayer et al. (1953) and Rostow (1972) for the nineteenth century, based on the NBER methodology of Burns and Mitchell (1946). This involved checking a large number of microeconomic time series and establishing turning points in "general business activity" as a "consensus of statistical data rather than turning-points in any particular magnitude such as national income" (Matthews, 1954: 2). The peak and trough years obtained with this methodology are shown in Table 18. The minor disagreements over turning points in the overlap period can be put down to the difficulties of assigning tuning points on an annual basis when monthly data would be more appropriate. Since growth rates are conventionally calculated between peaks, Table 18 suggests that there is likely to be some bias in the conventional periodisation used in the analysis of British economic growth. Picking peak years on the basis of the NBER methodology, the appropriate

periodisation would be 1701, 1761, 1783, 1802, 1831 and 1866 rather than 1700, 1760, 1780, 1801, 1831 and 1870.

Table 19 sets out the business cycle chronology obtained from the real GDP series constructed above, using the Hodrick-Prescott filter, with the smoothing parameter λ set equal to 100, following Backus and Kehoe (1992).[1] Using a lower value of λ equal to 6.25, as suggested by Ravn and Uhlig (2002), reduces the amplitude but not the frequency of the business cycle. The cycle with λ equal to 100 is graphed in Figure 13. If GDP can be taken as a more appropriate summary measure of "general business activity", the correct periodisation would be 1701, 1761, 1780, 1802, 1832, 1868. Given the disagreements on the precise dates of the turning points, we have taken 10-year averages based on the years traditionally analysed in the growth literature.

VIII. CONCLUSIONS

This paper provides the first estimates of GDP on an annual basis for Great Britain during the period 1700-1870. This enables us to analyse economic growth and the business cycle within a consistent framework. The results are broadly consistent with the long run path of real output suggested by Crafts and Harley (1992), although growth rates for sub-periods differ, largely as a result of changes in the growth of agriculture. Nominal GDP increased more rapidly than suggested by Lindert and Williamson (1982) during the eighteenth century, and more slowly than suggested by Deane and Cole (1967) during the first half of the nineteenth century, as a result of

[1] See Hodrick and Prescott (1997).

differences in the price indices. We also refine the business cycle chronologies of Ashton (1959) and Gayer, Rostow and Schwartz (1953).

TABLE 1: English arable land use (millions of acres)

	Wheat	Rye/ Maslin	Barley/ Dredge	Oats	Pulses	Potatoes	Other crops	Total sown	Fallow arable	Total arable
1700	2.02	0.43	1.85	1.17	0.99	0.00	1.31	7.76	1.94	9.70
1750	1.96	0.06	1.51	1.83	0.98	0.09	2.63	9.06	1.62	10.67
1800	2.59	0.06	1.46	2.05	0.83	0.17	3.07	10.23	1.29	11.52
1830	3.33	0.06	1.96	1.56	0.59	0.28	5.09	12.86	1.33	14.19
1871	3.32	0.06	1.96	1.45	0.90	0.39	5.66	13.35	0.48	13.83

Sources: Overton and Campbell (1996: Tables III, V); Early Modern Probate Inventory Database; Holderness (1989); Overton (1996).

FIGURE 1: English weighted national average grain yields per acre, gross of tithe and seed (bushels, log scale)

A. Wheat

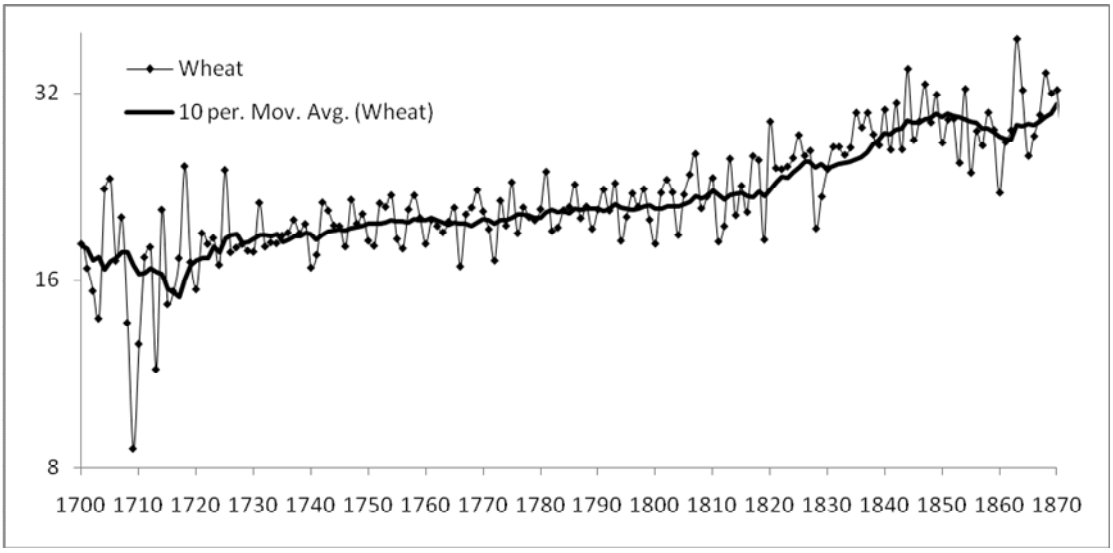
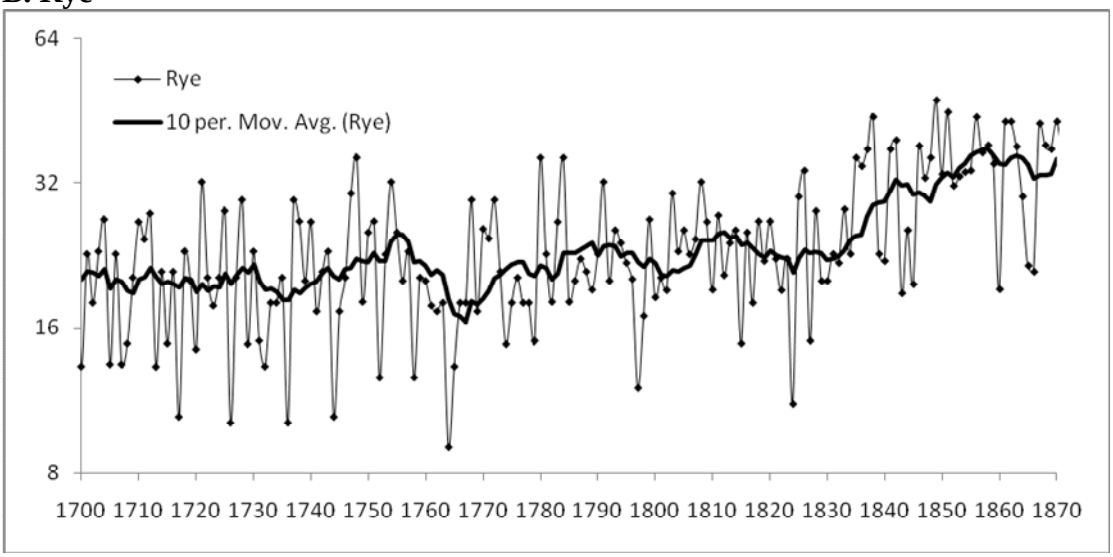


FIGURE 1 (continued): English weighted national average grain yields per acre, gross of tithe and seed (bushels, log scale)

B. Rye



C. Barley

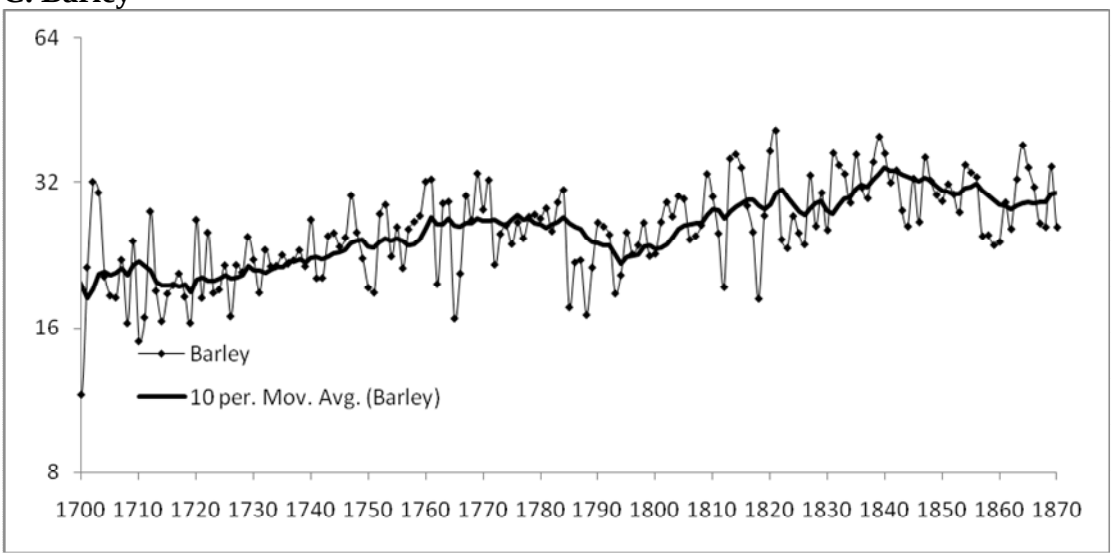
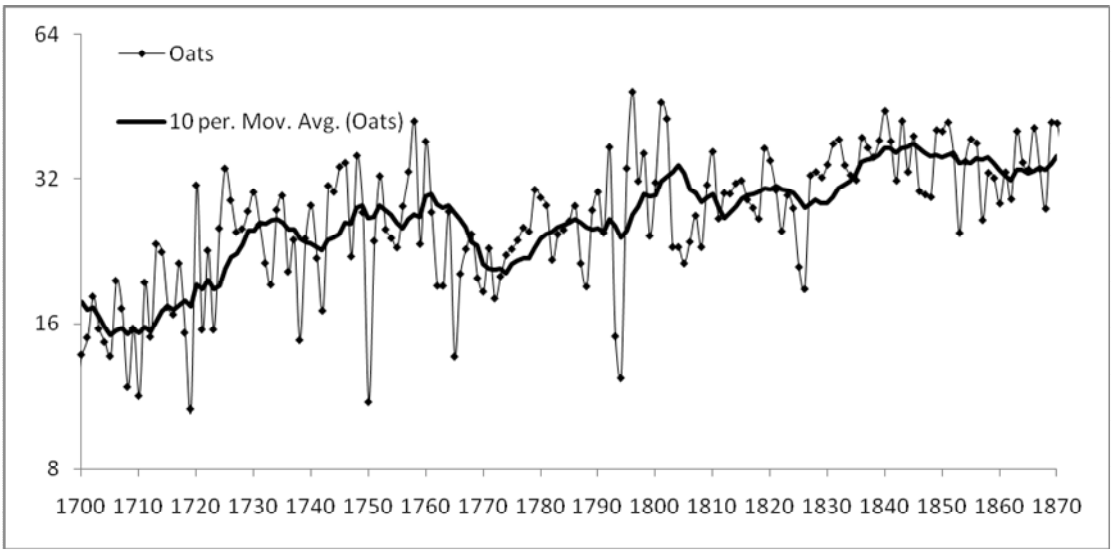
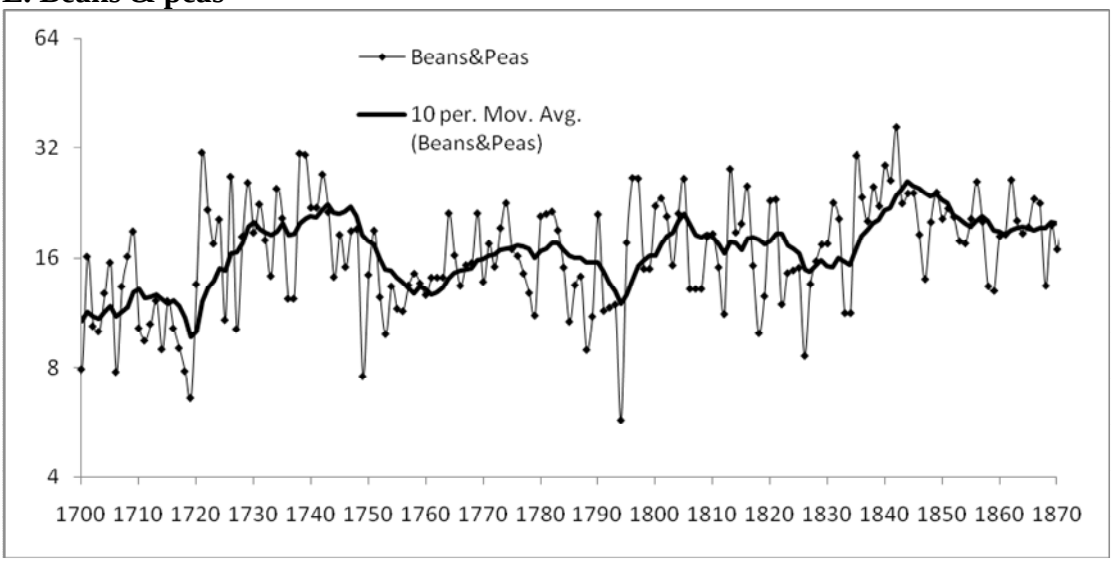


FIGURE 1 (continued): English weighted national average grain yields per acre, gross of tithe and seed (bushels, log scale)

D. Oats



E. Beans & peas



Sources: Early Modern Probate Inventories Database and Modern Farm Accounts Database.

TABLE 2: English mean yields per acre gross of tithes, net of seeds in bushels (10-year averages)

	Wheat	Rye	Barley	Oats	Pulses	Potatoes
1700-1709	14.38	15.94	17.33	11.54	9.88	150.00
1750-1759	17.75	17.26	20.93	22.66	10.36	150.00
1800-1809	19.43	16.56	23.62	25.28	16.13	150.00
1850-1859	25.25	20.06	26.13	30.60	16.58	150.00
1861-1870	28.19	19.99	27.15	31.69	17.35	150.00

Sources and notes: Gross yield per acre taken from the Early Modern Probate Inventories Database and the Modern Farm Accounts Database. Seed sown per acre from the Modern Database. Pulses are taken from Overton and Campbell (1996), Allen (2005).

TABLE 3: Working animals in England in millions (10-year averages)

	Oxen	Horses
1700-1709	0.10	0.57
1750-1759	0.07	0.78
1800-1809	0.03	0.89
1850-1859	0.00	1.25
1861-1870	0.00	1.26

Sources: Derived from the Early Modern Probate Inventories Database; Allen (1994); John (1989); Turner (1998).

TABLE 4: English arable output net of seed and animal consumption in million bushels (10-year averages)

	Wheat	Rye	Barley	Oats	Pulses	Potatoes
1700-1709	29.75	6.41	30.78	5.21	7.29	1.31
1750-1759	38.63	1.12	30.36	16.36	7.50	13.91
1800-1809	48.54	1.01	34.56	31.16	9.10	25.98
1850-1859	68.36	1.12	68.18	13.97	8.56	47.90
1861-1870	70.75	1.07	83.16	12.91	9.61	50.14

Source: Output gross of tithe and net of seed were derived by multiplying sown area from Table 1 with net yields from Table 2. The sown area from Table 1 was interpolated where necessary. Consumption by working animals was derived from the numbers of working animals shown in Table 3. For oats, outlying observations based on a very small number of inventories were dropped in 1700-09 and 1750-59, to eliminate excessive volatility.

TABLE 5: Numbers of non-working animals in England in millions (10-year averages)

	Milk cattle	Beef cattle	Calves	Sheep	Swine	Livestock units per 100 acres
1700-1709	0.36	0.33	0.36	15.68	0.97	35.04
1750-1759	0.47	0.42	0.47	14.86	1.12	32.44
1800-1809	0.83	0.75	0.83	19.82	1.75	46.18
1850-1859	1.15	1.04	1.15	22.62	2.20	46.49
1861-1870	1.30	1.17	1.30	25.39	2.19	51.46

Sources and notes: Derived from Early Modern Probate Inventory Database; Allen (2005); John (1989 Tales III.1 and III.2), Mitchell (1988); Turner (1998).
* Livestock units compare different animals on the basis of relative feed requirements. Ratios from Campbell (2000: 104-107): (adult cattle for beef and milk x 1.2) + (immature cattle x 0.8) + (sheep and swine x 0.1).

TABLE 6: Percentages of English animals producing specific products

	Milk	Beef	Veal	Mutton	Pork	Wool
1700	90	25	21.1	26	49	90
1850	90	33	25.0	40	100	80

Sources: Holderness (1989: 147); Clark (1991: 216).

TABLE 7: English yields per animal (10-year averages)

Years	Milk (gallons)	Beef (lb)	Veal (lb)	Mutton (lb)	Pork (lb)	Wool (lb)
1700-1709	272.01	384.98	67.12	46.39	86.56	2.51
1750-1759	316.69	440.22	76.84	52.53	98.78	2.91
1800-1809	368.72	503.37	87.96	59.49	112.72	3.38
1850-1859	429.29	575.59	100.69	67.36	128.63	3.92
1861-1870	443.90	592.82	103.73	69.22	132.42	4.05

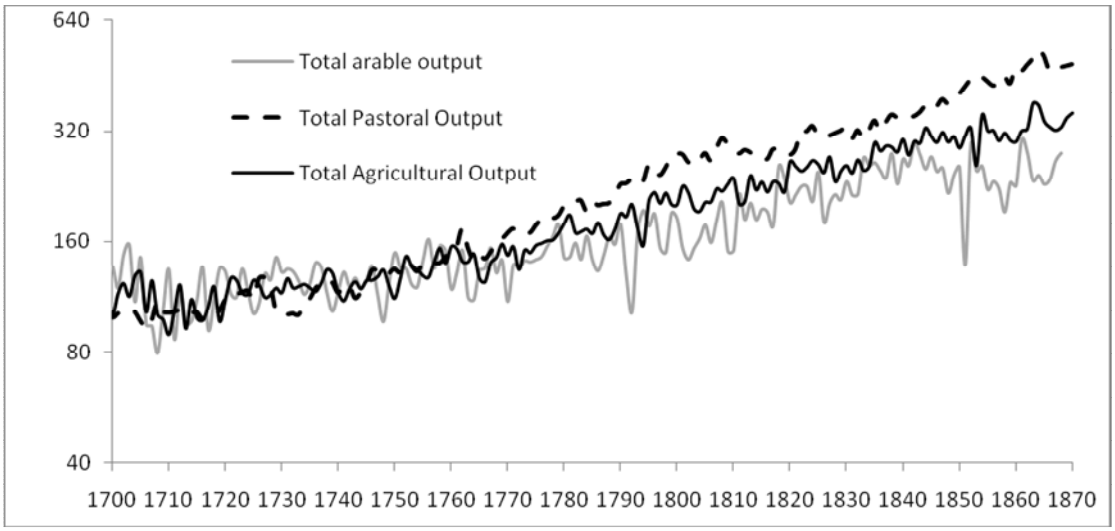
Sources and notes: Milk, beef, mutton, pork, and wool are obtained from Clark (1991: 216), while veal is taken from Allen (2005: Table 6). The missing years were interpolated in line with the ratio of product to animal prices.

TABLE 8: Output in English pastoral farming (10-year averages)

Years	Milk (m.gals)	Beef (m. lb)	Veal (m. lb)	Mutton (m. lb)	Pork (m. lb)	Wool (m. lb)	Hides (m. lb)	Hay (m. tons)
1700-1709	89.16	31.91	5.54	191.86	49.67	35.34	14.65	0.32
1750-1759	133.51	51.51	8.59	237.29	78.30	37.32	20.59	0.51
1800-1809	275.67	114.30	18.27	414.29	167.54	55.53	38.03	1.37
1850-1859	443.26	196.73	28.88	609.29	282.94	70.85	53.48	1.93
1861-1870	517.47	228.77	33.59	703.05	290.31	82.19	59.69	1.94

Sources: Total output estimates are derived by multiplying animal numbers from Table 5 with the percentage of animals producing in Table 6. The resulting numbers of producing animals are then multiplied with the animal yields from Table 7.

FIGURE 2: Indexed output in English arable and pastoral agriculture (log scale, 1700=100)



Sources: See text.

TABLE 9: Output shares in English agriculture, in current prices, 10-year averages (%)

A. Arable products

Year	Wheat	Rye	Barley	Oats	Pulses	Potatoes	Total arable products
1700-09	31.1	4.4	18.3	0.9	5.3	0.3	60.2
1750-59	32.0	0.6	13.5	8.4	4.0	4.1	62.5
1800-09	28.8	0.4	10.3	6.5	3.4	3.1	52.6
1861-70	17.4	0.2	14.3	1.5	1.9	7.6	42.8

B. Pastoral products

Year	Dairy	Beef	Pork	Mutton	Hay	Wool	Hides	Total pastoral products
1700-09	8.3	2.8	4.4	13.3	4.0	5.7	1.3	39.8
1750-59	9.4	3.2	4.6	10.9	4.8	3.4	1.2	37.5
1800-09	11.6	5.1	5.6	13.7	7.6	2.9	0.8	47.4
1861-70	16.1	7.1	7.9	14.9	6.2	4.3	0.9	57.2

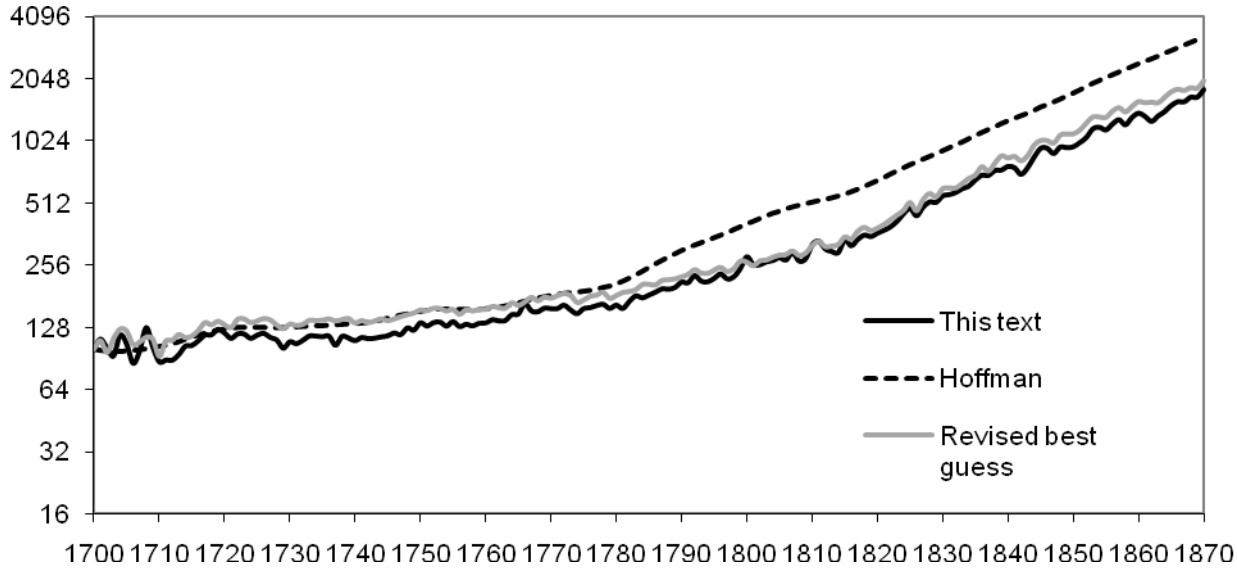
Sources: Derived from Early Modern Probate Inventories Database; Modern Farm Accounts Database.

TABLE 10: Output growth in agriculture

	Annual data			10-year averages
	Crafts-Harley	Present estimates		Present estimates
1700-1760	0.60	0.73	1700/09 - 1760/69	0.38
1760-1780	0.13	0.74	1760/69 - 1780/89	0.96
1780-1801	0.75	1.11	1780/89 - 1801/10	1.03
1801-1830	1.18	0.45	1801/10 - 1830/39	0.81
1830-1870	--	0.82	1830/39 - 1861/70	0.75
1700-1830	0.68	0.73	1700/09 - 1830/39	0.67
1700-1870	--	0.75	1700/09 - 1861/70	0.68

Sources: Crafts (1985: 45; Crafts and Harley (1992: 715); see text.

FIGURE 3: British industrial output in real terms, 1700-1870 (log scale, 1700=100)



Sources: Crafts and Harley (1992); Hoffmann (1955); see text.

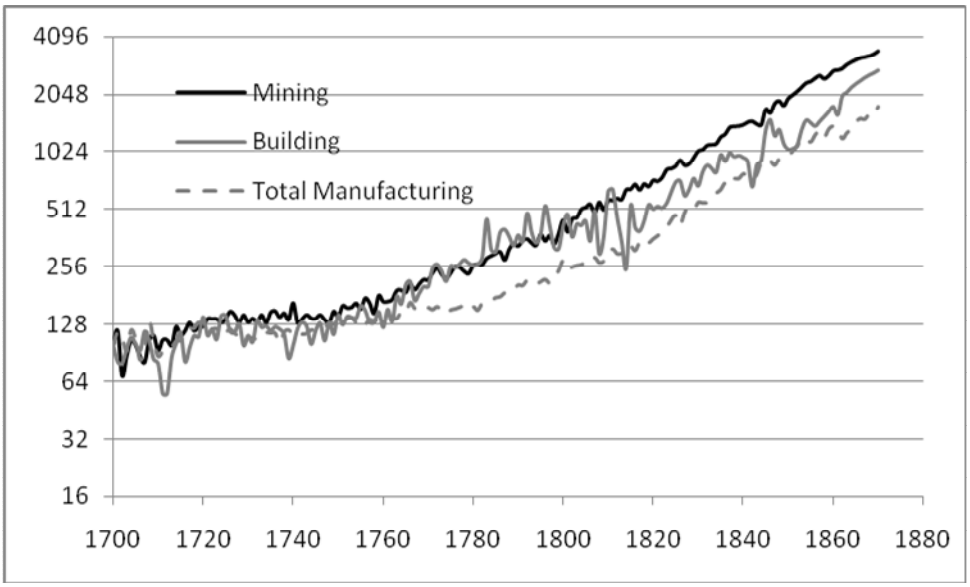
TABLE 12: Output growth in British industry, 1700-1870 (% per annum)

	Crafts-Harley	Present estimates (annual data)		Present estimates (10-year averages)
1700-1760	0.71	0.49	1700/09 - 1760/69	0.58
1760-1780	1.29	1.00	1760/69 - 1780/89	1.04
1780-1801	1.96	2.18	1780/89 - 1801/10	2.01
1801-1830	2.78	2.59	1801/10 - 1830/39	2.87
1830-1870	3.06	3.01	1830/9 - 1861/70	2.91
1700-1830	1.39	1.33	1700/09 - 1830/39	1.41
1700-1870	1.78	1.72	1700/09 - 1861/70	1.93

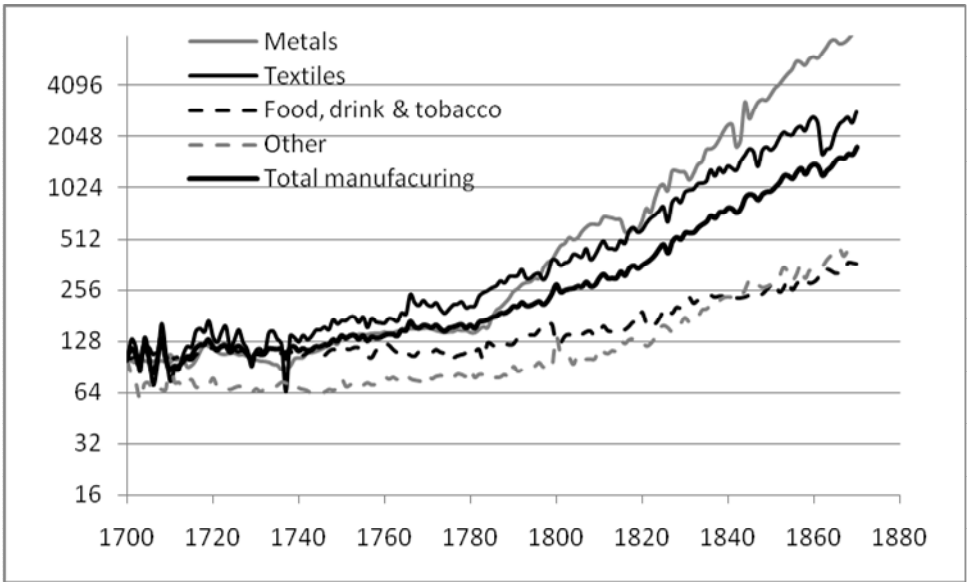
Sources: Crafts (1985: 32); Crafts and Harley (1992: 715); see text.

FIGURE 4: Industrial output by sub-sector (1700=100, log scale)

A. Mining, building and manufacturing

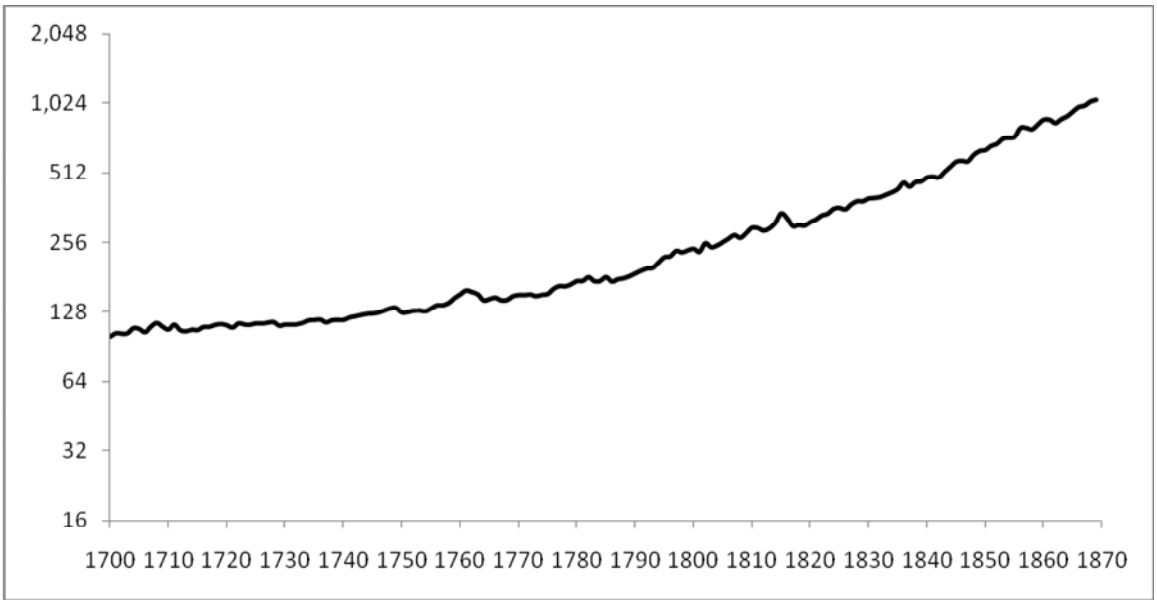


B. Metals, textiles, FDT, other manufacturing



Source: see text.

FIGURE 5: British service sector output in real terms, 1700-1870 (log scale, 1700=100)



Sources: See text.

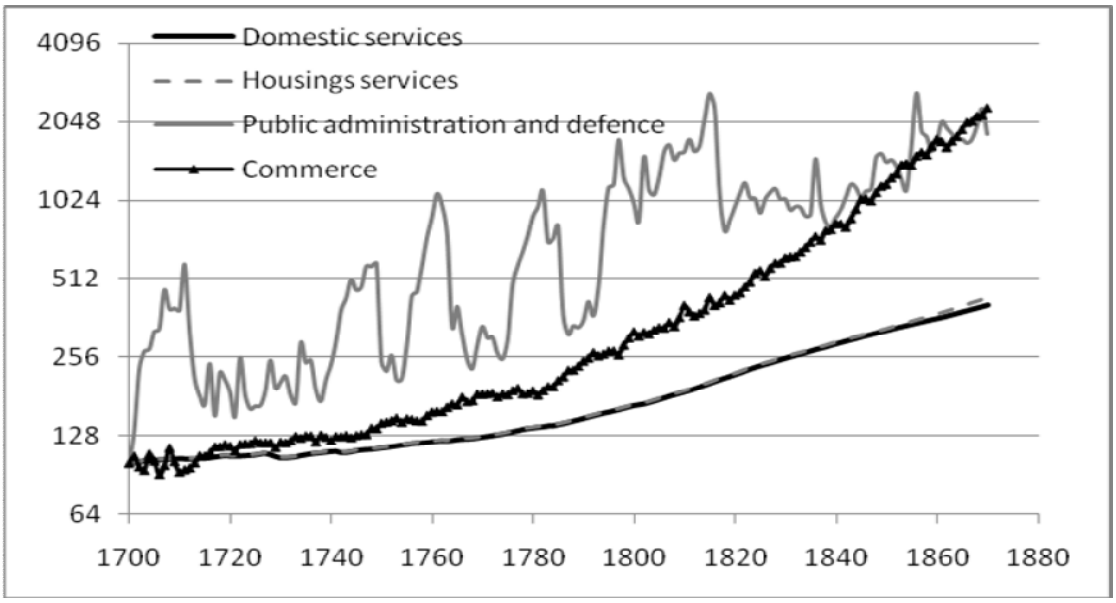
TABLE 13: Output growth in British services, 1700-1870 (% per annum)

	Crafts-Harley	Present estimates (annual data)		Present estimates (10-year averages)
1700-1760	0.74	0.71	1700/09 - 1760/69	0.56
1760-1780	0.77	0.66	1760/69 - 1780/89	0.85
1780-1801	1.31	1.40	1780/89 - 1801/10	1.90
1801-1830	1.68	1.79	1801/10 - 1830/39	1.67
1830-1870	--	2.58	1830/39 - 1861/70	2.71
1700-1830	1.05	1.07	1700/09 – 1830/39	1.08
1700-1870	--	1.61	1700/09 - 1861/70	1.58

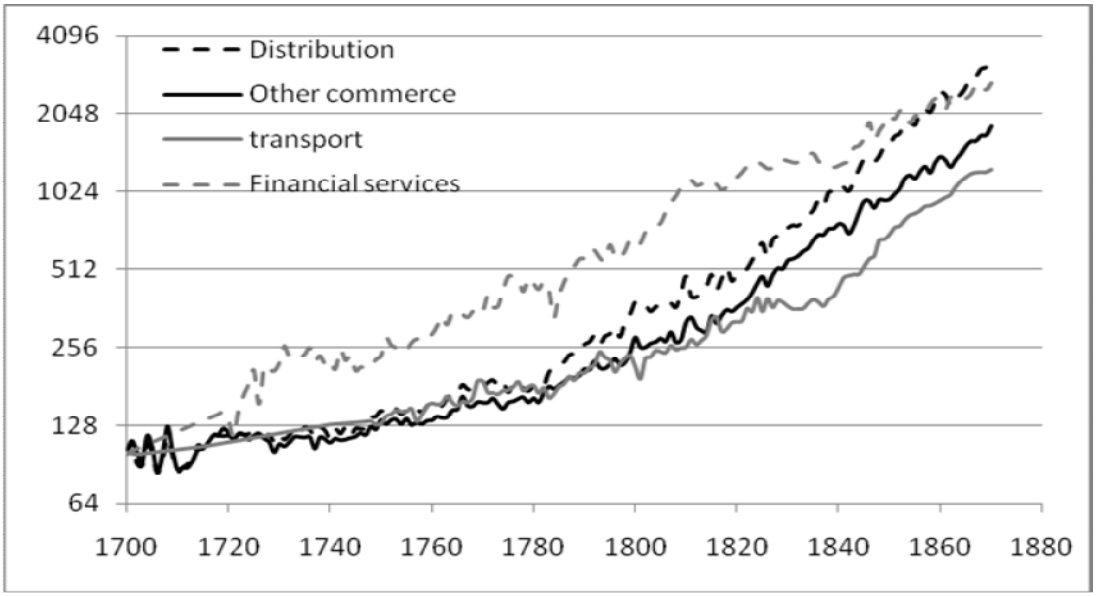
Sources: Derived from Crafts (1985: 16-17, 32, 37); Crafts and Harley (1992: 715); see text.

FIGURE 6: Services output by sub-sector (1850=100, log scale)

A. Commerce, government, housing and domestic service



B. Transport, distribution, finance and other commerce



Source: see text.

TABLE 14: British sectoral weights, 1700-1850 (%)

	1700	1759	1801	1841
Agriculture	28.0	26.1	30.9	22.1
Industry	37.8	38.6	31.9	36.4
Services	34.2	35.3	37.2	41.5
GDP	100.0	100.0	100.0	100.0

Sources and notes: Derived from reconstruction of nominal GDP by sector. Real output trends above are transformed into current price trends using sectoral price deflators, with absolute levels of GDP in current prices established using an input-output table for 1841, based on Horrell *et al.* (1994). 1700 weights are used for the period 1700-1740, 1759 weights for 1740-1780, 1801 weights for 1780-1820 and 1841 weights for 1820-1870.

FIGURE 7: British GDP in real terms, 1700-1870 (log scale, 1700=100)

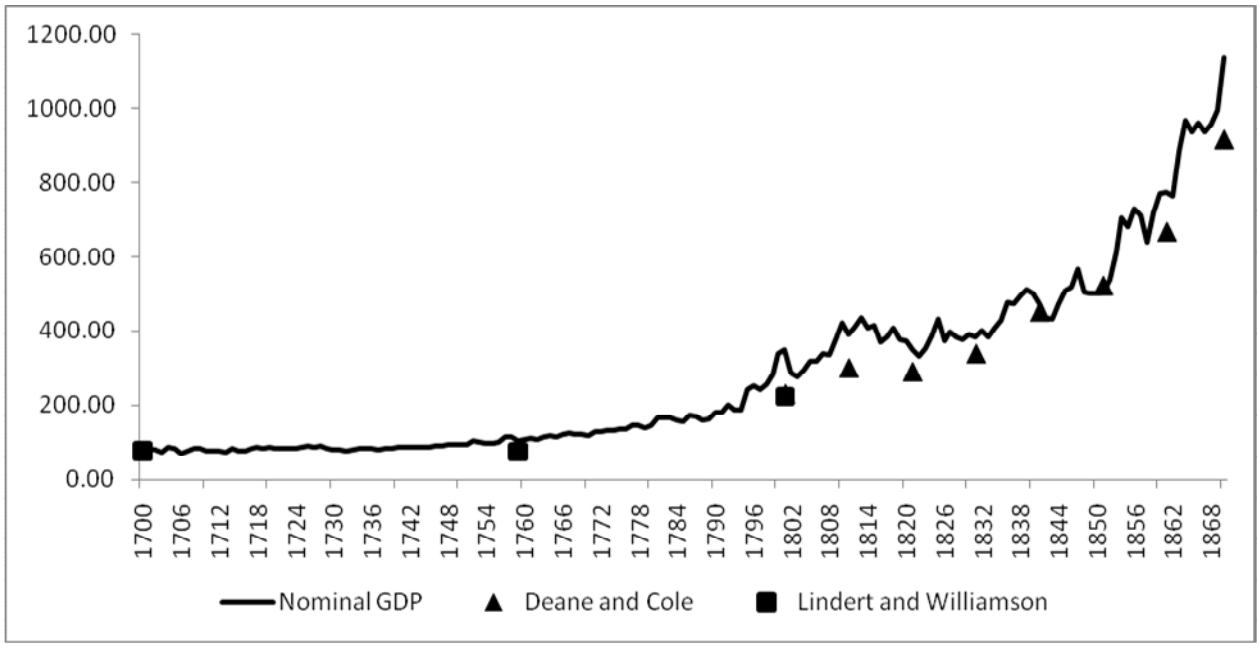
Sources: See text.

TABLE 15: British GDP growth, 1700-1870 (% per annum)

	Annual data			10-year averages
	Crafts-Harley	Present estimates		Present estimates
1700-1760	0.69	0.63	1700/09 - 1760/69	0.52
1760-1780	0.64	0.81	1760/69 - 1780/89	0.89
1780-1801	1.38	1.54	1780/89 - 1801/10	1.66
1801-1830	1.90	1.69	1801/10 - 1830/39	1.86
1830-1870	--	2.40	1830/39 - 1861/70	2.40
1700-1830	1.06	1.04	1700/09 – 1830/39	1.06
1700-1870	--	1.36	1700/09 - 1861/70	1.31

Sources: Crafts (1985: 45); Crafts and Harley (1992: 715); see text.

FIGURE 8: Nominal GDP, Great Britain 1700-1870 (£ million, log scale)



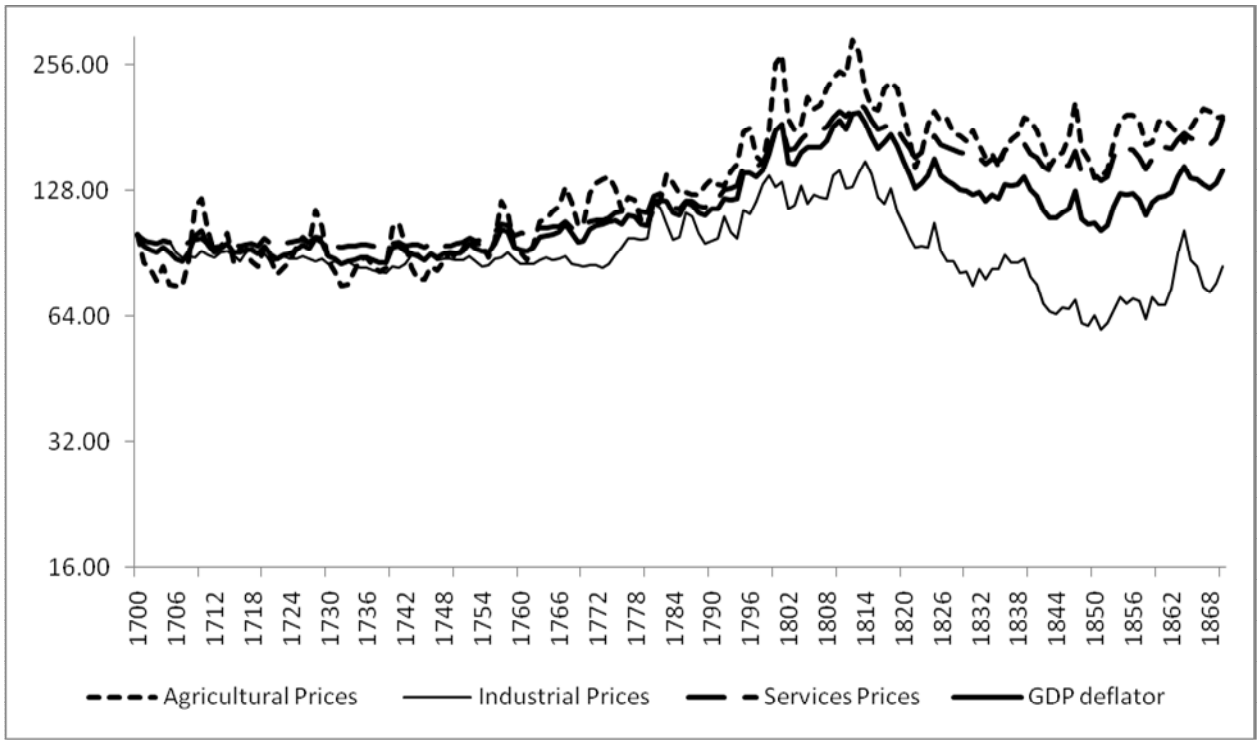
Sources: Deane and Cole (1967); Lindert and Williamson (1982); see text.

TABLE 16: British GDP in current prices (£ million)

	This paper	Deane & Cole	Lindert & Williamson
1700	80.12		75.76
1759	104.89		75.33
1801	348.36	232.0	223.80
1811	392.02	301.1	
1821	348.21	291.0	
1831	382.44	340.0	
1841	473.80	452.3	
1851	504.89	523.3	
1861	774.62	668.0	
1871	1,136.07	916.6	

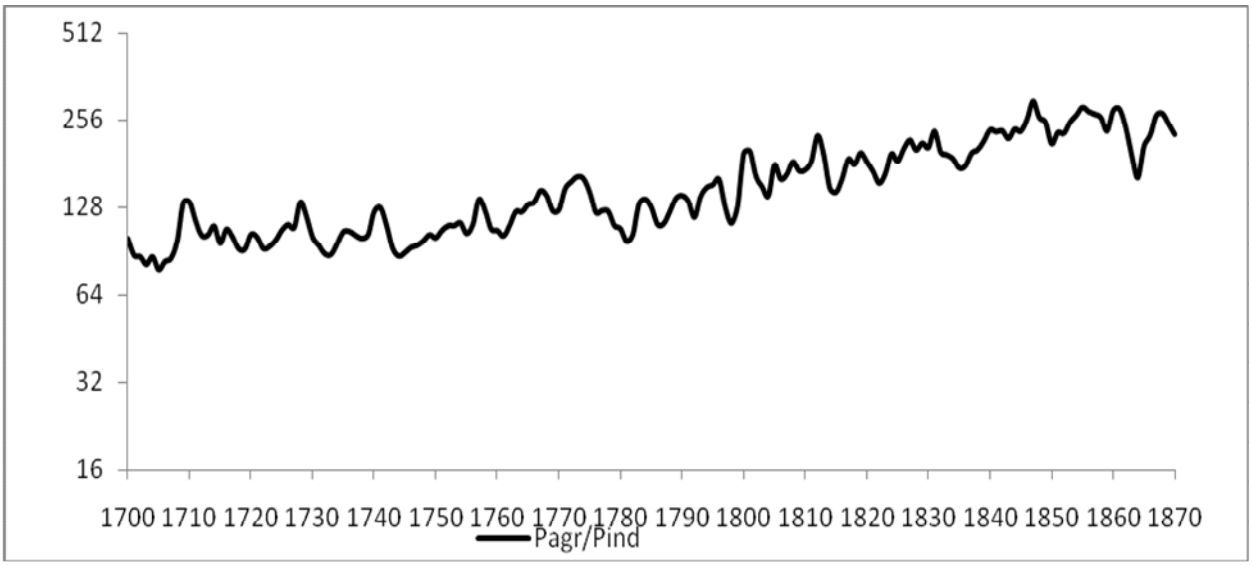
Sources and notes: See text; Deane and Cole (1967); Lindert and Williamson's (1982) estimates for England converted to a Great Britain basis using data on the population share of Scotland and Scottish per capita incomes as a percentage of the average for Great Britain from income tax data in Lee (1986: 127, 131).

FIGURE 9: Aggregate and sectoral price indices, Great Britain 1700-1870 (1700=100, log scale)



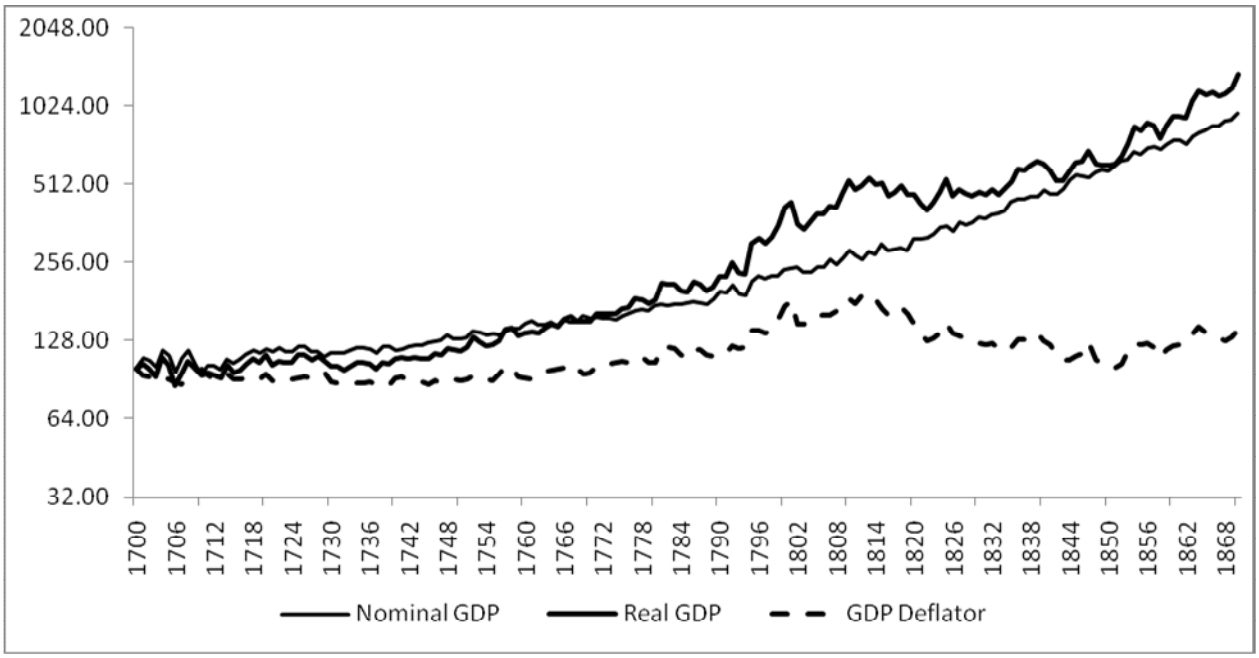
Sources: see text.

FIGURE 10: Inter-sectoral terms of trade between agriculture and industry, Great Britain 1700-1870 (1700=100) (log scale)



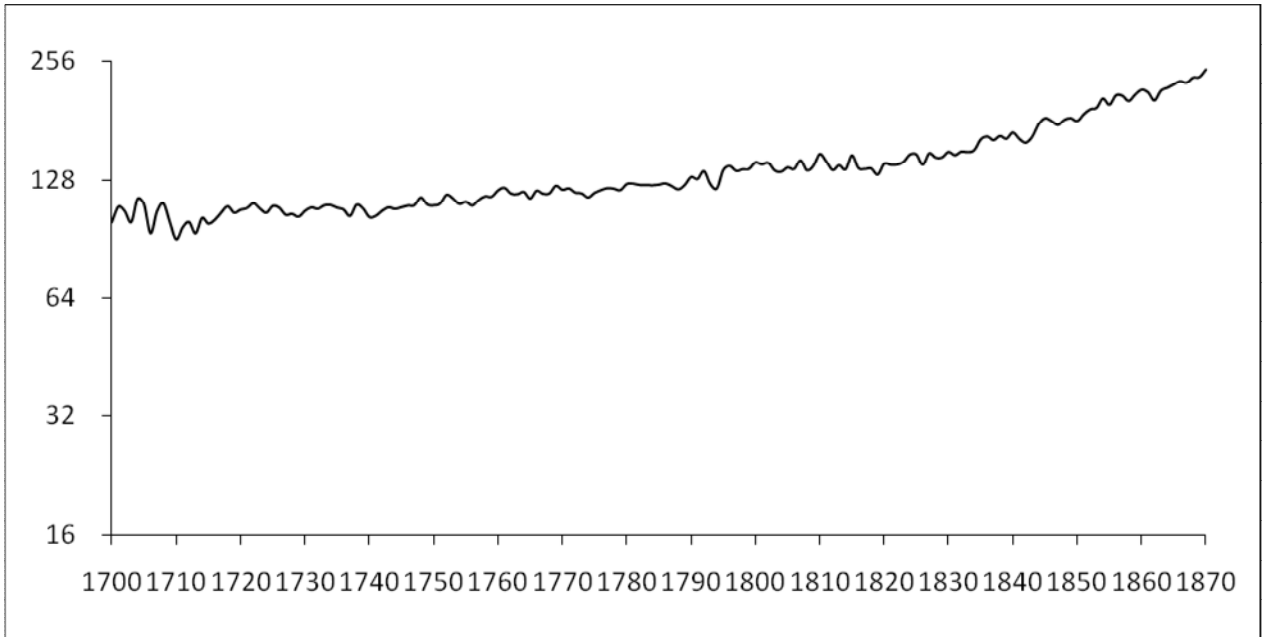
Sources: see text.

FIGURE 11: Real and nominal GDP, Great Britain 1700-1870 (1700=100, log scale)



Sources: see text.

FIGURE 12: British real GDP per capita, 1700-1870 (log scale, 1700 = 100)



Sources: See text.

TABLE 17: Average annual growth rate of British population and per capita income, 1700-1870 (% per annum)

	Annual data			10-year averages	
	Population growth	Per capita GDP growth		Population growth	Per capita GDP growth
1700-1760	0.32	0.31	1700/09 - 1760/69	0.31	0.21
1760-1780	0.62	0.19	1760/69 - 1780/89	0.68	0.20
1780-1801	0.97	0.56	1780/89 - 1801/10	1.10	0.56
1801-1830	1.43	0.25	1801/10 - 1830/39	1.44	0.42
1830-1870	1.18	1.22	1830/39 - 1861/70	1.21	1.20
1700-1830	0.72	0.32	1700/09 – 1830/39	0.75	0.31
1700-1870	0.83	0.53	1700/09 - 1861/70	0.83	0.48

Sources: Mitchell (1988), Wrigley and Schofield (1989), Schofield (1994) and Wrigley *et al.* (1997); see text.

TABLE 18: Business cycle chronology based on sectoral indicators

A. Eighteenth Century

Peak	Trough	Peak	Trough
1701	1702	1751	1755
1704	1706	1761	1763
1708	1712	1764	1769
1714	1716	1771-72	1775
1717-18	1722	1777	1781
1724-25	1727	1783	1784
1728	1730	1787	1789
1733	1734	1792	1794
1738	1742	1796	1798
1743	1746	1799	1800
1746	1748	1802	

B. Nineteenth Century

Peak	Trough	Peak	Trough
1792	1793	1828	1829
1796	1797	1831	1832
1800	1801	1836	1837
1802	1803	1839	1842
1806	1808	1845	1848
1810	1811	1854	1855
1815	1816	1857	1858
1818	1819	1860	1862
1825	1826	1866	1868

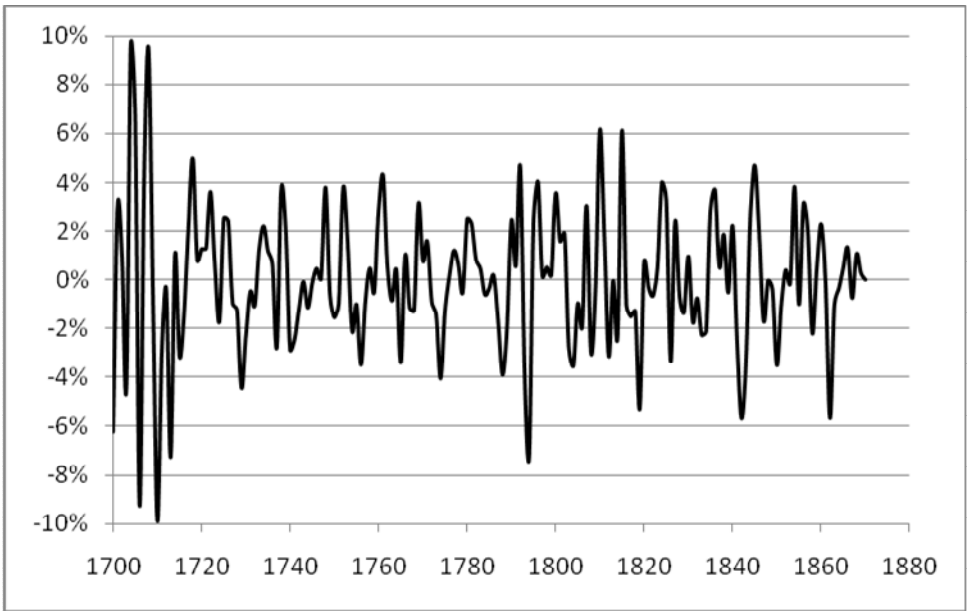
Sources: Ashton (1959: 172); Gayer et al. (1953: 348); Rostow (1972: 77).

TABLE 19: Business cycle chronology based on GDP series

Peak	Trough	Peak	Trough
1701	1703	1796	1797
1704	1706	1798	1799
1708	1710	1800	1801
1712	1713	1802	1804
1714	1715	1805	1806
1718	1719	1807	1808
1722	1724	1810	1812
1725	1729	1813	1814
1731	1732	1815	1817
1734	1737	1818	1819
1738	1740	1820	1822
1743	1744	1824	1826
1746	1747	1827	1829
1748	1750	1830	1831
1752	1754	1832	1833
1755	1756	1836	1837
1758	1759	1838	1839
1761	1763	1840	1842
1764	1765	1845	1847
1766	1768	1848	1850
1769	1770	1852	1853
1771	1774	1854	1855
1777	1779	1856	1858
1780	1784	1860	1862
1786	1788	1866	1867
1790	1791	1868	
1792	1794		

Sources: see text.

FIGURE 13: Cyclical component of the log of the GDP index (1850=100) after Hodrick-Prescott filter (λ=100)



Sources: see text.

APPENDIX 1: DATA SOURCES AND METHODS

A. REAL OUTPUT SERIES

1. Agriculture

The weighting scheme is given in Table 9, and data sources are listed in the notes to Tables 1-8.

2. Industry

The weighting scheme presented in Table A1 is based on Hoffmann (1955), but modified as discussed in the text. The basic data are obtained from Hoffmann (1955), apart from the modifications listed below:

*Mining: c*oal: Pollard's (1980) decadal estimates, interpolated using the Hoffmann series.

Metals: Iron, steel and machine building: Hoffmann's series is replaced for the period before 1839 using bar iron output from King (2005). The yearly data can be downloaded from the Economic History Society website at http://www.ehs.org.uk/ehs/Datasets/datasets.asp. Shipbuilding: Gross capital formation in ships from Feinstein (1988: 446), interpolated using the Hoffmann series.

Textiles: Silk thread and goods: Mitchell (1988: 343) reports the imports of raw, thrown and waste silk for 1700-1825. These are used to extend the Hoffmann series. Linen yarn and cloth: Hoffmann's series extended using linen yarn imports from Schumpeter (1960: 52).

Food, Drink & Tobacco: Beer: Prior to 1787, the data are brought back in time by connecting an index of small, strong, and table beer charged with duty (Mitchell 1988: 404-405) to the Hoffmann index. Tobacco products: This series is extended back to 1700 with the value of imported tobacco at official prices from Mitchell (1988: 462-463).

Other Manufacturing: Paper: Paper charged with duty from Mitchell (1988: 413). Printed matter: Index of new English language book titles (1700-1800) from the English Short Title Catalogue (http://www.rlg.org/estc.html). This is extended from 1800 to 1870 with an index of new titles from the Integrated Catalogue of the British Library (http://catalogue.bl.uk/F/?func=file&file_name=login-bl-list). The overlapping years show a high correlation, thus these two series can be linked together. Leather: Hoffmann's series is extended back from 1801 to 1722 with an index of hides and skins charged with duty from Mitchell (1988: 416). Soap and candles: For the period prior to 1821, separate series are available for soap and candles from Mitchell (1988: 412, 415). Soap charged with duty is available back to 1713, while tallow candles charged with duty are available back to 1711.

Building: The Hoffmann series is replaced with a constant price series of total buildings and works from Feinstein (1988: 446), available for 1761-1870 but with gaps. Timber imports from Mitchell (1988: 462) were used to interpolate.

3. Services

Weights of the four main service sectors are given as shares of total services in Table A2. These shares are taken from Crafts (1985: 16-17). Data sources are as follows:

3.1. Commerce

Transport: We used shipping tonnage from Mitchell (1988: 534), the length of railways from Mitchell (1988: 541), total investment in waterways and roads from Ginarlis and Pollard (1988: 217-219) and the number of weekly passenger road

services from Bogart (2005: 487), which we interpolated assuming constant rates of growth. The index is created from the unweighted average of the available series.
Financial services: We used the number of country banks from Pressnell (1956: 11), available for 1784, 1793, 1796, 1798, 1800-1842. These points were interpolated using the drawing accounts of the Bank of England from Mitchell (1988: 665) for 1720-1844, extended to 1870 with total deposits from Mitchell (1988: 658). The period 1700-1720 was projected using an exponential trend. We also used Pearson's (2004: 374-375) series on fire insurance (real sum insured). The composite index was obtained as the unweighted average of the banking and insurance indices.
Distribution: In the spirit of Deane and Cole's (1967) work on the eighteenth century, we assumed that the growth of distribution is a weighted average of the growth of foreign trade and industry, with weights of 0.6 and 0.4 respectively. Checking the sensitivity of the results to changing the weights, we found that reducing the share of foreign trade to 30 per cent reduced the growth rate over the period 1700-1870 by just 0.2 percentage points. The data on exports and imports are taken from Mitchell (1988: 448-450).
Other commerce: We assume that other commerce grew in line with industry.

3.2 Domestic and personal services
We assume that domestic and personal services grew in line with population, following the assumption of Deane and Cole (1967: 77) for the eighteenth century.

3.3 Government
We use civil government and defence expenditure from Mitchell (1988: 578, 587), deflated using the Schumpeter-Gilboy price index to 1800 and the Rousseaux price index after 1800, both from Mitchell (1988: 719, 722).

3.4 Housing
We use housing stock data from Feinstein (1988: 389), using a regression relationship between housing stock and population to fill in gaps.

B. PRICE SERIES
1. Agriculture
Data are from Clark (2004, 2005, 2007), and can be downloaded from: http://www.iisg.nl/hpw/data.php#united.

2 Industry
Unless otherwise specified, data are from Clark (2004, 2005, 2007), and can be downloaded from: http://www.iisg.nl/hpw/data.php#united. Commodities used are as follows:
Textiles: cotton, cotton cloth, wool, wool cloth, silk thread, linen cloth.
Metals: iron manufactures, pewter.
Other manufacturing: wood, paper-foolscap, books, leather (Beveridge, 1939; the average of Naval Stores leather, backs and hose), soap, candles, lamp oil, coal gas.
Construction: bricks, tiles (Beveridge, 1939; the average of Winchester, Eton, Westminster, Sandwich, Greenwich, Office of Works, Naval Stores. We used paving, roof, and plain tiles but omitted ridge and paving tiles from the Naval Stores because these were outliers compared to the other series), laths (Beveridge, 1939; the average of Greenwich and Office of Works), lime (Beveridge, 1939; the average of Winchester, Eton, Westminster, Sandwich, Greenwich, Office of Works, Naval

Stores), sand (Beveridge, 1939; the average of Westminster, Office of Works, Naval Stores; we used masons' sand and gravel, and sand, cement and tarras (Beveridge 1939; the average of cement, mortar, and tarras from Greenwich and Westminster), lead (Beveridge, 1939; the average of lead, milled sheet, sheet and cast, pipe from Westminster, Greenwich, Office of Works, and Naval Stores), building labourer's wage.
Mining: coal.
Foodstuff: wheaten flour, bread, bacon, treacle, sugar, beer, malt (Beveridge, 1939; the average of Winchester, Eton, Westminster, Greenwich and Navy Victualling in London, Portsmouth, and Plymouth), spirits, tobacco.

3 Services
Unless otherwise specified, data are from Clark (2004, 2005, 2007), and can be downloaded from: http://www.iisg.nl/hpw/data.php#united. Series used are as follows:
Housing: rent.
Domestic service: wages of building labourers.
Government: wages of craftsmen.
Financial services: fire insurance (Pearson, 2004: 374-380)
Transport: comprised of shipping (Harley, 1988; 873-875); goods road transport (Bogart 2005: 505, interpolated decadal figures, 1700-1830); passenger road transport (Bogart 2005: 506, interpolated decadal figures, 1750-1830).
Distribution: weighted average of agriculture and industry prices.

TABLE A1: Industrial output weights (%)

1700-1711	Coal, 11.4; Iron, steel and machine building, 11.8; Tin, 1.7; Cotton yarn and cloth, 8.8; Silk thread and goods, 11.4; Linen yarn and cloth, 21.2; Sugar, 0.8; Beer, 14.0; Malt, 4.4; Tobacco products, 2.1; Printed matter, 3.6; Building, 8.7
1711-1713	Coal, 10.7; Iron, steel and machine building, 11.8; Tin, 1.6; Cotton yarn and cloth, 8.2; Silk thread and goods, 10.7; Linen yarn and cloth, 19.7; Sugar, 0.7; Beer, 13.0; Malt, 4.1; Tobacco products, 2.0; Printed matter, 3.6; Candles, 5.2; Building, 8.7
1713-1722	Coal, 11.3; Iron, steel and machine building, 13.2; Tin, 1.4; Cotton yarn and cloth, 7.3; Silk thread and goods, 9.5; Linen yarn and cloth, 17.7; Sugar, 0.6; Beer, 11.7; Malt, 3.6; Tobacco products, 1.8; Paper, 0.8; Printed matter, 4.0; Soap, 2.6; Candles, 4.7; Building, 9.7
1722-1727	Coal, 5.9; Iron, steel and machine building, 8.2; Tin, 0.8; Cotton yarn and cloth, 4.6; Silk thread and goods, 5.9; Linen yarn and cloth, 10.8; Sugar, 0.3; Beer, 7.1; Malt, 2.2; Tobacco products, 1.0; Paper, 0.5; Printed matter, 4.1; Leather and leather goods, 34.1; Soap, 1.6; Candles, 2.9; Building, 9.9
1727-1739	Coal, 5.8; Copper ore, 0.5; Iron, steel and machine building, 8.1; Tin, 0.8; Cotton yarn, 4.5; Silk thread and goods, 5.8; Linen yarn and cloth, 10.7; Sugar, 0.3; Beer, 7.1; Malt, 2.2; Tobacco products, 1.0; Paper, 0.5; Printed matter, 4.1; Leather and leather goods, 33.9; Soap, 1.6; Candles, 2.9; Building, 9.9
1739-1761	Coal, 4.0; Copper ore, 0.4; Iron, steel and machine building, 5.6; Tin, 0.5; Cotton yarn and cloth, 2.4; Woollen and worsted yarn and cloth, 27.5; Silk thread and goods, 4.0; Linen yarn and cloth, 7.4; Sugar, 0.3; Beer, 5.0; Malt, 1.5; Tobacco products, 0.8; Paper, 0.3; Printed matter, 4.1; Leather and leather goods, 23.2; Soap, 1.1; Candles, 2.0; Building, 9.9
1761-1771	Coal, 3.9; Copper ore, 0.4; Iron, steel and machine building, 6.5; Tin, 0.5; Cotton yarn and cloth, 6.7; Woollen and worsted yarn and cloth, 27.1; Silk thread and goods, 3.9; Linen yarn and cloth, 7.3; Sugar, 0.3; Beer, 4.9; Malt, 1.5; Tobacco products, 0.8; Paper, 0.3; Printed matter, 3.4; Leather and leather goods, 19.7; Soap, 1.1; Candles, 2.0; Building, 9.8
1771-1780	Coal, 3.8; Copper ore, 0.3; Iron, steel and machine building, 6.5; Copper, 0.4; Tin, 0.5; Cotton yarn and cloth, 6.7; Woollen and worsted yarn and cloth, 27.0; Silk thread and goods, 3.9; Linen yarn and cloth, 7.2; Sugar, 0.3; Beer, 4.9; Malt, 1.5; Tobacco products, 0.8; Paper, 0.3; Printed matter, 3.4; Leather and leather goods, 19.6; Soap, 1.1; Candles, 1.9; Building, 9.8
1780-1787	Coal, 3.8; Copper ore, 0.3; Iron, steel and machine building, 6.5; Copper, 0.4; Tin, 0.5; Cotton yarn and cloth, 6.7; Woollen and worsted yarn, 12.2; Woollen and worsted cloth, 14.8; Silk thread and goods, 3.9; Linen yarn and cloth, 7.2; Sugar, 0.3; Beer, 4.9; Malt, 1.5; Tobacco products, 0.8; Paper, 0.3; Printed matter, 3.4; Leather and leather goods, 19.6; Soap, 1.1; Candles, 1.9; Building, 9.8

TABLE A1 (continued): Industrial output weights (%)

1787-1789	Coal, 3.8; Copper ore, 0.3; Iron, steel and machine building, 6.5; Copper, 0.4; Tin, 0.5; Cotton yarn and cloth, 6.7; Woollen and worsted yarn, 12.2; Woollen and worsted cloth, 14.7; Silk thread, 1.3; Silk goods, 3.0; Linen yarn and cloth, 7.2; Sugar, 0.3; Beer, 4.9; Malt, 1.5; Tobacco products, 0.8; Paper, 0.3; Printed matter, 3.4; Leather and leather goods, 19.5; Soap, 1.1; Candles, 1.9; Building, 9.7
1789-1801	Coal, 3.7; Copper ore, 0.3; Iron, steel and machine building, 6.5; Copper, 0.4; Tin, 0.5; Shipbuilding, 1.9; Cotton yarn and cloth, 6.7; Woollen and worsted yarn, 11.9; Woollen and worsted cloth, 14.4; Silk thread, 1.2; Silk goods, 2.5; Linen yarn and cloth, 7.0; Sugar, 0.3; Beer, 4.8; Malt, 1.4; Tobacco products, 0.8; Paper, 0.3; Printed matter, 3.4; Leather and leather goods, 19.1; Soap, 1.1; Candles, 1.9; Building, 9.8
1801-1831	Coal, 8.6; Copper ore, 1.0; Iron, steel and machine building, 11.5; Copper, 0.9; Copper products, 0.9; Tin, 0.4; Shipbuilding, 2.6; Cotton yarn, 5.1; Cotton cloth, 10.1; Woollen and worsted yarn, 6.9; Woollen and worsted cloth, 6.9; Silk thread, 0.6; Silk goods, 1.4; Linen yarn and cloth, 5.3; Wheaten flour, 1.4; Bread and cakes, 3.0; Sugar, 0.5; Beer, 0.9; Malt, 0.6; Spirits, 1.4; Tobacco products, 0.6; Paper, 1.9; Printed matter, 3.9; Leather, 1.3; Leather goods, 8.8; Soap and candles, 2.0; Building, 11.5
1831-1850	Coal, 10.7; Tin ore, 0.3; Copper ore, 0.8; Lead ore, 0.6; Iron, steel and machine building, 12.2; Copper, 0.6; Copper products, 1.0; Lead, 0.3; Tin, 0.1; Shipbuilding, 1.4; Furniture, 2.6; Timber products, 4.3; Cotton yarn, 11.3; Cotton cloth, 6.3; Woollen and worsted yarn, 3.8; Woollen and worsted cloth, 4.1; Silk thread, 1.0; Silk goods, 2.3; Linen yarn and cloth, 2.5; Hemp products, 0.1; Wheaten flour, 2.4; Bread and cakes, 1.6; Confectionary, 0.4; Sugar, 0.4; Beer, 2.3; Malt, 0.4; Spirits, 0.6; Tobacco products, 0.5; Paper, 1.5; Printed matter, 3.1; Leather, 1.1; Leather goods, 7.0; Soap and candles, 1.0; Vegetable oils, 0.1; Building, 11.4

Source: derived from Hoffmann (1955: 18-19) as described in the text.

TABLE A2: Service sector output weights (%)

	1688 & 1759	1801
Commerce	37.2	38.1
Domestic & personal	32.6	30.9
Government	16.3	16.7
Housing	14.0	14.3

Source: derived from Crafts (1985: 16-17).

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