

THE SECTORAL DISTRIBUTION OF THE LABOUR FORCE AND LABOUR PRODUCTIVITY IN BRITAIN, 1381-1851

Stephen Broadberry, London School of Economics, S.N.Broadberry@lse.ac.uk
Bruce M. S. Campbell, The Queen's University of Belfast, b.m.campbell@qub.ac.uk
Bas van Leeuwen, University of Warwick, bas.vanleeuwen1@googlemail.com

17 March 2011

File: SectoralSharesGB10b

Abstract: The British economy was less agricultural during the medieval and early modern periods than previous writers have assumed and a substantial part of the structural transformation from agriculture to industry occurred before rather than after 1700. However, the growth rates of output by sector and in the economy as a whole during the eighteenth and nineteenth centuries remain broadly as suggested by Crafts and Harley. The classic Industrial Revolution was thus characterised by more rapid labour productivity growth in industry and less rapid labour productivity growth in agriculture than has generally been assumed in the recent literature.

Acknowledgements: This paper forms part of the project "Reconstructing the National Income of Britain and Holland, c.1270/1500 to 1850", funded by the Leverhulme Trust, Reference Number F/00215AR. It is also part of the Collaborative Project HI-POD supported by the European Commission's 7th Framework Programme for Research, Contract Number SSH7-CT-2008-225342.

INTRODUCTION

In this paper we provide estimates of the sectoral distribution of the labour force in Britain during the period 1381-1851, working with three main sectors of agriculture, industry and services. These estimates are then combined with the reconstruction of GDP from Broadberry et al (2011a; 2011b) to chart the growth of labour productivity by sector. For the period 1700-1851, we work with the territory of Great Britain, deriving our labour force shares from the social tables of King [1696], Massie [1760] and Colquhoun (1806), but drawing also on the reworking of these figures by Lindert and Williamson (1982) and Crafts (1985). We also make use of the population census estimates for the nineteenth century, particularly the reworking of these figures by Shaw-Taylor (2009a). For the period 1381-1700, we work with the territory of England. Key sources for labour force shares are the Poll Tax Returns of 1381, published by Fenwick (1998; 2001; 2005) and the Muster Rolls of 1522, published in Pound (1981), Cornwall (1980) and Hulton (1999).

The results of this exercise suggest a number of important revisions to the received view of long run British economic development. First, the British economy was much less agricultural during the medieval and early modern periods than previous writers have assumed. Second, a substantial part of the structural transformation of the British economy from agriculture to industry occurred before rather than after 1700. Third, however, the growth rates of output by sector and in the economy as a whole during the eighteenth and nineteenth centuries remain broadly as suggested by Crafts and Harley (1992). The classic Industrial Revolution was thus characterised by more rapid labour productivity growth in industry and less rapid labour productivity growth in agriculture than has generally been assumed in the recent literature.

The paper proceeds as follows. In section II, we derive the estimates of the sectoral labour force shares, beginning in the mid-nineteenth century and proceeding back to 1381. Section III then combines the data on sectoral labour force shares with sectoral output shares to derive sectoral estimates of nominal value added per worker for benchmark years. Section IV uses the sectoral labour force shares to derive estimates of the number of workers in each sector and combines these estimates with time series of real output to chart trends in labour productivity by sector. Section V offers a critical evaluation of a recent paper by Clark (2010), who argues for no trend growth in per capita incomes before 1800 and a later shift of labour out of agriculture. Section VI concludes.

II. LABOUR FORCE SHARES

1. Labour force shares from the Population Census, 1851-1871

For the period 1851-1871, we derive sectoral labour force shares from the population census data as reworked by Shaw-Taylor (2009a). Table 1 presents data for males, females and the total occupied labour force in Parts A, B and C. The data refer to England and Wales, but the estimates of Mitchell (1988) for Great Britain do not suggest any major difference between the sectoral distributions of the labour force in the different territories. The central message to be drawn from Table 1 is that Britain was already highly industrialised by 1851, with more than 45 per cent of the labour force in industry and with less than a quarter of the labour force in agriculture. However, services also accounted for a sizeable share of the work force.

The share of the labour force in agriculture in England and Wales in Table 1 is very similar to the share derived for Great Britain by Deane and Cole (1967: 146) from the same population census data. However, Deane and Cole (1967) reported a higher share in services and a correspondingly lower share in industry. Unfortunately, Deane and Cole (1967) did not

set out clearly how they allocated workers between services and industry. Furthermore, the earlier reworking of the population data for Great Britain by Mitchell (1988) supports Shaw-Taylor's sectoral allocation between industry and services. We prefer to use Shaw-Taylor's data for England and Wales rather than Mitchell's data for Great Britain because the latter understates the share of female employment in agriculture, an issue that has also been raised by Higgs (1987). Although this does not have a dramatic effect on the sectoral shares for the labour force as a whole, since the labour force participation rate was much lower for females than for males, the Shaw-Taylor data fit better with trends in female as well as male employment. Making an allowance for female as well as male employment has a substantial effect on the patterns of sectoral labour productivity growth during the Industrial Revolution period.

2. Labour force shares from social tables, circa 1801, 1759 and 1700

The occupational structure for circa 1801, 1759 and 1700 can be derived from social tables produced by contemporaries. For circa 1801, we have the work of Patrick Colquhoun (1806), based on the first population census and supplemented with parliamentary surveys of paupers and taxation data on the richest families. For 1759, social tables were drawn up by Joseph Massie [1760] as part of a campaign against the colonial sugar lobby, while Gregory King's [1696] social table for 1688 was drawn up as a result of wartime financial concerns. These social tables have been reworked within a consistent framework by Lindert and Williamson (1982) and Crafts (1985).

Table 2 sets out Colquhoun's social table for circa 1801. Part A presents the basic data on the number of families in each occupational grouping, as reworked by Lindert and Williamson (1982). To Colquhoun's total of 2,193,114 families, Crafts (1985: 14) suggests

adding 10 per cent for domestic service. However, our approach involves applying the Colquhoun occupational distribution to males and making a separate allowance for females. Since around three-quarters of domestic servants were females, we have added just 2.5 per cent for domestic service. We also follow Crafts (1985: 14) in classifying high titles and gentlemen plus vagrants as unoccupied, and allocate the various occupations between agriculture, industry and services as indicated in the table. Note an important difference from Crafts (1985) is that whereas he allocated all labourers, cottagers and paupers to agriculture, we have allocated 36 per cent to industry and the remaining 64 per cent to agriculture, in line with the ratio for 1522 derived below.

In Part B of Table 2, female employment is distributed across sectors in line with the 1813-20 estimates from Shaw-Taylor (2009a). We then assume that females worked 30 per cent of the total number of days worked in the economy. This ratio is derived from the mid-nineteenth century data, where Shaw-Taylor found a male participation rate of 97 per cent and a female participation rate of 42 per cent. Although Field and Erickson (2009) appear to suggest higher rates of female participation during the early modern period, it should be noted that they are referring to women participating in the labour market, however few days they worked. Since we are interested in labour productivity, it is more helpful to think in terms of the proportion of days worked by women. On a full-time equivalent basis, it seems highly unlikely that women could have worked much more than 30 per cent of total days worked, given the unequal distribution of child-rearing and household duties in these unenlightened times, while at the other end of the spectrum the poll tax returns suggest females accounted for just 16.8 per cent of the labour force. Shaw-Taylor (2009a) finds that during the nineteenth century the female labour force participation rate fell from 43.0 per cent in 1851 to 35.1 per cent in 1911, at a time when the male participation rate was close to 100

per cent, thus suggesting a female share of the labour force declining from around 30 per cent to around 25 per cent. Further research may uncover earlier fluctuations in female labour force participation, but for now we shall hold the female share of the labour force constant at 30 per cent before the mid-nineteenth century. This is consistent with the work of Humphries (2010: 107), who finds no evidence from a sample of autobiographies to support the idea of a change in women's aggregate participation rates during the eighteenth century, despite the large literature on the supposed effects of industrialisation on women's employment. However, even holding the participation rate constant in this way is already sufficient to demonstrate that taking account of female employment has important implications for sectoral labour productivity trends, because of the large gender differences in the sectoral distribution of employment.

For 1759, the basic family data for Joseph Massie's social table are set out in Part A of Table 3. Again, an allowance of 2.5 per cent is made for domestic service, labourers are divided between agriculture and industry in the ratio 64:36 and in Part B, the 1813-20 distribution is used to allocate females, who are assumed to account for 30 per cent of the labour force. Table 4 uses Gregory King's [1696] social table for England in 1688 to estimate the occupational distribution for circa 1700. Part A sets out the basic data on the number of families in each occupational grouping identified by King, and makes the same assumptions as in 1801 and 1759 for the allocation of occupations across sectors.

Putting together the information in Tables 1 to 4, it is clear that a substantial part of the structural shift away from agricultural employment occurred before 1700. Between 1700 and 1871, structural change was decidedly more limited than suggested by earlier writers, including Crafts (1985) as well as Deane and Cole (1967). Nevertheless, there was some

further decline in the proportion of the labour force in agriculture and a corresponding increase in the shares of industry and services. The classic period of the Industrial Revolution therefore has to be seen more as a period of mechanisation and technological transformation than as an era of unusually rapid industrialisation and structural change. These findings build upon and have been inspired by the work of Shaw-Taylor et al. (2010), who have reworked the male occupational data for England over this period.

3. Labour force shares from the 1522 Muster Rolls

Although the Muster Rolls or military surveys of 1522 were carried out across the whole country, occupations were systematically recorded in only three surveys, providing information on an urban environment (Coventry), a semi-rural environment (Babergh) and a rural environment (Rutland). The Babergh data have been published in Pound (1981), the Rutland data in Cornwall (1980) and the Coventry data in Hulton (1999). All the data were digitised at the Centre for Data Digitisation and Analysis, Queen's University, Belfast.

Part A of Table 5 shows the distribution of the labour force in the three districts and in the sample as a whole. The unweighted total cannot be taken as representative of the country as a whole, due to the overrepresentation of urban areas. The three districts are therefore weighted in line with the shares of urban, semi-rural and rural districts in the overall population as 10 per cent urban (Coventry), 10 per cent semi-rural (Babergh), and 80 per cent rural (Rutland). These proportions are derived from the *Cambridge Urban History of Britain*, with urban measured by the proportion of the population living in towns of at least 2,000 inhabitants, semi-rural by the proportion living in towns smaller than 2,000 inhabitants, and rural by the rest of the population (Barron, 2000; A. Dyer, 2000; C. Dyer, 2000; Kermode, 2000).

A problem that we face with the data from the Muster Rolls is the allocation across sectors of workers designated simply as “labourers”. These workers accounted for 25.9 per cent of the sample, and have been allocated in Parts B and C of Table 5 using a regression approach. We begin with the identity that the total number of labourers (L) consists of labourers in agriculture (L_A), labourers in industry (L_I) and labourers in the service sector (L_S):

$$L = L_A + L_I + L_S \quad (1)$$

Now assume that the number of labourers in each sector is proportional to the number of identified workers in each sector:

$$\theta = L_A/A$$

$$\mu = L_I/I$$

$$\eta = L_S/S$$

where A , I and S are the numbers of identified workers in agriculture, industry and services, respectively. We can then rewrite (1) as:

$$L = \theta A + \mu I + \eta S \quad (2)$$

Turning to the district level data, we can run a cross-sectional regression as follows:

$$L_i = a A_i + b I_i + c S_i + \varepsilon_i \quad (3)$$

Here, the subscript i refers to the district, so the number of labourers in each district is regressed on the numbers of identified workers in the agricultural, industrial and service sectors in each district. The regression coefficients can then be interpreted as the ratios of labourers to identified workers in each sector:

$$a = \theta = L_A/A$$

$$b = \mu = L_I/I$$

$$c = \eta = L_S/S$$

It should be noted that the method relies upon the stability of these ratios across districts. It may be thought that reporting conventions would vary systematically across districts, but this can be tested for by the inclusion of dummy variables at the level of the hundred. In fact, the inclusion of hundred dummies had very little impact on the results, suggesting that variation in reporting practices was not a major issue in the Muster Rolls.

The Muster Rolls provide information only on males, so we have therefore had to rely on a number of assumptions to derive the female occupational shares in Part D of Table 5. As for the eighteenth century, we have assumed that women worked 30 per cent of the total number of days worked in the economy. The second assumption is that female workers are allocated across sectors in the same proportions as in 1381. Putting together the male and female sectoral distributions produces the total sectoral distribution of the labour force in Part D of Table 5. In the early sixteenth century, the English economy was predominantly rural, with more than half the labour force engaged in agriculture, broadly in line with the findings of Clark et al. (2010) for the sixteenth century, based on occupations recorded in wills. Of the remaining workers, slightly more were engaged in industry than in services.

4. Labour force shares from the 1381 Poll Tax Returns

For 1381, the Poll Tax Returns provide a much wider geographic spread of data than the Muster Rolls. Although occupations were not recorded in all counties, we were able to derive information for the following counties: Berkshire, Derbyshire, Dorset, Essex, Gloucestershire, Hampshire, Kent, Lancashire, Leicestershire, Lincolnshire, Norfolk, Northamptonshire, Oxfordshire, Shropshire, Somerset, Staffordshire, Suffolk, Surrey, Sussex, Warwickshire, Wiltshire and Yorkshire. The data have been published by Fenwick (1998;

2001; 2005) and were digitised at the Centre for Data Digitisation and Analysis, Queen's University, Belfast.

To derive the sectoral shares of the labour force from the occupational data in the Poll Tax Returns requires a number of steps, which are set out in Tables 6 to 8. We begin in Table 6 with the analysis of male workers. First, it should be noted that although we have data from a wider range of counties than in the Muster Rolls, the sample is still biased towards urban and semi-rural areas. Hence it is necessary to weight the observations, with the weights again taken from the *Cambridge Urban History of Britain*. Areas with more than 70 per cent of occupations in agriculture are classified as rural, cities with more than 2,000 inhabitants identified by A. Dyer (2000) are classified as urban, and the rest are semi-rural. Urban areas have a 10 per cent weight, semi-rural areas 10 per cent and rural areas 80 per cent.

As with the Muster Rolls, the Poll Tax Returns contain a large number of workers designated simply as labourers, accounting for 15.0 per cent percent of the sample of 25,203. Again, labourers were allocated across sectors using regression analysis, with the results reported in Parts B and C of Table 6. To allow for the possibility of regional variations in reporting conventions, so that the ratio of labourers to identified workers is not constant across the whole sample, we include dummy variables at the level of the hundred. In the Poll Tax Returns, a number of hundred dummies were large and statistically significant: Blackheath and Wotton, Canterbury, Cirencester, Derby, Dunmow, Hinckford, Lackford, Salisbury and Thorngate.

Information was collected on female as well as male occupations in the Poll Tax Returns, and the female data are presented in Table 7. Part A shows the sectoral proportions

with labourers unallocated. Again, labourers are allocated using regression analysis in Parts B and C of Table 7. Table 8 combines the male and female data from Tables 6 and 7 to derive the sectoral distribution of the total labour force in 1381. As for other years, females are assumed to make up 30 per cent of the labour force, although the poll tax returns suggest a share of just 16.8 per cent, surely a serious under-estimate. Around 60 per cent of the labour force in 1381 were engaged in agriculture. Of the remainder, slightly more were engaged in services than in industry.

5. The issue of by-employment

One obvious difficulty with allocating workers to specific occupations is the fact that some people have combined more than one occupation. This issue of by-employment has been investigated by Saito (2010) and Shaw-Taylor (2009b), who conclude that the assumption of specialisation may not distort the allocation of workers across the three main sectors too seriously. The reason for this is that where data do exist, they suggest that flows between sectors occurred in both directions, with a relatively small net effect.

III. OUTPUT SHARES

Table 9 provides information on sectoral value added shares for 1841. The starting point is the input-output table for 1841 provided by Horrell et al. (1994), but covering the whole of the United Kingdom. This is presented on a UK basis in Part A, but has also been reconstructed for the territory of Great Britain using the detailed source notes provided in Horrell et al. (1991), and presented in Part B. The income-based estimates for Great Britain, derived from Deane and Cole (1967: 166) are also presented in Part B. The sectoral shares are very similar, whichever set of estimates is used.

The nominal value added in 1841, which underpins the sectoral shares in Table 9, can be projected backwards and forwards with times series of real output and prices by sector, to derive nominal value added by sector between 1700 and 1851 (Broadberry et al., 2011b). This provides the basis for the calculation of the sectoral value added shares, shown in Part A of Table 10. Part B provides the occupational shares from Tables 1 and 2, while Part C provides the sectoral income per worker ratios derived from Parts A and B. As noted by Crafts (1985: 61), by the beginning of the nineteenth century, agriculture no longer had an income per worker significantly below the economy-wide average. However, it should be noted that agriculture's share of current value added in 1700 was much lower than assumed by Crafts (1985), who worked with a figure of 37 per cent, rather than the 26.0 per cent reported here. The reason for this difference seems to lie largely with what happened to the relative price of agricultural goods, which increased sharply relative to the price of industrial goods between 1700 and 1851. This offset the effects of the slower real growth of output in agriculture than in the rest of the economy, so that the share of agriculture in current price output changed relatively little.

Part A of Table 11 presents information on sectoral value added shares, derived by projecting back nominal value added in 1700 from Broadberry et al. (2011a), using time series of real output and prices by sector. Part B restates the occupational shares from Tables 4, 5 and 8, while Part C provides the sectoral incomes per worker relative to the average, derived from Parts A and B. Agricultural incomes were substantially below the economy-wide average before 1700, while incomes were higher in both industry and services throughout the period. However, whereas industrial incomes were regressing to the mean, service sector incomes were increasingly rising above the economy-wide average as commercial services grew in importance relative to domestic service.

IV. TRENDS IN LABOUR PRODUCTIVITY

The next step is to examine trends in labour productivity in the economy as a whole and in the three main sectors. This involves setting out the trends in real output in Table 12, the labour force in Table 13 and labour productivity in Table 14. Table 15 then presents the annual growth rates for output, the labour force and labour productivity for England between 1381 and 1700 and for Great Britain between 1700 and 1851. Turning first to the trends in real output in Table 12, agriculture was the slowest growing sector both before and after 1700. Industry was the fastest growing sector before as well as during the Industrial Revolution period.

Table 13 derives the labour force in thousands from the population data set out in Broadberry et al. (2011a; 2011b). The first step is to allocate the population total between males and females, which is based on the assumption of a 51:49 split in favour of females, based on census evidence for the nineteenth century. The second step is to make an allowance for the population below the age of 16, who are assumed not to be part of the labour force. The proportion of the population under the age of 16 is assumed to be 37.5 per cent, in line with our assumptions for the poll tax data, based on evidence from Wrigley et al. (1989). The third step is to derive the male labour force on the assumption of a 97 per cent participation rate and the female labour force on the assumption of a 42 per cent participation rate, consistent with evidence from Shaw-Taylor (2009a) for the nineteenth century. The total labour force is then broken down by sector using the labour force shares from Tables 1 to 8. Between 1381 and 1522, the labour force declined slightly in agriculture and services but grew in industry. After 1522, the labour force grew in all three sectors, but much less rapidly in agriculture than in industry and services.

Labour productivity trends by sector are derived in Table 14 from the output and labour force data in Tables 12 and 13. Table 15 also presents the annual growth rates for the periods 1381-1700 and 1700-1851. Between 1381 and 1700, labour productivity growth was positive in all sectors, with the fastest growth in services and the slowest growth in industry. Between 1700 and 1851, labour productivity growth was again positive in all sectors, but during this period the fastest growth was in industry and the slowest growth was in agriculture. It should be noted that this provides a more conventional picture of labour productivity growth by sector during the Industrial Revolution than the implicit suggestion in the work of Crafts (1985) that productivity growth was faster in agriculture than in industry, as a result of a large structural shift of labour from agriculture to industry. In our work, much of this structural transformation occurred between 1522 and 1700. Industrial development after 1700 was therefore much more a case of technological progress driven by a process of mechanisation, rather than a case of output growth driven by an expansion of the labour input.

V. 1381 AND THE MALTHUS DELUSION

In this section we discuss a paper by Clark (2010), which also presents evidence on the share of the labour force engaged in agriculture between 1381 and 1851. Although we are in broad agreement with Clark (2010) on agriculture's share of the labour force in 1381, we do not share the view embodied in his Figure 3 that the release of labour from agriculture occurred only from the late eighteenth century. Indeed, Clark's view runs counter to the weight of recent scholarship, which dates much of the release of labour from agriculture to the period before the mid-eighteenth century (Shaw-Taylor, 2009a; Shaw-Taylor et al., 2010). Clark's

view would also be difficult to reconcile with the dramatic increase in English urbanisation that occurred during the seventeenth century (de Vries, 1984).

The alternative paths for agriculture's share of the labour force are shown in Table 16. Part A shows the estimates presented in Tables 1 to 8 of this paper, being careful to distinguish between males and females. Part B shows how our estimates are broadly consistent with the estimates of Shaw-Taylor (2010) for the period when the two datasets overlap, between the mid-eighteenth and the mid-nineteenth centuries. Part C shows the estimates of Clark (2010) and Clark et al. (2010). It will be immediately apparent that there is no substantial disagreement over agriculture's share of the labour force at the beginning of the period in 1381 or at the end of the period in the 1860s. Furthermore, any disagreement in the sixteenth century is also quite small, with our estimate of 58.1 per cent based on the muster rolls of 1522 very close to the figure of 61 per cent estimated by Clark et al. (2010) for 1560-79 from a sample of wills. We are also inclined to accept Clark et al.'s (2010) figure of 59 per cent in 1652-60, again based on a sample of wills. However there does seem to be substantial disagreement over the trend in agriculture's share of the labour force between the 1650s and 1817. Our series suggests that by the beginning of the nineteenth century, the share of the labour force engaged in agriculture had fallen sharply to little more than 30 per cent, whereas Clark et al. (2010) try to suggest a substantially higher figure of 42 per cent for 1817, citing Shaw-Taylor and Wrigley (2008) as the source. There are at least two ways in which this is misleading, since Shaw-Taylor and Wrigley (2008) clearly indicate that their data refer to males and also include mining as well as farming. The correct figure for males and females and excluding mining is the 31.4 per cent shown in Part B of Table 16.

Derived on a consistent basis, then, the agricultural labour force share seems to have remained fairly constant between 1381 and the 1650s, before falling steadily to 1801. This would be quite consistent with both the negative relationship between agriculture's share of the labour force and the level of GDP per capita claimed by Clark (2010) and with the trend in per capita GDP outlined in Broadberry et al. (2010), and reproduced here in Figure 1. After rising sharply across the Black Death, GDP per capita remained on a plateau until the mid-seventeenth century and then trended upwards. These trends in the agricultural labour force share would certainly not be consistent with Clark's (2007) claim that "England in 1800 was no richer than in most of its history since 1200, and even more surprisingly, no richer than the average hunter-gatherer society".

One way in which Clark (2010) tries to rescue his argument is by inflating the agricultural share of the labour force in 1817, so that most of the shift of labour out of agriculture appears to have occurred after rather than before 1800. As well as reporting the higher figure for males only and including the mining industry, Clark (2010) further adjusts the figure upwards by making an allowance for imports of food and raw materials, presumably on the grounds that without those imports, more people would have been required to work in the agricultural sector. This is supposed to produce a "corrected farm share", but it should be noted that in deriving his relationship between GDP per capita and the share of the labour force in agriculture from data for the period 1946-2005, Clark takes absolutely no account of trade in agricultural goods, so there would be no justification for adjusting the historical data in this way.

VI. CONCLUDING COMMENTS

The evidence presented in this paper suggests that the British economy was much less agricultural during the medieval and early modern periods than previous writers have assumed. The proportion of the labour force in agriculture during the early modern period is broadly consistent with the findings of Clark et al. (2010) on the basis of occupations recorded in wills and matches the findings of Shaw-Taylor (2009a) for the modern period. Much of the structural transformation of the British economy from agriculture to industry occurred before rather than after 1700. However, the growth rates of output by sector and in the aggregate economy during the eighteenth and nineteenth centuries remain broadly as suggested by Crafts and Harley (1992). The classic Industrial Revolution was thus characterised by more rapid labour productivity growth in industry and less rapid labour productivity growth in agriculture than has generally been assumed in the recent literature.

TABLE 1: Sectoral distribution of the labour force, England and Wales 1851-1871 (%)

A. Males			
	1851	1861	1871
Agriculture	27.2	24.4	19.8
Industry	50.1	49.6	52.6
Services	22.7	26.0	27.6
Total	100.0	100.0	100.0

B. Females			
	1851	1861	1871
Agriculture	15.6	12.6	11.2
Industry	36.4	38.3	35.8
Services	48.0	49.1	53.0
Total	100.0	100.0	100.0

C. Males and females			
	1851	1861	1871
Agriculture	23.5	20.6	16.9
Industry	45.7	45.9	47.1
Services	30.9	33.5	36.0
Total	100.0	100.0	100.0

Sources: Shaw-Taylor (2009a).

TABLE 2: Sectoral distribution of the labour force from a social table, circa 1801**A. Patrick Colquhoun's social table, 1801**

	Family numbers (labourers etc. unallocated)	Family numbers (labourers etc. allocated)	% of occupied
High titles & gentlemen	27,203	27,203	
Vagrants	179,718	179,718	
UNOCCUPIED	206,921	206,921	
Agriculture	320,000	320,000	
Agricultural labourers		384,115	
AGRICULTURE		704,115	34.5
Industry and building	541,026	541,026	
Industrial labourers		216,064	
INDUSTRY		757,090	37.1
Commerce	205,800	205,800	
Professions	74,840	74,840	
Military & maritime	244,348	244,348	
Domestic servants (2.5%)		54,828	
SERVICES		579,816	28.4
Labourers, cottagers & paupers	600,179		
TOTAL (including unoccupied)	2,193,114		
TOTAL OCCUPIED		2,041,021	100.0

B. Total labour force (%)

	Males	Females	Total
Agriculture	34.5	22.3	30.8
Industry	37.1	37.8	37.3
Services	28.4	39.9	31.9
Total	100.0	100.0	100.0

Sources and notes: Part A: Derived from Colquhoun (1806), Lindert and Williamson (1982: 388) and Crafts (1985: 13-15), but assuming that the distribution applies to males only. This involves reducing the allowance for domestic servants from 10 per cent to 2.5 percent, since the majority of domestic servants were female. Labourers, cottagers and paupers have been allocated to agriculture and industry in the ratio 64% to 36%, derived from 1522. Part B: Female employment distributed across sectors in line with the 1813-20 shares from Shaw-Taylor (2009a), and females assumed to account for 30 per cent of total employment, in line with Shaw-Taylor (2009a).

TABLE 3: Sectoral distribution of the labour force from a social table, circa 1759**A. Joseph Massie's social table, 1759**

	Family numbers (labourers etc. unallocated)	Family numbers (labourers etc. allocated)	% of occupied
High titles & gentlemen	18,070	18,070	
Vagrants	13,418	13,418	
UNOCCUPIED	31,488	31,488	
Agriculture	379,008	379,008	
Agricultural labourers		268,091	
AGRICULTURE		647,099	41.9
Industry and building	366,252	366,252	
Industrial labourers		150,801	
INDUSTRY		517,053	33.4
Commerce	200,500	200,500	
Professions	57,000	57,000	
Military & maritime	86,000	86,000	
Domestic servants (2.5%)		38,479	
SERVICES		381,979	24.7
Labourers, cottagers & paupers	418,892	418,892	
TOTAL (including unoccupied)	1,539,140		
TOTAL OCCUPIED		1,546,131	100.0

B. Total labour force (%)

	Males	Females	Total
Agriculture	41.9	22.3	36.0
Industry	33.4	37.8	34.7
Services	24.7	39.9	29.3
Total	100.0	100.0	100.0

Sources and notes: Part A: Derived from Massie [1760], Lindert and Williamson (1982: 388) and Crafts (1985: 13-15), but assuming that the distribution applies to males only. This involves reducing the allowance for domestic servants from 10 per cent to 2.5 percent, since the majority of domestic servants were female. Labourers, cottagers and paupers have been allocated to agriculture and industry in the ratio 64% to 36%, derived from 1522. Part B: Female employment distributed across sectors in line with the 1813-20 shares from Shaw-Taylor (2009a), and females assumed to account for 30 per cent of total employment, in line with Shaw-Taylor (2009a).

TABLE 4: Sectoral distribution of the labour force from a social table, circa 1700**A. Gregory King's social table, 1688**

	Family numbers (labourers etc. unallocated)	Family numbers (labourers etc. allocated)	% of occupied
High titles & gentlemen	19,626	19,626	
Vagrants	23,489	23,489	
UNOCCUPIED	43,115	43,115	
Agriculture	227,440	227,440	
Agricultural labourers		382,835	
AGRICULTURE		610,275	44.1
Industry and building	256,866	256,866	
Industrial labourers		215,345	
INDUSTRY		472,211	34.2
Commerce	128,025	128,025	
Professions	42,960	42,960	
Military & maritime	94,000	94,000	
Domestic servants (2.5%)		34,765	
SERVICES		299,750	21.7
Labourers, cottagers & paupers	598,180	598,180	
TOTAL (including unoccupied)	1,390,586		
TOTAL OCCUPIED		1,382,236	100.0

B. Total labour force (%)

	Males	Females	Total
Agriculture	44.1	22.3	37.6
Industry	34.2	37.8	35.3
Services	21.7	39.9	27.2
Total	100.0	100.0	100.0

Sources and notes: Part A: Derived from King [1696], Lindert and Williamson (1982: 388) and Crafts (1985: 13-15), but assuming that the distribution applies to males only. This involves reducing the allowance for domestic servants from 10 per cent to 2.5 percent, since the majority of domestic servants were female. Labourers, cottagers and paupers have been allocated to agriculture and industry in the ratio 64% to 36%, derived from 1522. Part B: Female employment distributed across sectors in line with the 1813-20 shares from Shaw-Taylor (2009a), and females assumed to account for 30 per cent of total employment, in line with Shaw-Taylor (2009a).

TABLE 5: Sectoral distribution of the labour force from the 1522 Muster Rolls**A. Male labour force, labourers unallocated**

	Babergh	Coventry	Rutland	Unweighted total	Weighted total
	(number)	(number)	(number)	(number)	(%)
Agriculture	273	12	868	1,153	40.4
Industry	577	594	38	1,209	42.3
Services	133	143	218	494	17.3
Labourers	561	39	396	996	
Total	1,544	788	1,520	3,852	100.0

B. Regression equation for allocation of labourers

	Labourers	
	Coefficient	Standard error
A_i	0.365	(0.071)
I_i	0.197	(0.068)
S_i	-0.149	(0.254)
R^2	0.706	
N	98	

C. Male labour force (weighted), labourers allocated

	Allocation of labourers		Total with labourers allocated	
	(number)	(%)	(number)	(%)
Agriculture	636	63.9	2,585	67.1
Industry	360	36.1	821	21.3
Services	0	0.0	446	11.6
Total	996	100.0	3,852	100.0

D. Total labour force (%)

	Males	Females	Total
Agriculture	67.1	37.0	58.1
Industry	21.3	25.9	22.7
Services	11.6	37.1	19.2
Total	100.0	100.0	100.0

Sources and notes: Part A: Babergh: Pound (1986); Coventry: Hulton (1999); Rutland: Cornwall (1980); Occupations allocated to agriculture, industry and services using Wrigley's (2006) PST scheme, but with mining included in the industrial sector, as in Shaw-Taylor (2009a). Weights derived from the *Cambridge Urban History of Britain* as described in the text: Babergh (semi-rural) 10%, Coventry (urban) 10%, Rutland (rural) 80%. Parts B and C: Labourers allocated using regression method as described in the text. Hundred dummies are included in the regression. Part D: Female distribution of labour force assumed to be the same as in 1381, and females assumed to account for 30 per cent of total employment, in line with Shaw-Taylor (2009a).

TABLE 6: Sectoral distribution of the male labour force from the 1381 Poll Tax Returns

A. Male labour force, labourers unallocated

	Unweighted total		Weighted total
	(number)	(%)	(%)
Agriculture	9,775	45.6	67.0
Industry	5,538	25.8	12.1
Services	6,120	28.6	20.9
Labourers	3,770		
Total	25,203	100.0	100.0

B. Regression equation for allocation of labourers

	Labourers	
	Coefficient	Standard error
A_i	0.103	(0.019)
I_i	0.140	(0.020)
S_i	0.057	(0.053)
R^2	0.965	
N	803	

C. Male labour force (weighted), labourers allocated

	Allocation of labourers		Total with labourers allocated	
	(number)	(%)	(number)	(%)
Agriculture	3,192	84.7	17,543	69.6
Industry	578	15.3	3,180	12.6
Services	0	0.0	4,480	17.8
Total	3,770	100.0	25,203	100.0

Sources and notes: Part A: Total with labourers unallocated from Fenwick (1998; 2001; 2005). Occupations allocated to agriculture, industry and services using Wrigley's (2006) PST scheme, but with mining included in the industrial sector, as in Shaw-Taylor (2009a). Weights derived from the *Cambridge Urban History of Britain* as described in the text: urban 10%, semi-rural 10%, rural 80%. Areas with more than 70% of occupations in agriculture are classified as rural, cities as identified in Dyer (2001) are classified as urban, and the rest are semi-rural. Parts B and C: Labourers allocated using regression method as described in the text. Hundred dummies are included in the regression, with highly significant values for Blackheath and Wotton, Canterbury, Cirencester, Derby, Dunmow, Hinckford, Lackford, Salisbury, and Thorngate.

Table 7: Sectoral distribution of the female labour force in 1381**A. Female labour force, labourers unallocated**

	Unweighted total		Weighted total
	(number)	(%)	(%)
Agriculture	1,276	30.0	34.5
Industry	1,033	24.3	21.1
Services	1,945	45.7	44.4
Labourers	835		
Total	5,089	100.0	100.0

B. Regression equations for allocation of labourers

	Labourers	
	Coefficient	Standard error
A_i	0.159	(0.016)
I_i	0.263	(0.036)
S_i	0.273	(0.217)
R^2	0.889	
N	630	

C. Female labour force, labourers and servants allocated

	Allocation of labourers		Total with labourers allocated	
	(number)	(%)	(number)	(%)
Agriculture	415	49.7	1,882	37.0
Industry	420	50.3	1,319	25.9
Services	0	0.0	1,888	37.1
Total	835	100.0	5,089	100.0

Sources and notes: Part A: Total with labourers and servants unallocated from Fenwick (1998; 2001; 2005). Occupations allocated to agriculture, industry and services using Wrigley's (2006) PST scheme, but with mining included in the industrial sector, as in Shaw-Taylor (2009a). Parts B and C: Labourers allocated using regression method as described in the text. Hundred dummies are included in the regression.

TABLE 8: Total labour force in 1381(%)

	Males	Females	Total
Agriculture	69.6	37.0	59.8
Industry	12.6	25.9	16.6
Services	17.8	37.1	23.6
Total	100.0	100.0	100.0

Sources and notes: Males from Table 4 and females from Table 5. Females are assumed to make up 30 per cent of total employment, in line with Shaw-Taylor (2009a).

TABLE 9: Sectoral value added shares for 1841**A. United Kingdom**

	£m	%
Agriculture	127.9	24.3
Industry	179.4	34.1
Services	219.5	41.6
GDP	526.8	100.0

B. Great Britain

	Output estimates		Income estimates	
	£m	%	£m	%
Agriculture	104.5	22.1	99.9	22.4
Industry	172.4	36.4	155.5	34.8
Services	196.8	41.5	190.8	42.8
GDP	473.8	100.0	446.2	100.0

Sources and notes: UK: Horrell et al. (1994). Great Britain: Output estimates derived from Horrell et al. (1991); income estimates from Deane and Cole (1967: 166).

TABLE 10: Sectoral shares in British GDP, 1700-1851 (%)

A. Sectoral value added shares				
	1700	1759	1801	1851
Agriculture	26.0	27.5	30.8	19.7
Industry	39.7	34.6	31.4	38.4
Services	34.3	37.9	37.8	41.9
GDP	100.0	100.0	100.0	100.0

B. Occupational shares				
	1700	1759	1801	1851
Agriculture	37.6	36.0	30.8	23.5
Industry	35.3	34.7	37.3	45.7
Services	27.2	29.3	31.9	30.9
GDP	100.0	100.0	100.0	100.0

C. Sectoral income per worker				
	1700	1759	1801	1851
Agriculture	69.2	76.3	99.8	84.0
Industry	112.5	99.7	84.2	84.0
Services	126.3	129.5	118.6	135.6
GDP	100.0	100.0	100.0	100.0

Sources and notes: Part A: Derived from Broadberry et al. (2011b). Part B: Tables 1 and 2. Part C: Derived by dividing Part A by Part B.

TABLE 11: Sectoral shares in English GDP, 1381-1700

A. Sectoral value added shares (%)			
	1381	1522	1700
Agriculture	45.2	39.1	26.0
Industry	29.8	39.3	39.7
Services	25.0	21.6	34.3
GDP	100.0	100.0	100.0
B. Occupational shares (%)			
	1381	1522	1700
Agriculture	59.8	58.1	37.6
Industry	16.6	22.7	35.3
Services	23.6	19.2	27.2
GDP	100.0	100.0	100.0
C. Sectoral income per worker (average =100)			
	1381	1522	1700
Agriculture	75.5	72.8	69.2
Industry	179.9	149.8	112.5
Services	106.0	107.4	126.3
GDP	100.0	100.0	100.0

Sources and notes: Part A: Derived from Broadberry et al. (2011a). Part B: Tables 2-4. Part C: Derived by dividing Part A by Part B.

TABLE 12: Trends in British output (1700=100)

A. England, 1381-1700				
	1381	1522	1700	
Agriculture	53.7	51.5	100.0	
Industry	19.9	28.6	100.0	
Services	25.1	27.4	100.0	
GDP	30.4	34.6	100.0	
B. Great Britain, 1700-1851				
	1700	1759	1801	1851
Agriculture	100.0	147.8	226.9	339.9
Industry	100.0	144.7	275.2	1,206.3
Services	100.0	150.9	266.6	777.4
GDP	100.0	147.4	253.1	722.0

Sources and notes: Broadberry et al. (2011a; 2011b). Data reported for 10-year averages.

TABLE 13: British population and labour force, 1381-1851 (thousands)

A. England, 1381-1700				
	1381	1522	1700	
Male population	1,198	1,163	2,571	
Female population	1,224	1,187	2,625	
Total population	2,422	2,350	5,196	
Male labour force	726	705	1,559	
Female labour force	321	312	689	
Total labour force	1,048	1,017	2,248	
Agriculture	627	546	844	
Industry	174	267	793	
Services	247	204	611	
B. Great Britain, 1700-1851				
	1700	1759	1801	1851
Male population	3,145	3,793	5,287	10,330
Female population	3,212	3,872	5,399	10,549
Total population	6,357	7,665	10,686	20,879
Male labour force	1,907	2,299	3,205	5,093
Female labour force	843	1,017	1,417	1,815
Total labour force	2,750	3,316	4,622	6,908
Agriculture	1,033	1,194	1,426	1,539
Industry	970	1,151	1,725	3,059
Services	748	971	1,474	2,310

Sources and notes: Population from Broadberry et al. (2011a; 2011b), allocated as 51 per cent female and 49 per cent male before 1801. Male and female proportions after 1801 from Wrigley (2011). Population of working age derived on the assumption of 37.5 per cent below age 16. Labour force derived on the assumption of a participation rate of 97 per cent for males and 42 per cent for females. Labour force by sector derived using the shares for appropriate years from Tables 1 to 6. For 1300, we assume the same distribution as in 1381.

TABLE 14: British labour productivity trends (1700=100)

A. England, 1381-1700				
	1381	1522	1700	
Agriculture	72.3	79.7	100.0	
Industry	90.8	84.9	100.0	
Services	62.1	81.9	100.0	
GDP	65.1	76.6	100.0	

B. Great Britain, 1700-1851				
	1700	1759	1801	1851
Agriculture	100.0	127.8	164.4	228.1
Industry	100.0	122.0	154.8	382.6
Services	100.0	116.2	135.3	251.6
GDP	100.0	122.3	150.6	287.4

Sources and notes: Derived from Tables 12 and 13.

TABLE 15: Annual growth rates (%)

A. Output		
	1381-1700	1700-1851
Agriculture	0.20	0.81
Industry	0.51	1.66
Services	0.43	1.37
GDP	0.37	1.32

B. Labour force		
	1381-1700	1700-1851
Agriculture	0.09	0.26
Industry	0.48	0.76
Services	0.28	0.75
GDP	0.24	0.61

C. Labour productivity		
	1381-1700	1700-1851
Agriculture	0.10	0.55
Industry	0.03	0.90
Services	0.15	0.62
GDP	0.13	0.71

Sources and notes: Derived from Tables 12 to 14.

TABLE 16: Share of the English labour force engaged in agriculture, 1381-1869 (%)**A. Broadberry, Campbell, van Leeuwen**

	Males	Females	Total
1381	69.6	37.0	59.8
1522	67.1	37.0	58.1
1700	44.1	22.3	37.6
1759	41.9	22.3	36.0
1801	34.5	22.3	30.8
1851	27.2	15.6	23.5
1861	24.4	12.6	20.6

B. Shaw-Taylor

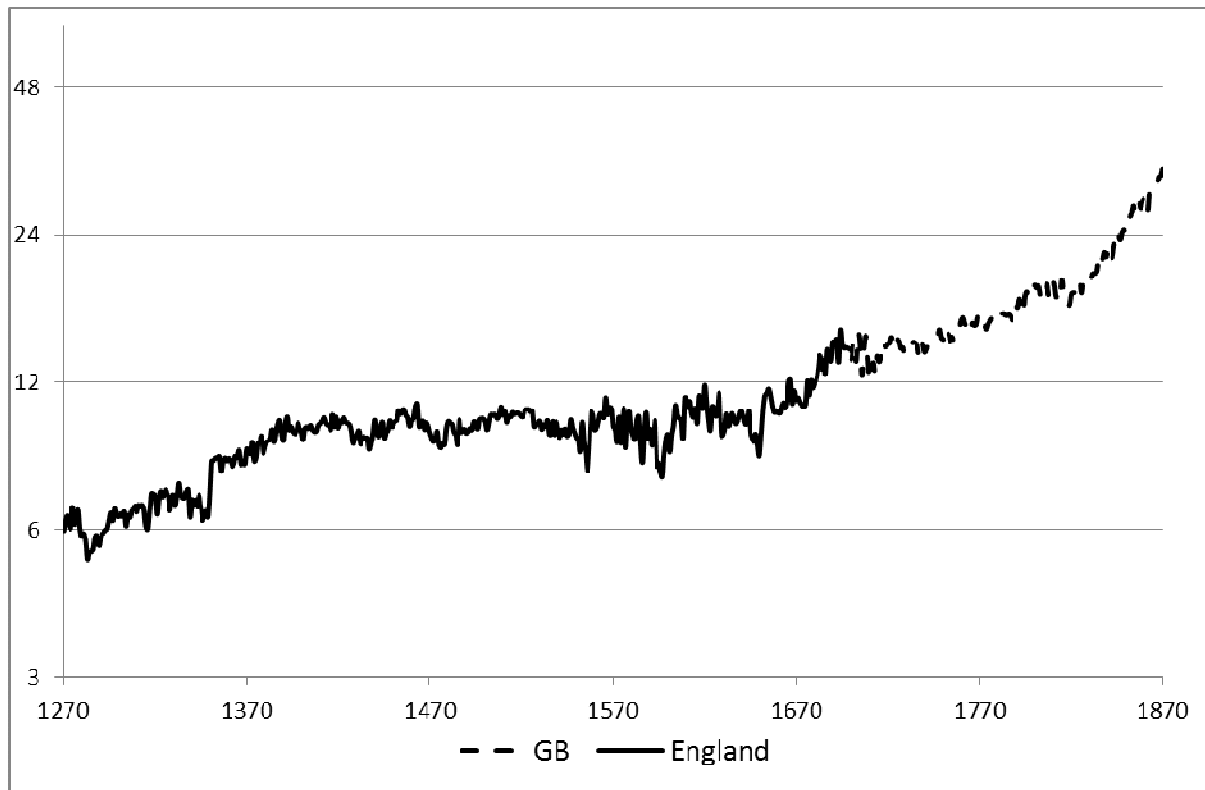
	Males	Females	Total
1755	44.0		
1813-20	35.4	22.3	31.4
1851	27.2	15.6	23.5
1861	24.4	12.6	20.6

C. Clark

	Males	Females	Total
1381	61	43	56-59
1560-79			61
1652-60			59
1817	42		
1860-69			20

Sources: Part A: Tables 1-8; Part B: Shaw-Taylor (2010); Part C: Clark (2010: Table 1); Clark et al. (2010: Table 6).

FIGURE 1: British GDP per capita in constant 1850 prices (£)



Source: Broadberry et al. (2010).

REFERENCES

- Barron, C.M. (2000), "London 1300-1540", in Palliser, D.M. (ed.), *The Cambridge Urban History of Britain, Volume 1, 600-1540*, Cambridge: Cambridge University Press, 395-440.
- Broadberry, S.N., Campbell, B., Klein, A., Overton, M. and van Leeuwen, B. (2011a), "English Economic Growth, 1270-1700", London School of Economics.
- Broadberry, S.N., Campbell, B., Klein, A., Overton, M. and van Leeuwen, B. (2011b), "British Economic Growth and the Business Cycle, 1700-1870", London School of Economics.
- Clark, G. (2007), *A Farewell to Alms: A Brief Economic History of the World*, Princeton: Princeton University Press.
- Clark, G. (2010), "1381 and the Malthus Delusion", University of California, Davis, <http://www.econ.ucdavis.edu/faculty/gclark/research.html>.
- Clark, G., Cummins, J. and Smith, B. (2010), "The Surprising Wealth of Pre-industrial England", University of California, Davis, <http://www.econ.ucdavis.edu/faculty/gclark/research.html>.
- Colquhoun, P. (1806), *A Treatise on Indigence*, London: J. Hatchard.
- Cornwall, J. (ed.) (1980), *The County Community under Henry VIII: The Military Survey, 1522 and the Lay Subsidy, 1524-5*, Oakham: Rutland Record Society.
- Crafts, N.F.R. (1985), *British Economic Growth during the Industrial Revolution*, Oxford: Oxford University Press.
- Crafts, N.F.R. and Harley, C.K. (1992), "Output Growth and the British Industrial Revolution: A Restatement of the Crafts-Harley View", *Economic History Review*, 45, 703-770.
- Deane, P. and Cole, W.A. (1967), *British Economic Growth, 1688-1959: Trends and Structure*, 2nd edition, Cambridge: Cambridge University Press.
- Dyer, A. (2000), "Appendix: Ranking Lists of English Medieval Towns", in Palliser, D.M. (ed.), *The Cambridge Urban History of Britain, Volume 1, 600-1540*, Cambridge: Cambridge University Press, 747-770.
- Dyer, C. (2000), "Small Towns 1270-1540", in Palliser, D.M. (ed.), *The Cambridge Urban History of Britain, Volume 1, 600-1540*, Cambridge: Cambridge University Press, 505-537.
- Fenwick, C.C. (ed.) (1998), *The Poll Taxes of 1377, 1379 and 1381, Part 1: Bedfordshire - Leicestershire*, Oxford: British Academy and Oxford University Press.
- Fenwick, C.C. (ed.) (2001), *The Poll Taxes of 1377, 1379 and 1381, Part 2: Lincolnshire - Westmorland*, Oxford: British Academy and Oxford University Press.

- Fenwick, C.C. (ed.) (2005), *The Poll Taxes of 1377, 1379 and 1381, Part 3: Wiltshire - Yorkshire*, Oxford: British Academy and Oxford University Press.
- Field, J. And Erickson, A. (2009), "Prospects and Preliminary Work on Female Occupational Structure in England from 1500 to the National Census", Cambridge Group for the History of Population and Social Structure, Occupations Project Paper No.18, <http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/>.
- Higgs, E. (1987), "Women, Occupations and Work in the Nineteenth Century Censuses", *History Workshop Journal*, 23, 59-80.
- Horrell, S., Humphries, J. and Weale, M. (1991), "Input-Output Table 1841: Notes on Construction", University of Cambridge.
- Horrell, S., Humphries, J. and Weale, M. (1994), "An Input-Output Table for 1841", *Economic History Review*, 47, 545-566.
- Hulton, M.H.M. (ed.) (1999), *Coventry and its People in the 1520s*, Stratford-upon-Avon: The Dugdale Society.
- Humphries, J. (2010), *Childhood and Child Labour in the British Industrial Revolution*, Cambridge: Cambridge University Press.
- Kermode, J. (2000), "The Greater Towns", in Palliser, D.M. (ed.), *The Cambridge Urban History of Britain, Volume 1, 600-1540*, Cambridge: Cambridge University Press, 441-465.
- King, G. [1696] (1936), "Natural and Political Observations and Conclusions upon the State and Condition of England", in Barnett, G.E. (ed.), *Two Tracts by Gregory King*, Baltimore: Johns Hopkins Press.
- Lindert, P.H. and Williamson, J.G. (1982), "Revising England's Social Tables, 1688-1812", *Explorations in Economic History*, 19, 385-408.
- Massie, J. [1760] (2010), "[Appendix] A Computation of the Money that Hath been Exorbitantly Raised upon the People of great Britain by the Sugar-Planters, in One Year, from January 1759 to January 1760; Shewing How Much Money a Family of Each Rank, Degree or Class Hath Lost by that Rapacious Monoply Having Continued so Long after I Laid it Open, in my State of the British Sugar-Colony Trade, which was Published Last Winter", London. *The Making of the Modern World*, Gale, Cengage Learning.
- Mitchell, B.R. (1988), *British Historical Statistics*, Cambridge: Cambridge University Press.
- Pound, J. (ed.) (1986), *The Military Survey of 1522 for Babergh Hundred*, Woodbridge: Suffolk Records Society and Boydell Press.

- Saito, O. (2010), "By-employment and Historical Occupational Structures in Comparative Perspective", paper presented at Economic History Society Conference, University of Durham.
- Shaw-Taylor, L. (2009a), "The Occupational Structure of England and Wales, c.1750-1911", Cambridge Group for the History of Population and Social Structure, Occupations Project Paper No.19, <http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/>.
- Shaw-Taylor, L. (2009b), "The Nature and Scale of the Cottage Economy", Cambridge Group for the History of Population and Social Structure, Occupations Project Paper No.15, <http://www.hpss.geog.cam.ac.uk/research/projects/occupations/abstracts/>.
- Shaw-Taylor, L. and Wrigley, E.A. (2008), "The Occupational Structure of England c. 1750-1871: A Preliminary Report", Cambridge Group for the History of Population and Social Structure, Occupations Project Paper No.1, <http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/>.
- Shaw-Taylor, L., Wrigley, E.A., Kitson, P., Davies, R., Newton, G. and Satchell, M. (2010), "The Occupational Structure of England, c.1710-1871", Cambridge Group for the History of Population and Social Structure, Occupations Project Paper No.22, <http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/>.
- de Vries, J. (1984), *European Urbanization 1500-1800*, London: Methuen.
- Wrigley, E.A. and Schofield, R.S. (1989), *The Population History of England, 1541-1871: A Reconstruction*, Cambridge: Cambridge University Press.
- Wrigley, E.A. (2006), "Categorising Occupations: The Primary, Secondary, Tertiary (PST) System", Department of Geography, University of Cambridge, <http://www.geog.cam.ac.uk/research/projects/occupations/categorisation/>.
- Wrigley, E.A. (2011), *The Early English Censuses*, British Academy Records of Social and Economic History, Oxford: Oxford University Press, (forthcoming).