The occupational structure of England and Wales, c.1750-1911
Paper prepared for the INCHOS workshop held in Cambridge
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This paper is an early draft and is not to be cited without permission.

I

Introduction

This paper was originally intended to be a preliminary draft of a chapter for the book on the comparative history of occupational structure which the INCHOS 2009 conference will lead to. For a variety of reasons the paper falls short of that aim and what follows might be considered more as notes towards such a preliminary paper. I have focussed on presenting an outline of the data which will underlie the completed chapter with a brief discussion of the sources and methodological problems together with a preliminary analysis. I have not attempted, except briefly in the introduction and elsewhere in passing, to relate the findings to the wider historiography though there is some attempt to make comparison with some of the other papers (one of the advantages of backwardness). It should be noted, that all the data are provisional and should not be cited outside of INCHOS. In particular, whilst there are unlikely to be any major changes to the account presented here of the evolution of the male primary, secondary and tertiary sectors between 1817 and 1911, the pre 1817 estimates may be subject to more significant change while the female data and some of the more sectorally disaggregated male data for the nineteenth century may be subject to substantial change.[2]

II

Historiographical background

The 'traditional' historiographical view of British industrialization is that the process was dramatic and revolutionary and took place in the late eighteenth and early nineteenth centuries. Whilst it should be noted that this view was challenged in the early twentieth century by Herbert Heaton, J.H. Clapham and John Nef amongst others, it remained the basic orthodoxy amongst economic historians until perhaps the 1980s.[3] Deane and Cole, in their pioneering quantitative reconstruction of the British Economy from 1688 to 1959, published in 1962, took care to distance themselves from the traditional view of the Industrial Revolution. Nevertheless, their estimates of

[1] Whilst I have written the text of this paper, it is entirely based on an ongoing research project on which many people have laboured over the last six years. The paper is based on work by Ros Davies, Peter Kitson, Gill Newton, Max Satchell, E.A Wrigley and a small army of research assistants. The research project has been very generously funded by the ESRC, the Leverhulme Trust and the British Academy.

[2] In fact since this paper was written the account given here of the eighteenth century has been partially superceded by further work which takes the story back to c.1710. This new work will be incorporated when the chapter is revised for publication. In the meantime see: Shaw-Taylor, L., et al 'The occupational structure of England and Wales c.1710-1871.'

[3] Heaton, H., 'The Industrial Revolution'; Clapham, J.H., *An Economic History of Modern Britain*, I. (p.143-5. Nef, J.U. 'The progress of technology and the growth of large-scale industry', p.24.

GDP per capita, shown in figure one below, were indeed suggestive of a very sharp discontinuity in economic growth in the late eighteenth century.

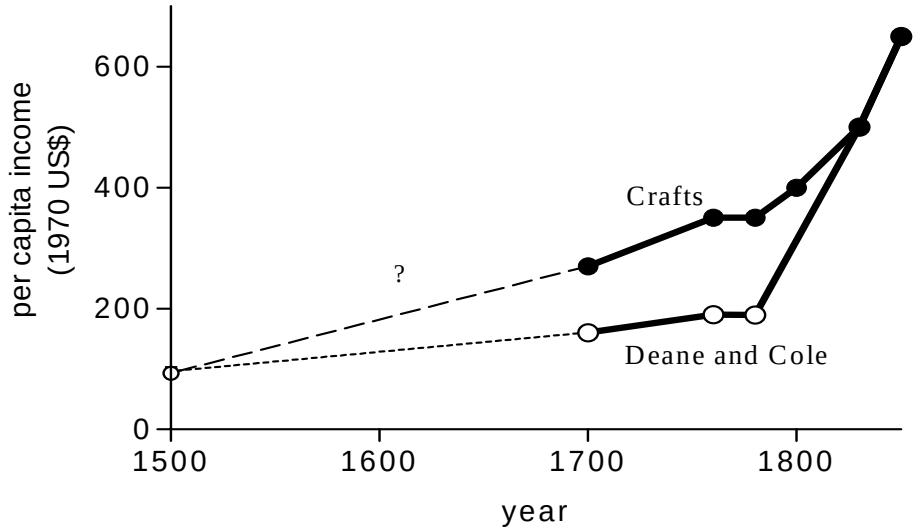
N.F.R. Crafts' revisions of Deane and Cole's growth figures, published during the 1980s were a critically important element in shifting the orthodoxy more firmly towards the view that industrialisation had longer term roots than had traditionally believed and that the process remained incomplete in the middle of the nineteenth century. Subsequent work by Crafts and Harley has produced somewhat modified figures and these are graphed in figure one. Whilst Crafts and Harley's figures are widely accepted as the best guide we have to the course of economic growth over the eighteenth and nineteenth centuries they have not found universal acceptance and some critics continue to adhere to the older view of British industrialization as a sudden and dramatic change.[4] As is often the case with historical debates a key cause of disagreement amongst historians has been the weakness of the existing evidential base though there are conceptual differences as well. The national accounts framework is based on three key sets of data: population data, estimates of occupational structure and estimates of sectoral output. These three sets of data are integrated into a consistent econometric framework but, inevitably, the results are only as good as the inputs. There are unlikely to be any large errors with the demographic data produced by Wrigley and Schofield.[5] There is however, considerable scope for error in the estimates of occupational structure and in the output estimates. With the latter this is perhaps especially true with respect to agriculture and the service sector.[6] Those who remain sceptical of Crafts and Harley's description of change base their scepticism partly on their doubts about data quality and partly on the view that even if Crafts and Harley's aggregate figures on GDP per capita growth rates are correct they conceal dramatic structural shifts, especially at the regional level and that in any case the Industrial Revolution was a regional phenomenon not a national one.

[4] Most notably Maxine Berg, Pat Hudson and Jack Langton. Berg, M., and Hudson, H., 'Rehabilitating the Industrial Revolution'; Langton, J., 'The Industrial Revolution and the regional geography of England.'

[5] Controversy over the demographic work of the Cambridge Group has focussed largely on the causes of the trends in population growth rather the population series itself which has found very general acceptance and is the relevant input to the national accounts framework.

[6] Much of service sector output is assumed to have grown in line with population. The new occupational data suggest that all components of the service sector grew more rapidly than that. It is my own view that agricultural output growth may have been significantly distorted by treating agricultural demand as significantly more price elastic than was the case.

Figure 1 English per capita income



One of the great strengths of historical data about occupational structure is that datasets can be produced at the local and regional as well as at the national aggregate level. Exactly the same point applies, perhaps with even more force, to population data. It is unlikely to prove possible to produce robust estimates of regional GDP and GDP per capita before the nineteenth century but the geographical aspects of change are clearly critically important. Our newly available datasets of occupational structure the national level will, when finalised, make possible significantly more robust national income estimates and sectoral productivity figures. But our regional and local datasets on both occupational structure and population levels also allow us to examine the sub-national geography of structural change and throw light on the integration of the national economy.

Since the work of Simon Kuznets it has been appreciated that the onset of modern economic growth is normally associated with a major shift in occupational structure and in particular with a substantial and long-term decline in the proportion of the population working in agriculture. Adam Smith, of course, noted the relationship between an increasing division of labour and higher income levels long before that. Table one reproduces data compiled by Bob Allen on the share of the workforce in agriculture in a number of European countries c.1500 and c.1800. The lowest estimates for 1500 are to be found in what are now Belgium (58 per cent) and the Netherlands (56 per cent). This suggests these were the most highly developed European economies at this date. Italy and Spain follow at 62 per cent and 65 per cent respectively. In the more backward parts of Europe, which included England at this date the figure is generally around 75 per cent. By 1800 England in particular had seen a dramatic decline and at 35 per cent was the least agricultural European economy. Progress elsewhere in north-western Europe was more modest and in Italy and Spain was almost non-existent reflecting long-term economic stagnation.

Table 1 **R.C. Allen's estimates of occupational structure 1500-1800**		
Country	***1500*** ***Share of labour force in agriculture*** ***%***	***1800*** ***Share of labour force in agriculture*** ***%***
England	74	35
The Netherlands	56	41
Belgium	58	49
Germany	73	62
France	73	59
Austria/Hungary	76	57
Poland	75	56
Italy	62	58
Spain	65	64
Source: Allen, R.C., The British Industrial Revolution, p.17		

These figures are highly suggestive and may be reasonably accurate at this very broad brush-level of analysis. Hopefully, one long-run result of INCHOS will be to replace these figures with figures which are both more robust but also capable of greater disaggregation: sectorally, temporally and spatially.

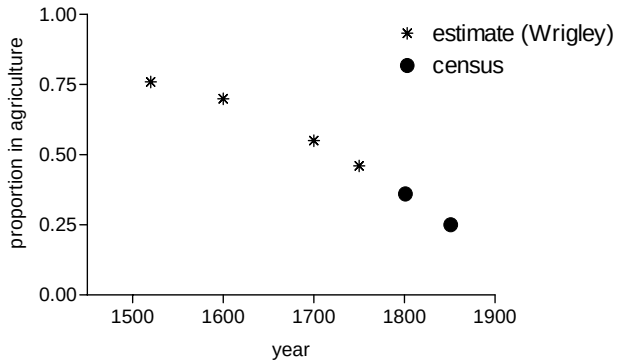
At a very general level our knowledge of English occupational structure has come a long way since 1962 when Deane and Cole suggested that in 1688 between 60 and 80 per cent of the workforce was in agriculture.[7] No-one would now suggest that a figure as high as 80 per cent is remotely plausible. Lindert and Williamson's work in the early eighties provided improved estimates of occupational structure which were subsequently utilised by Crafts and by Harley.[8] Crafts' derives an estimate of 55.6 per cent of the workforce in agriculture in 1688 and 48.0 per cent from the Lindert and Williamson data.[9]

The most widely cited and most robust long-run estimates for England remain those made twenty-five years ago by Tony Wrigley and are shown in figure two.[10] These data are estimates based on reasonably firm data on the size of the urban population and plausible guesses as to the share of the rural population engaged in agriculture. However, the figures shown for 1700 and 1750 are broadly in line with Lindert and Williamson's work and with our new estimates. But, again these data provide no further sectoral breakdown and no geographical disaggregation. However, whilst the figures for agriculture are probably about right and in line with our the new estimates the estimates for the size of the secondary and tertiary sectors are seriously adrift from the new estimates which are undoubtedly much more robust. Moreover, Lindert and

[7] Deane and Cole, British economic growth, p. 137.
[8] Lindert, P.H., and Williamson, J.G., 'Revising England's social tables'; Lindert, P.H., 'English occupations, 1670-1811'; Crafts, N.F.R., *British economic growth*'; Crafts, N.F.R., Harley, C.K. 'A restatement.'
[9] Crafts, *British economic growth*, p.15.
[10] Wrigley, 'Urban growth.'

Williamson's data give only a very limited sectoral breakdown and do not provide any geographical disaggregation.

Figure 2 English male agricultural employment



III

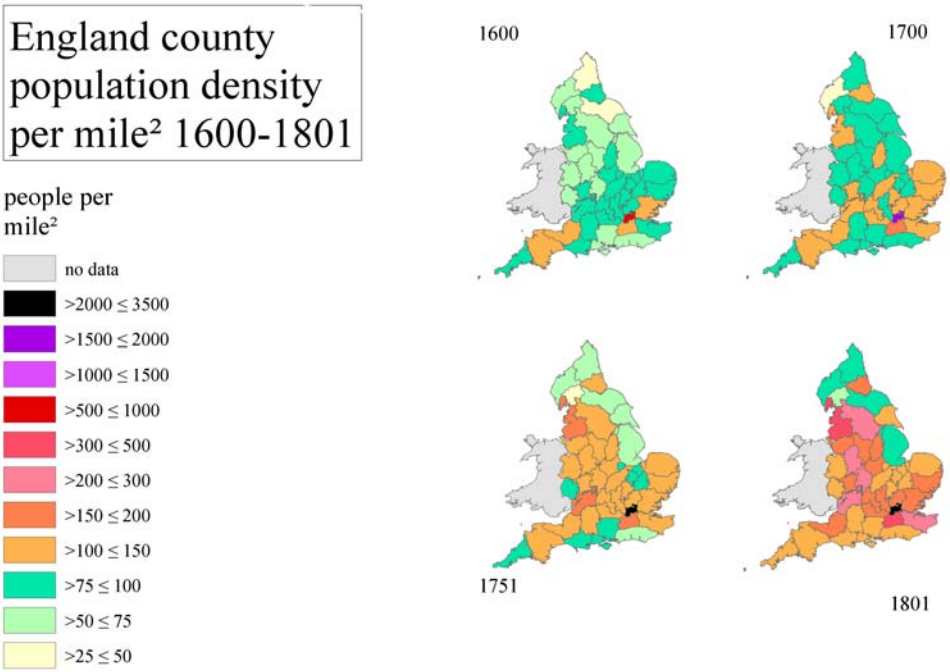
Population geography

Data on occupational structure give a very clear indication of the level and nature of economic development. However, in the pre-census era, such data can be hard to come by and often only cover parts of the country under investigation. Spatially comprehensive data on population levels will often be available when occupational data are not and this is certainly the case in England. Whilst population levels represent a very thin description of economic structure in comparison with data on occupational structure such data are nevertheless profoundly revealing. At its simplest it is evident that being able to quantify the proportion of the population which is urban is of great importance.[11] But there is more to population geography than that. In any long-settled and highly agricultural economy rural population densities are likely to be relatively low and to vary spatially in a relatively modest way which reflects variations in topography, soil quality and climate. In a more advanced economy in addition to urban centres there may be high population densities in mining areas and areas of rural industry. Data on historical population densities can probably be collected relatively easily for many parts of the world and are very straightforward to compare internationally compared with occupational structure and especially with monetary quantities.

Work by Tony Wrigley on local population estimates and by Max Satchell on the boundaries and areas of historical administrative units means it is currently possible for us to map estimates population densities at a variety of spatial levels over time.[12] Figure three shows estimates of population densities for the English counties in 1600, 1700, 1751 and 1801.

[11] De Vries, J., *European urbanization.*
[12] On the population data see Wrigley, 'Rickman revisited' and Wrigley, 'English county populations.'

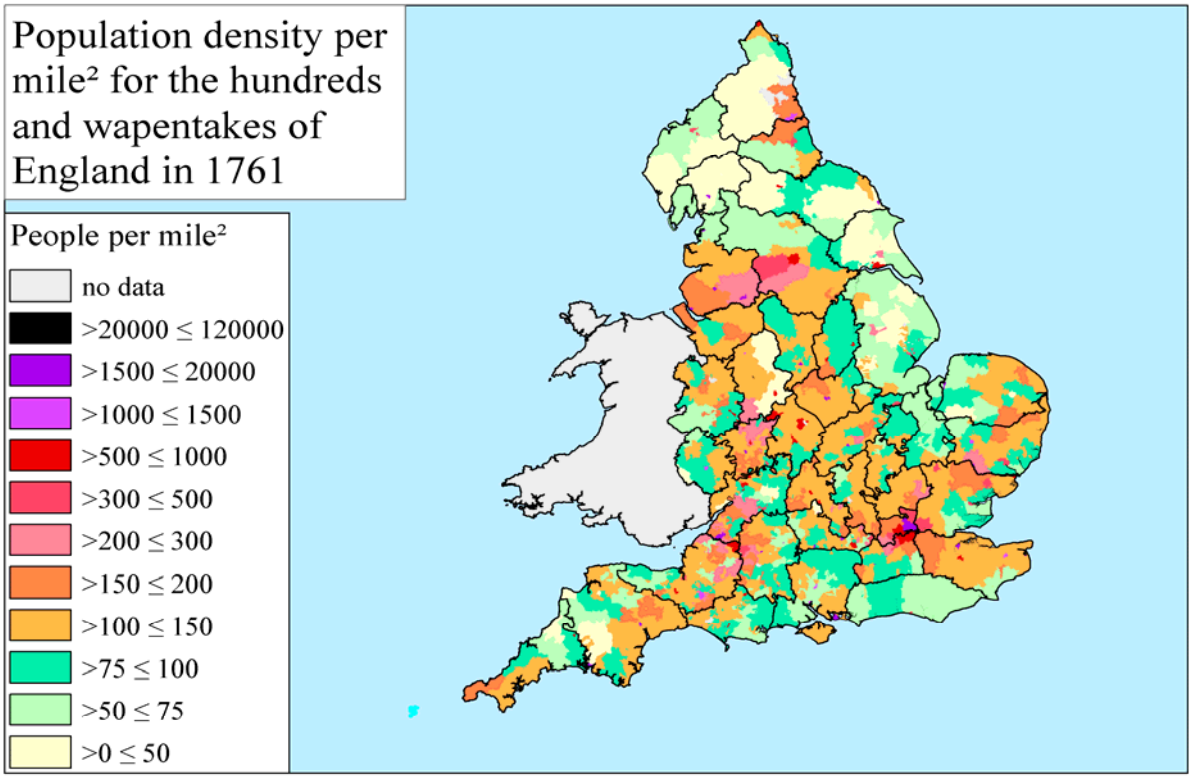
Figure Three



Before discussing these four maps it should be noted that the counties bordering London each contained part of the London population within their boundaries and the relatively high population densities for Surrey, Kent and Essex in some years is a reflection of this and not necessarily a reflection of high population densities elsewhere in these counties. In 1600, no county outside Middlesex (which contained most of London) had a population density which exceeded 150 person per square mile and most counties were below 100 with many below 50. By 1801 all counties, except Westmorland, were more densely populated but the variability between counties was much greater. Lancashire, home of the cotton textile industry had over 300 people per square mile and the West Riding, the ascendent location for wool textiles had over 200 people per square mile. Whilst Lancashire had a relatively high population density in 1600 compared with other northern counties it was no higher than many southern agricultural counties. These data do not suggest very large concentrations of rural industrial populations in the north-west by 1600.

However, there are limits to what can be learned from county level data. At present we are able to map population densities for ancient sub-county administrative units called the hundreds every ten years from 1761 to 1851 (soon to be extended to 1881) and for individual parishes from 1801 to 1851 (soon to be extended to 1881). Figure four, below, shows population densities for each English hundred in 1761. In due

Figure 4



course, as a result of work currently being undertaken by Peter Kitson, we hope to have a much more localised picture for various earlier dates (with most data being available for 1563 and c.1676) which should shed much light on the early growth of rural industry and may pin down the critical periods of development (and decline) in particular proto-industrial districts.

In figure four substantial variation within counties is immediately apparent. Large swathes of agricultural England had population densities below 100 persons per square mile in 1761 and much of northern England was below 75 persons per square mile. The textile districts on Lancashire and the West Riding by contrast had population densities in excess of 200 per thousand, as did the area around Birmingham and some of the south-western textile districts. Outside London, there were no large densely settled areas in the south-east of England. The absence of any very striking concentration of population around Norwich, one of the leading centres of the cloth trade in the medieval and early modern periods, suggesting the region was already being eclipsed by the West Riding.[13] More work is required but it is already clear that England's population geography in 1761 was not that of a predominantly agricultural country. For the most part this will not surprise readers of Daniel Defoe's *Tour through the Whole Island of Great Britain*, published in 1723, where he recounted the teeming populations of the textile districts of the West Riding and Lancashire. But this map is more comprehensive and gives much greater precision

[13] Perhaps rather earlier than is usually believed. See Clapham,J.H., 'The transference'; Lloyd Pritchard, M.F., 'The decline of Norwich', P., Hudson, *The Industrial Revolution*.

than Defoe's account, if less colour, and some features, such as the modest populations densities of east Norfolk by 1761 might well surprise readers of Defoe.

IV

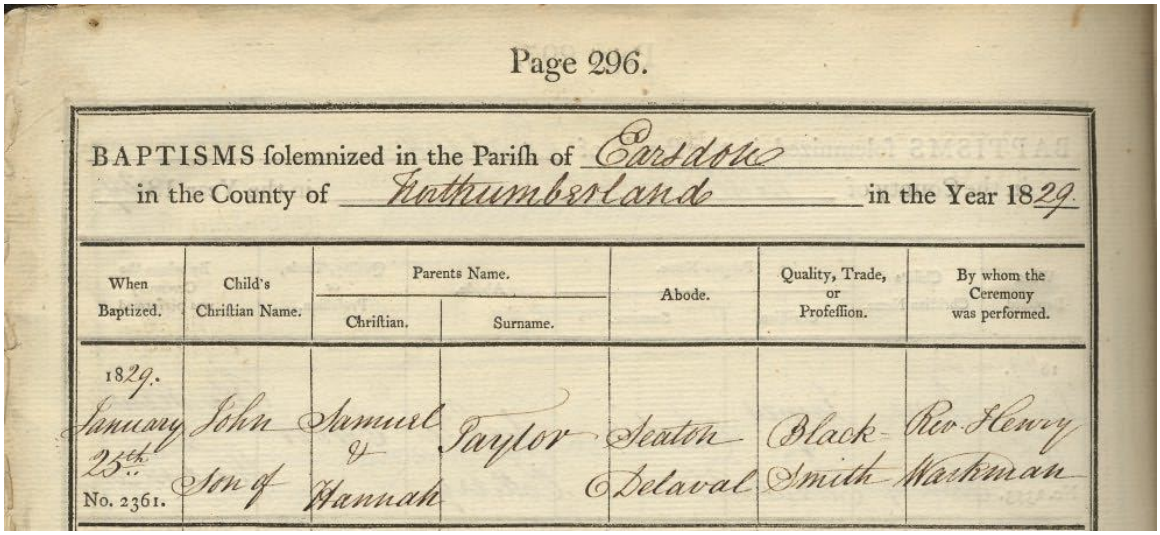
A preliminary discussion of sources for occupational structure 1750-1911

The first census for Britain was taken in 1801. Since then a census has been taken every ten years with the single exception, for obvious reasons, of 1941. The first three censuses (1801-1821) contain some very limited and problematic occupational data which have allowed historians to make ballpark estimates of the share of the workforce in agriculture but not much more can be done with the data. The census of 1831 provides rather more detail but is still problematic. In essence it provides partial and very valuable information on occupational structure but does not provide comprehensive information. The 1841 census was the first census to record male occupations in a comprehensive manner. However, the recording of female occupations was highly inadequate (married women and unmarried women residing with their fathers were not supposed to report an occupation). Whilst there are still problems with the recording of female occupations (which will be discussed below), the 1851 census suddenly shines a brilliant light on both male and female occupational structure. To put the deficiencies of the 1841 census in context, reported female employment roughly doubles between 1841 and 1851. For these reasons our use of the census data to provide occupational data essentially starts in 1851. In the next section census data on both male and female data are presented for the period from 1851 to 1911.

For late industrialising countries the census may provide a more or less adequate source for mapping occupational structure over the course of industrialisation. For Britain that is clearly not the case since the economy was entering the final phases of the industrialization process by 1851. Whilst extensive work is currently underway by Amy Erickson and Jacob Field to identify sources which may enable us to chart the history of female occupational structure in the period before the 1851 census, it is not possible, currently, to present datasets on female employment for the pre-1851 period based on direct evidence.[14] It is therefore necessary to turn to other sources for the earlier period. By far the most important source of data for male occupations for the earlier period are the Anglican parish registers. From the 1st January 1813 it was a legal requirement under Rose's Act that Anglican Baptism registers should record the occupations of the fathers of all legitimate children baptised. A standard pro-forma was used with eight entries per page. An example is shown in figure five for the parish of Earsdon in Northumberland.

Figure 5

[14] Field, J.,and Erickson, A.L., 'Prospects and preliminary work.'



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BAPTISMS solemnized in the Parish of Eardoue
in the County of Northumberland in the Year 1829.

When Baptized.	Child's Christian Name.	Parents Name. Christian.	Parents Name. Surname.	Abode.	Quality, Trade, or Profession.	By whom the Ceremony was performed.
1829. January 25th. No. 2361.	John Son of	Samuel & Hannah	Taylor	Seaton Delaval	Black-Smith	Rev. Henry Watkman

Peter Kitson designed an ingenious and remarkably efficient data collection process which allowed researchers to collect occupational descriptors from these registers at an average rate of around 1,000 descriptors an hour. This made it practical to collect male occupational data from 11,400 Anglican baptism register for the period 1813-20. This represents virtually every single baptism register in England and Wales.[15] Data were collected for approximately 2.5m baptisms. As a result we have what is effectively a new census of male occupations for the period 1813-20. In two respects this dataset is of higher quality than the published census material. Firstly, it goes down to the level of the individual parish.[16] This affords great geographical detail and, as a result of a massive exercise in matching the data to a Geographical Information System (GIS) managed by Max Satchell and Gill Newton, this dataset can be aggregated up to produce datasets for any larger spatial units. Thus it is possible to produce occupational datasets for 1813-20 which correspond to the areas used in later published census tabulations, or indeed to any earlier datasets we can create. For this reason the 1813-20 dataset is the fulcrum of the entire project. A second advantage this dataset has is that it consists of the occupational descriptors supplied by the individuals described. The published census by contrast uses aggregated occupational codings which: change from one census to the next; are hard to replicate; and aren't always ideal for analytical purposes. Thus the coding of the parish register data, whilst highly time-consuming, is of a much higher quality than the published census material.

The parish register dataset has several disadvantages compared with the later census material. Firstly, it does not provide data on female occupations.[17] Secondly, it only covers married men in fertile marriages who used Anglican registers to baptise their children. However, as will be seen, this does not seem to lead to serious distortions. Thirdly, it is not possible to generate tabulations of occupations by age-group.

[15] A very small number of registers, exclusively for very small rural settlements could not be accessed, and were regrettably omitted, because they were still held in the parish church. Where parish registers have not survived it was generally possible to use copies made at the time for the Diocese (Bishops' Transcripts). The omitted registers covered less than 0.1 per cent of the population and their exclusion can have no statistically significant impact on the results.

[16] Strictly speaking, the parish or chapelry or whichever part of a parish a particular register covered.

[17] Though a few parish registers do provide occupations for the mothers of illegitimate children.

Fourthly, it does not distinguish between agricultural labourers and other labourers.[18] This problem is discussed further in the next section.

For the period before 1813 three sources of male occupational data have been used. The most important by far is again the Anglican parish baptism registers. Whilst it was not a legal requirement to record baptisms, many parishes never the less did so. We have searched all 11,400 English and Welsh baptism registers from 1690 to 1799 for runs of good occupational recording. The data used in this paper are confined to Northern England for the period from 1750 to 1799. It should be noted that we have only used registers where we could find periods where 95 per cent or more of all baptisms of legitimate children recorded the fathers' occupation.[19] In due course we will be able to specify the male occupational structure of England and Wales for c.1700, c.1755 and c.1785.

A further source of data (primarily for the counties of Buckinghamshire, Hertfordshire, Northamptonshire and Northumberland) is provided by a class of documents known as militia ballot lists.[20] These were lists of virtually all males aged 18-45 (or sometimes somewhat different age ranges) with their occupations. These were compiled annually from 1757 to 1832 for most parts of the country for the purposes of selecting men to serve in the militia. Tragically very few survive but those that do survive are invaluable.[21] The final source used, exclusively for London, are the marriage registers of the Fleet Prison for the period before 1753. Bizarre as that may sound, around half of all London marriages took place in the Fleet Prison in the first half of the eighteenth century. In some years occupations were recorded for most baptisms. It is plausible, but not yet firmly established, that those married in the Fleet were broadly representative of Londoners as a whole (of which more later).

All of the data have been coded to the PST (Primary, Secondary, Tertiary) system devised by Tony Wrigley. The monumental task of coding the data was undertaken primarily by Ros Davies and E.A. Wrigley. Some further adjustments may be required, primarily to the census data, which is one reason why the data reported in the present paper are provisional and not for citation.

More specific points relating to particular sources will be dealt with as they arise in subsequent sections of the paper.

[18] The census itself is not perfect in this regard but this is a relatively modest problem.

[19] This was to avoid the risk that where a substantial share of all baptism entries did not record the fathers' occupation, some systematic social bias in the recording of occupations might distort the result. No such quality control appears to have been used by Lindert and Williamson in their use of burial records. The same quality requirement was imposed for 1813-20. Where necessary a smaller number of years was used and then inflated by the appropriate factor.

[20] See appendix one for the geographical location of these counties.

[21] It is entirely possible that further militia lists do in fact survive, currently undiscovered, in the attics and muniment rooms of surviving aristocratic estates.

V

The sectoral allocation of labourers in the pre-census datasets

In the census from 1841 onwards agricultural labourers are distinguished from non-agricultural labourers. Whilst there are grounds for thinking this distinction was not without imperfections it does not produce very serious problems.[22] For the purposes of this paper all non-agricultural labourers enumerated in the censuses of 1851-1911 have been counted as part of the secondary sector. No attempt has been made to allocate them to particular sub-sectors. In the longer-run it may prove possible to find plausible ways of allocating census-period non-agricultural labourers to particular sub-sectors within the secondary sector and of allocating some of them to the tertiary sector and to sectors within that. However, the problems are much more serious for the pre-census period because no distinction was made at all in parish registers or militia ballot lists between agricultural and non-agricultural labourers. Since around 30 per cent of all adult males were recorded as labourers in 1813-20 this is not a small problem.

The procedure used by Lindert and Williamson was to use data in the 1831 census which suggested that only 60 per cent of all labourers were agricultural, to split labourers in the pre-census period between sectors. However, this appears to rests on a misunderstanding of how the term 'labourer' was used in the 1831 census which added to those described as labourers in other sources, all miners, fisherman and a number of other groups and which therefore significantly inflated the proportion of 'labourers' who appeared to be non-agricultural. In the 1851 census the corresponding figure was 74 per cent for England and this is likely to be much closer to the mark for the earlier period.

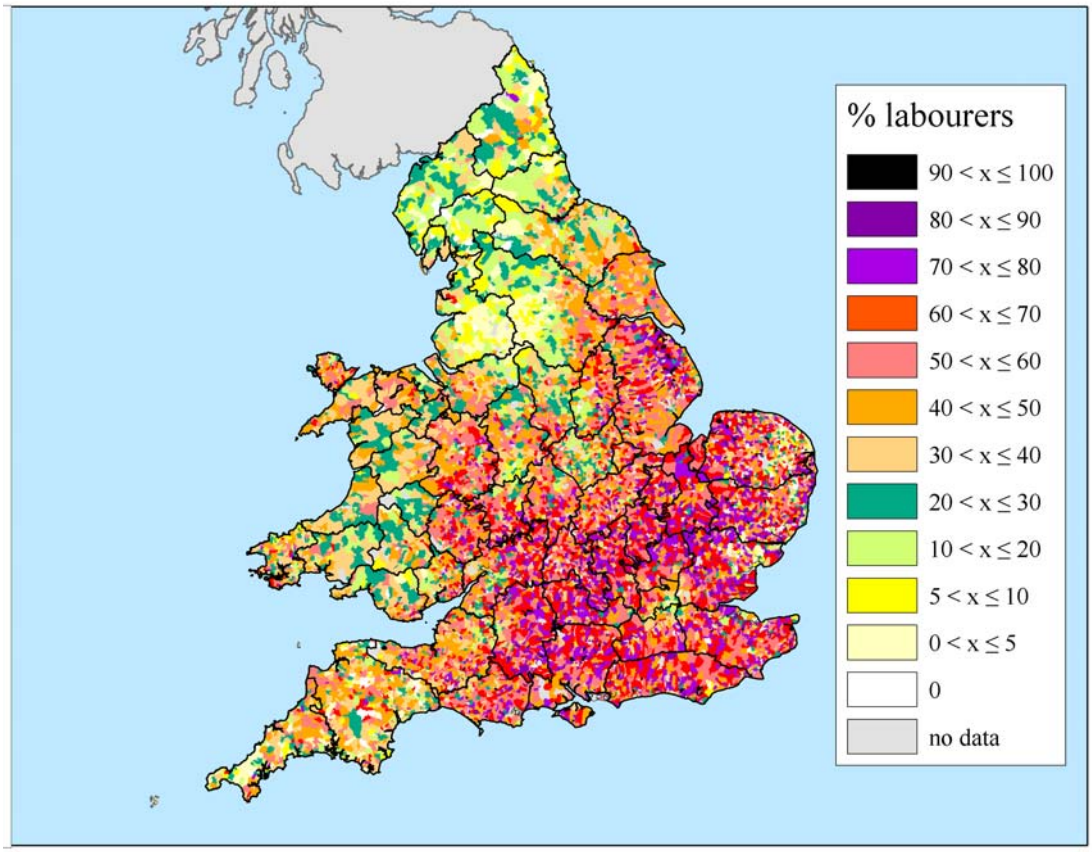
In this paper, it has been assumed that, non-agricultural labourers made up the same share of the occupied population in the pre-1851 period as they did in 1851 both nationally (6.4 per cent) and at county level.[23] This is far from ideal and in due course it will be possible to come up with better algorithms for allocating of labourers making use of a variety of other datasets – including the 1831 census.

Geography provides powerful clues to providing an optimal allocation between agriculture and the rest. In 1851 at one extreme only 55 per cent of Lancashire labourers were agricultural while at the other extreme 91 per cent of Suffolk labourers were returned as agricultural. Figure six below shows that labourers varied greatly as a proportion of the population in different parts of the country. Fortunately they were a large proportion of the population only in parts of the country (the south-east) where we can assume they were very largely agricultural whereas in areas such as Lancashire, where a high proportion of labourers where non-agricultural, the proportion of labourers in the population was low. In consequence if we use county level data from 1851 to allocate labourers between the agricultural and secondary sectors for earlier periods the overall error is likely to be modest. However, this is a complex issue and will require a paper in its own right. In the meantime, the errors introduced by the present procedure are likely to be small.

[22] See Wrigley (2004) for a discussion of this issue in the 1841 and 1851 censuses.

[23] There is a logical inconsistency in applying the 1851 national proportion of 6.4 per cent to the national data and the county level 1851 shares to the county data. This will be corrected in the revised paper.

Figure six
The proportion of adult males who were labourers 1813-20



VI

Distortion caused by reliance on adult male data

For the period before 1851 we do not currently have female datasets and for the period before 1841 we do not have data for non-adult males. It is therefore important to consider the nature and degree of the biases this might introduce. Since we lack data for these periods no direct assessment is possible. However, it is possible to see what difference it makes it would have made in 1851 when we do have data available for women and child workers as well as adult males. A simple comparison at the broad-brush (PST) sectoral level is shown in table 2.

Table 2 *PST shares of occupied workforce in 1851*			
	Primary %	Secondary %	Tertiary %
Males 20 years +	27.2	50.1	22.7
Females 20 years +	15.6	36.4	48.0
Both sexes 20 years +	23.5	45.7	30.9
Both sexes 10 years +	23.4	46.5	30.2

The first two lines of table 2 show the proportions of occupied men and women twenty years and older in the primary, secondary and tertiary sectors. It is immediately apparent from comparing lines one and two that the distribution of adult men and adult women between these three sectors are very different. Occupied women were much less likely to be employed in the primary sector, rather less likely to be employed in the secondary sector and much more likely to be employed in the tertiary sector than were occupied men. The third line of table two shows the distribution of all adults regardless of sex. There are still significant differences with the male only figures in line one but the differences are less acute. The impact made by the female figures is limited by the fact that the reported participation rates for women 20 and over was 43 per cent whereas for men it was 97 per cent. If we now compare lines three and four we can see that it makes remarkably little difference whether we include or exclude those under twenty years of age. Whilst not shown here, it makes almost no difference whether we look at those 25 and over or those 20 and over.

A number of obvious caveats are in order. The first of these is that if the census seriously under-recorded female participation then any male-only datasets are likely to be less representative of the workforce than these data suggest. There has been much debate over the purported under-enumeration of women's work in the nineteenth century census.[24] However, much of the literature is pre-occupied with the undoubted fact that many women, who worked irregularly, especially in agriculture, were not accorded an occupation in the census. This was undoubtedly the case. How much distortion this produces in sectoral shares is another matter and the direction of bias is less straight-forward than is sometimes imagined.

In an ideal world we would be able to measure not counts of occupations but the numbers of hours worked over the course of the year in every sector of the economy (including household labour) by individuals of all kinds (men, women and children). If individuals who worked very part-time were accorded an occupation in the census we might end up further from this ideal picture than if they were not accorded an occupation at all. This is not to deny that this would be a misleading a description of the individuals concerned.

Suppose there were a large number of women who laboured in agriculture, but only for twenty per cent of the average male working year in the same sector and that none of these women were accorded an occupation. This would undoubtedly bias the data but it would bias the measurement of sectoral shares much less than if all those women were recorded as agricultural labourers. A question that has not received any attention, so far as I am aware, is to what extent there were women who worked a

[24] See Shaw-Taylor, 'Diverse experiences' for a discussion of the literature and a detailed assessment of the 1851 census.

much larger fraction of average male hours (80 per cent for instance) and were given an occupation. To the extent that this were the case, it would introduce a reverse bias and the net bias might not be very large at all. This is mere speculation, but the point is that it is difficult to be certain of the direction or importance of bias in the census on *a priori* grounds. My own view (to which I will return later) is that it is likely that the recording of female employment in agriculture was indeed problematic in 1851 and other census years but that we have no grounds for making *a priori* assumptions about the direction of bias with respect to female employment in the secondary and tertiary sectors. Clearly this is a question which requires much more systematic empirical attention.[25]

The second caveat is that what is broadly true at this aggregated level of analysis will often not hold at a more sectorally disaggregated level of analysis. For instance, the exclusion of those under 20 in 1851 results in the textile sector's share of male labour appearing being understated by 13 per cent and the mining sector by 9 per cent because these two sectors had large numbers of workers under 20. On the other hand the construction sector is overstated by 9 per cent and the retail and wholesale sector by five per cent because these sectors had relatively few young workers. A third caveat is that what was true in 1851 may not have held true in earlier periods. I will return to this later. For the moment we may simply note that if we take the 1851 census data at face value then the exclusion of children and young adults makes little difference to PST shares whereas the exclusion of adult females very substantially understates the relative size of the tertiary sector and somewhat overstates the relative size of the primary and secondary sectors.

VII

The occupational structure of England and Wales 1817-1911
The national picture

Table three shows the percentage share of the male labour force made up by the primary, secondary and tertiary sectors from c.1817 to 1911 together with the labour force shares of a number of sub-sectors selected because they seemed likely to be interesting for the purposes of international comparisons. The first column of data derive from the parish register dataset for 1813-20 whilst the remaining columns derive from the published census reports of 1851 through to 1911. Whilst the first column relates to the fathers' of legitimate children baptised between 1813 and 1820 the remaining columns relate to men aged twenty and over. A comparison of the parish register data with the subsequent census data gives no rise for concern about the representativeness of the parish register data. This is equally true when the data are tabulated at county level. More tellingly, parish register occupational data for a number of urban and rural areas were collected for the period from 1830-1837 together with occupational data for adult males for the same areas from the 1841 census and showed very close agreement. The male participation rates will be discussed briefly in the revised paper.

[25] Such work is quite feasible and Amy Erickson, Jacob Field and myself hope, as an initial exercise, to compare the proportion of hours worked by men and by women from a sample of farm account books with the ratios of employment in the census.

Table 3
Male occupational structure of England and Wales c.1817 to 1911 (percentage shares)

Males	***Fathers***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***
	1813-20	**1851**	**1861**	**1871**	**1881**	**1891**	**1901**	**1911**
Primary	**35.4**	**27.2**	**24.4**	**19.8**	**16.8**	**13.9**	**11.6**	**11.2**
Secondary	**47.4**	**50.1**	**49.6**	**52.6**	**54.1**	**53.6**	**52.8**	**51.1**
Mining	3.2	4.6	5.2	5.4	6.0	6.6	7.2	8.2
Food processing	3.2	3.6	3.3	3.4	3.2	3.2	2.7	2.7
Footware and clothing	7.0	7.2	6.2	5.5	4.8	4.4	3.6	3.1
Textiles	7.7	6.8	5.7	4.7	4.0	3.8	3.5	3.7
Metals	3.7	4.7	5.2	5.6	5.9	5.6	5.2	5.4
Machine making	1.2	1.6	1.9	2.9	3.4	3.7	4.2	4.2
Construction	7.4	7.4	7.7	8.5	9.1	8.4	9.4	8.2
Rest of secondary	14.1	14.2	14.1	16.7	17.7	17.8	17.0	15.5
Tertiary total	**17.2**	**22.7**	**26.0**	**27.6**	**29.2**	**32.6**	**35.6**	**37.7**
Retail and wholesale	3.2	4.7	5.6	6.0	5.8	6.0	7.1	7.6
Domestic service	1.2	1.5	0.8	0.8	1.6	0.6	1.3	1.5
Transport	5.1	6.6	8.8	8.6	9.4	11.7	12.0	12.5
Rest of tertiary	7.6	9.9	10.7	12.2	12.3	14.3	15.2	16.1
Total	100	100	100	100	100	100	100	100
Reported participation rate	-	97.1	97.9	97.5	94.8	97.8	94.9	94.1

Male employment in the primary sector (overwhelmingly agriculture) fell from 35 per cent (which is in line with existing estimates) per cent to 11 per cent over the period,. The secondary sector accounted for 47 per cent of adult male employment in 1813-20, a much higher figure than earlier estimates. Growth was very modest between 1817 and 1851 and then plateaued or declined slightly to 1851 before rising gently to a peak in 1881 and then going into a decline. The 1911 level was only very slightly higher than the 1813-20 level and would be lower if mining, which grew very rapidly over the nineteenth century were not included in the secondary sector. The tertiary sector's share of adult male employment more than doubled from 1817 to 1911 rising from 17.2 per cent to 37.7 per cent and showing a significant growth in share in every inter-censal interval and overtook the primary sector as early as 1861.

Table four shows the available census data for females 20+ in the same categories. Table five shows both sexes combined. Some problems with the consistency of the census data in table four are immediately apparent. Reported primary sector employment falls from 15.6 per cent of employed females to 11.2 per cent over the period 1851 to 1871 in line with the decline in male employment. But between 1871 and 1881 it falls from 11.2 per cent to 2.3 per cent which is simply not plausible. Table six reports the share of the workforce which was reported as female by sector. For the primary sector this falls from 22 per cent to 5 per cent between 1871 and 1881 which again is clearly implausible.

Table 4
Female occupational structure of England and Wales c.1817 to 1911 (percentage shares)

Females	***N/A***	***100***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***
	1813-20	**1851**	**1861**	**1871**	**1881**	**1891**	**1901**	**1911**
Primary	**-**	**15.6**	**12.6**	**11.2**	**2.3**	**1.5**	**1.5**	**1.9**
Secondary	**-**	**36.4**	**38.3**	**35.8**	**40.8**	**32.5**	**31.3**	**31.0**
Mining	-	0.1	0.1	0.2	0.1	0.1	0.0	0.0
Food processing	-	1.6	1.8	2.0	1.3	1.6	0.9	1.4
Footware and clothing	-	19.3	20.2	17.6	20.0	15.5	14.5	13.5
Textiles	-	12.2	12.6	11.3	14.5	10.7	10.5	10.4
Metals	-	0.8	0.7	0.6	0.7	0.6	0.6	0.8
Machine making	-	0.0	0.1	0.5	0.3	0.6	0.1	0.2
Construction	-	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Rest of secondary	-	2.1	2.8	3.6	3.7	3.5	4.6	4.7
Tertiary total	**-**	**48.0**	**49.1**	**53.0**	**56.9**	**66.0**	**67.3**	**67.0**
Retail and wholesale	-	3.2	3.2	3.9	4.8	4.8	6.7	8.8
Domestic service	-	24.5	22.3	24.3	34.1	30.4	29.1	26.5
Transport	-	0.3	0.2	0.1	0.2	0.2	0.3	0.9
Rest of tertiary	-	20.1	23.4	24.8	17.7	30.6	31.2	30.8
Total		100	100	100	100	100	100	100
Reported participation rate	-	43	42.4	43.6	31.8	36.7	33.0	33.1

In the censuses of 1851 through to 1871 instructions to household heads and enumerators instructed that farmers' wives should have 'farmers' wife' recorded as their occupation and the same instruction applied to the co-resident female relatives of farmers. These individuals were then deemed to be part of the farm work-force. In 1881 this instruction and the accompanying assumption were dropped. Since in 1871 farmers' wives had accounted for 58 per cent of all women reported as working in agriculture then and other farmers' relatives (mainly daughters) accounted for a further 18 per cent this could be expected to lead to a 76 per cent decline. The actual decline in share is around 80 percentage points and the dramatic fall is clearly very largely an artefact generated by the peculiarities of the census.[26]

Reported female participation in agriculture from 1881 is implausibly low and cannot be regarded as reliable. Whether the figures for the period 1851 to 1871 are broadly reliable remains a moot point which requires much further exploration. The census figures suggest that nationally women made up around 20 per cent of the primary sector workforce (see table six). This figure is not out of line with the small number of published datasets deriving farm wage books in the period which suggest similar levels of female employment.[27] For the purposes of this paper it will be assumed that the female share of agricultural employment remained stable over the period 1871 and

[26] There are some other more minor but possibly artifactual changes which require further investigation: there are very sharp drops in the number of female farmers and in the combined totals of female agricultural labourers and servants, both of which are suspect.

[27] See Verdon, *Rural Women*, and, Field and Erickson, 'Prospects and preliminary work.' However, it should be noted that this may be a happy coincidence since the farm accounts data relate to day labourers whereas the census data relate largely to farmers relatives.

1911 at the 1871 level and that the data for 1851 through to 1871 are unproblematic. This assumption generates revised estimates of female and both sex employment in agriculture for 1881 through to 1911 and also necessarily reduces all the other sectoral shares in those years. The revised estimates are shown in tables seven and eight. In the longer run it may prove possible to replace the current estimates of female employment in agriculture with better figures utilising sex ratios derived from a larger sample of farm accounts and male census data.

Table 5
Both sexes: occupational structure of England and Wales c.1817 to 1911
(percentage shares)

Both Sexes	***N/A***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***
	1813-20	**1851**	**1861**	**1871**	**1881**	**1891**	**1901**	**1911**
Primary	**-**	**23.5**	**20.6**	**16.9**	**12.9**	**10.1**	**8.8**	**8.6**
Secondary	**-**	**45.7**	**45.9**	**47.1**	**50.5**	**47.2**	**46.8**	**45.4**
Mining	-	3.2	3.6	3.7	4.4	4.6	5.2	5.9
Food processing	-	3.0	2.8	2.9	2.7	2.7	2.2	2.4
Footware and clothing	-	11.1	10.8	9.5	8.9	7.7	6.6	6.0
Textiles	-	8.5	8.0	6.9	6.9	5.9	5.5	5.6
Metals	-	3.4	3.8	3.9	4.5	4.1	3.9	4.1
Machine making	-	1.1	1.3	2.1	2.5	2.8	3.0	3.1
Construction	-	5.0	5.3	5.7	6.6	5.9	6.8	5.9
Rest of secondary	-	10.3	10.5	12.4	13.9	13.5	13.5	12.5
Tertiary total	**-**	**30.9**	**33.5**	**36.0**	**36.6**	**42.6**	**44.4**	**46.0**
Retail and wholesale	-	4.2	4.8	5.3	5.5	5.6	7.0	8.0
Domestic service	-	9.0	7.7	8.5	10.4	9.6	9.0	8.5
Transport	-	4.6	6.1	5.8	6.9	8.3	8.7	9.2
Rest of tertiary	-	13.2	14.8	16.3	13.8	19.2	19.7	20.2
		100	100	100	100	100	100	100
Reported participation rate	-	69	68.8	69.3	61.8	61.8	62.3	62.0

Returning now to a fuller consideration of table six, which shows reported share of females in the adult workforce from 1851 through to 1911. If we examine the shares for the period 1851 to 1871 we can see that female shares were not particularly volatile and, on the whole are relatively stable in all the sectors tabulated. If we were to make an initial assumption that the ratios for 1851 held good for the 1813-20 period we could make initial estimates of female and both-sex labour-force shares for the 1813-20 period. The results of such a calculation can be seen in the first columns of tables seven and eight.

Clearly this involves some heroic assumptions. But in the absence of any direct empirical evidence on female employment of remotely similar scope it can be argued that the first column table seven represents a very plausible starting point for modelling female occupational structure in 1813-20.

Table 6
Adult females as a share of the adult workforce c.1817 to 1911

	N/A **1813-20**	*20+* **1851**	*20+* **1861**	*20+* **1871**	*20+* **1881**	*20+* **1891**	*20+* **1901**	*20+* **1911**
Primary	N/A	**0.22**	**0.20**	**0.22**	**0.05**	**0.04**	**0.05**	**0.06**
Secondary	N/A	**0.26**	**0.27**	**0.25**	**0.22**	**0.21**	**0.19**	**0.19**
Mining	N/A	0.02	0.01	0.01	0.01	0.00	0.00	0.00
Food processing	N/A	0.18	0.20	0.22	0.13	0.18	0.11	0.16
Footware and clothing	N/A	0.56	0.61	0.61	0.61	0.60	0.61	0.63
Textiles	N/A	0.46	0.51	0.54	0.57	0.55	0.54	0.52
Metals	N/A	0.07	0.06	0.05	0.04	0.04	0.04	0.05
Machine making	N/A	0.01	0.02	0.08	0.04	0.06	0.01	0.02
Construction	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rest of secondary	N/A	0.07	0.09	0.10	0.07	0.08	0.10	0.11
Tertiary total	N/A	**0.50**	**0.47**	**0.49**	**0.42**	**0.47**	0.42	**0.41**
Retail and wholesale	N/A	0.25	0.21	0.19	0.23	0.25	0.27	0.31
Domestic service	N/A	0.88	0.93	0.94	0.89	0.96	0.90	0.87
Transport	N/A	0.02	0.01	0.01	0.01	0.01	0.01	0.03
Rest of tertiary	N/A	0.49	0.51	0.56	0.35	0.48	0.44	0.43

As further direct evidence about absolute or relative levels of female employment in particular sectors becomes available it should be possible to improve these initial estimates. Agriculture, textiles and clothing are the most important large sectors which are likely to have significantly different sex ratios of employment in earlier periods. An approach to generating more accurate female shares for agriculture has already been discussed. There are a number of approaches which could be used to generate estimates of female labour-force shares in the textile sector and it may prove possible to do something similar for clothing.[28] It is highly likely that the textile sector work-force experienced a number of significant changes in the sex composition of the workforce over-time An increased feminisation of the textile workforce can be seen in the census data between 1851 and 1891 which may be linked to the further spread of power-loom weaving. But between 1813-20 and 1851 it is likely that change was in the opposite direction, as the mechanisation of wool and worsted spinning displaced massive numbers of female hand spinners.[29] Direct evidence on

[28] See Muldrew, , J.C. 'Th'ancient distaff' and whirling spindle', for one such approach. Business accounts, like farm accounts offer another possibility, as do parliamentary papers. A further possibility is to use Belgian census data to model the impact of changing technologies. The same technological changes took place a little later in Belgium than in Britain and within the census period. Here they resulted in a significant decline in the relative importance of female employment in the textile sector. Personal communication: Erik Buyst. All of these approaches could be followed and triangulated.

[29] See Saito, O., 'Who worked when' for the example of Corfe Castle, which may well represent the typical experience of rural parishes outside north-western England in this period. See Shaw-Taylor, L., 'Diverse experiences' for further discussion of this point. For a contrary view, see Berg, M., 'What difference.' Berg assumes that because textiles had a high share of female employment in 1851 and was a growing sector it must have provided an increasing number of jobs for women. This does not follow if, as is likely, the female share of employment had fallen over time.

this is limited but there is some. For instance, the returns of factory inspectors in the south-west show a very clear masculinisation of the wool textile industry over time.[30]

One further important feature of table six may be mentioned. There are a number of sectors where employment was almost exclusively male in the census period: mining, metal-work, construction and transport. With respect to mining we know that this did not reflect the situation in the earlier period and there is also some evidence of female nailers in the eighteenth century. But there is nothing in the historiography (as yet) to suggest that this was a new development in transport or construction.[31] So earlier male datasets on the size of these sectors may be quite unproblematic, though this should be regarded as a tentative hypothesis to be tested.

The revised estimates of female employment shares in table 7 show a much more plausible decline in the importance of agriculture. The participation rates calculated in the last line suggest some problem with the 1881 data. Further problems with 1881 are suggested by the shares of domestic service and the rest of the tertiary sector when compared with the following and preceding censuses. More work is needed on the changing census practices over time to improve these data but no further discussion of this issue is possible here.

Table 7
Female occupational structure of England and Wales c.1817 to 1911revised (percentage shares)

Females	**-1813-20**	***20+* 1851**	***20+* 1861**	***20+* 1871**	***20+* 1881**	***20+* 1891**	***20+* 1901**	***20+* 1911**
Primary	22.3	15.6	12.6	11.2	11.5	8.4	7.8	7.5
Secondary	**37.8**	**36.4**	**38.3**	**35.8**	**37.0**	**30.2**	**29.2**	**29.3**
Mining	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0
Food processing	1.6	1.6	1.8	2.0	1.2	1.5	0.8	1.3
Footware and clothing	20.5	19.3	20.2	17.6	18.1	14.4	13.6	12.7
Textiles	15.2	12.2	12.6	11.3	13.1	10.0	9.8	9.9
Metals	0.7	0.8	0.7	0.6	0.7	0.5	0.5	0.7
Machine making	0.0	0.0	0.1	0.5	0.3	0.5	0.1	0.2
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest of secondary	2.3	2.1	2.8	3.6	3.3	3.2	4.3	4.4
Tertiary total	**40.0**	**48.0**	**49.1**	**53.0**	**51.5**	**61.4**	**62.9**	**63.2**
Retail and wholesale	2.4	3.2	3.2	3.9	4.3	4.4	6.3	8.3
Domestic service	22.0	24.5	22.3	24.3	30.9	28.3	27.2	25.0
Transport	0.2	0.3	0.2	0.1	0.2	0.2	0.3	0.9
Rest of tertiary	17.0	20.1	23.4	24.8	16.1	28.5	29.1	29.1
Occupied	100	100	100	100	100	100	100	100
Reported participation rate	-	43.0	42.4	43.6	35.1	39.5	35.3	35.1

[30] See Randall, *Before the Luddites*,
[31] It is a striking contrast that Yoshifumi Usami reports a very high female share in the (radically smaller) Indian construction sector in the late nineteenth and early twentieth centuries. Usami, Y., 'Change in the workforce', p. 9.

Table eight shows the revised figures for both sexes from 1813-20 to 1911. The key points to note are:

(1) the steady decline in the primary sector from 31 per cent to 9 per cent of total employment between 1813-20 and 1911.

(2) The estimated share of secondary employment between 1813-20 and 1911 is surprisingly stable. It rose gently from 44.5 per cent to a peak of 50.5 per cent in 1881 before falling to reach 45.4 per cent in 1911, only one percentage point higher than it had been in 1813-20.

(3) The real dynamism in sectoral share was in the tertiary sector which rose throughout the period and nearly doubled from 24.1 per cent in 1813 to 46 per cent in 1911. On these estimates the tertiary sector over-took the primary sector sometime before 1851 and overtook the secondary sector in the first decade of the twentieth century.

(4) Mining, which was largely coal mining, experienced spectacular growth, growing from 2.3 per cent of the workforce in 1813-20 to 8.6 per cent in 1911.

(5) The rest of the secondary sector shrank from 42.2 per cent to 39.5 per cent over the same period.

(6) Textiles declined across the nineteenth century from 9.9 per cent of the workforce to 5.6 per cent.

(7) Machine making grew from 0.9 per cent of the workforce to 3.1 per cent presumably reflecting Britain's increasing role in exporting machinery to newly industrialising economies.

(8) Transport employment rose from 3.6 per cent to an astonishing 9.2 per cent of the workforce between 1813- 20 and 1911.[32]

Table 8
Both Sexes: Occupational structure of England and Wales c.1817 to 1911revised (percentage shares)

Both Sexes	**-**	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***	***20+***
	1813-20	**1851**	**1861**	**1871**	**1881**	**1891**	**1901**	**1911**
Primary	**31.4**	**23.5**	**20.6**	**16.9**	**12.9**	**10.1**	**8.8**	**8.6**
Secondary	**44.5**	**45.7**	**45.9**	**47.1**	**50.5**	**47.2**	**46.8**	**45.4**
Mining	2.3	3.2	3.6	3.7	4.4	4.6	5.2	5.9
Food processing	2.7	3.0	2.8	2.9	2.7	2.7	2.2	2.4
Footware and clothing	11.1	11.1	10.8	9.5	8.9	7.7	6.6	6.0
Textiles	9.9	8.5	8.0	6.9	6.9	5.9	5.5	5.6
Metals	2.8	3.4	3.8	3.9	4.5	4.1	3.9	4.1
Machine making	0.9	1.1	1.3	2.1	2.5	2.8	3.0	3.1

[32] This may be compared with less than two per cent in India in the same period, 0.2 per cent in Bulgaria in 1901 and was very substantially higher than other parts of Europe at this date. Whilst both these figures probably understate the importance of transport employment as a consequence of transport being a by-employment the contrast remains very striking. See Usami, Y., 'Change in the workforce', p. 9; Ivanov, M., and Stanev, K., 'Structural change and economic growth' pp.23-4; Mitchell, B.R., *European Historical Statistics*.

Construction	5.2	5.0	5.3	5.7	6.6	5.9	6.8	5.9
Rest of secondary	10.5	10.3	10.5	12.4	13.9	13.5	13.5	12.5
Tertiary total	**24.1**	**30.9**	**33.5**	**36.0**	**36.6**	**42.6**	**44.4**	**46.0**
Retail and wholesale	3.0	4.2	4.8	5.3	5.5	5.6	7.0	8.0
Domestic service	7.5	9.0	7.7	8.5	10.4	9.6	9.0	8.5
Transport	3.6	4.6	6.1	5.8	6.9	8.3	8.7	9.2
Rest of tertiary	10.5	13.2	14.8	16.3	13.8	19.2	19.7	20.2
Occupied	100	100	100	100	100	100	100	100
Reported participation rate	-	68.9	68.8	69.3	61.8	64.3	62.3	62.0

Table nine below shows the figures which Crafts used for his reconstruction of British national accounts for the share of the labour force in the primary, secondary and tertiary sectors. If the first two columns of the last panel of table eight are compared with the last two columns of table nine a number of interesting points emerge. Allowing for the slight differences in the dates of the snapshots we can see the new estimates suggest that size of the primary sector at the beginning of the nineteenth century was significantly smaller than Crafts believed. More strikingly, where Crafts estimated the secondary sector rising from 24.7 per cent of the workforce in 1802-3 to 40.5 per cent in 1841 we find a much more modest rise from 44.5 per cent in 1813-20 to 45.7 per cent in 1851. This has major implications. Since the new figures will have no effect on Crafts' estimates of secondary sector output, which are independent of the estimates of occupational structure, this suggests a major upward revision of secondary sector productivity growth and a downward revision of agricultural productivity changes will be required for the first half of the nineteenth century.[33]

Table 9
Crafts' figures for labour force shares[34]

	1688 %	1759 %	1802-3 %	1841 %
Primary	55.6	48	41.7	22.2
Secondary	18.5	23.8	24.7	40.5
Tertiary	25.9	28.2	33.6	37.3

VIII

The occupational structure of England and Wales 1817-1911
The regional picture

The published census reports tabulated male and female occupations in somewhat different ways in different census years. For this reason it is not always straightforward to produce consistent data series over time. For instance it is possible to tabulate male occupations for those aged 20+ by county in 1851, 1861 and 1871 but it is not possible to tabulate occupations at the county level for this age range

[33] Once the new occupational data are finalised, Crafts and Shaw-Taylor intend to explore their impact on the national accounts formally.
[34] In fact these figures may not be exactly those Crafts used. I have had difficulty ascertaining what figures Crafts used. See Crafts, *British Economic Growth*, pp. 11-16.

between 1881 and 1911. This is unfortunate because the 20+ age range is a good choice for comparing with the earlier parish register data (fathers' only). Given the problems of producing comparable datasets at a sub-national level after 1871 the following brief discussion of regional patterns is restricted to the period from 1813-20 to 1871.[35]

Figures seven through ten (below) show the male share of employment from 1813-20 to 1871 for agriculture, mining, the secondary sector and the tertiary sector. In the revised paper the maps will be for both sexes and relate to the longer period from 1813-20 to 1911.

Figure seven shows that agriculture had fallen below a 50 per cent share in male employment in most counties in England and Wales by 1813-20 and only in Cambridgeshire and Huntingdonshire did it exceed 60 per cent. The trend was sharply down almost everywhere and by 1871 Huntingdon was the only county left with more than half the male workforce in agriculture.

The most notable feature of figure eight is the great growth in the relative importance of mining and quarry in Wales, especially in the southern half of the principality over the nineteenth century.

Some historians have argued that the classic industrial revolution period (1750-1850) witnessed spectacular structural change at the regional level.[36] If this is to be understood as a dramatic rise in the importance of the secondary sector then figure nine indicates that the show was clearly over by 1813-20. The stability of the share of the workforce in the secondary sector over the first three-quarters of the nineteenth century is remarkable. The only major exception was in Durham and Northumberland in the north-east, which did see a significant increase over time.

Figure ten indicates that the rapid increase in the share of tertiary employment was a development that affected nearly all counties in England and Wales. Again Northumberland and Durham provide the only notable exception. The reason for this is essentially that the scale of coal mining in these counties meant that transport employment (and hence the tertiary sector as a whole) was already very high in 1813-20 but subsequent growth was much more limited presumably because the coming of the railway had a disproportionate effect here.

Figure eleven shows the percentage of the adult male workforce in the tertiary sector at the level of the parish for 1813-20 and for 1881. Now it can be seen that dramatic tertiary growth was something that affected not just every county but more or less every village and town in the country. All this suggests a greatly increased level of trade and market integration over the course of the nineteenth century. It also suggests that industrialisation was much more than just a regional phenomenon.

[35] However, the implication of table 2 is that the variation in the nature of the age reporting at county level over time produces only very modest distortions in practice in 1851. The same can be shown to be true in 1911. So, in the revised version of this paper, it will be possible to present the county level analysis from 1813-20 through to 1911.

[36] Langton, Berg and Hudson.

Figure 7
Agricultural employment by registration county 1813-20 to 1871

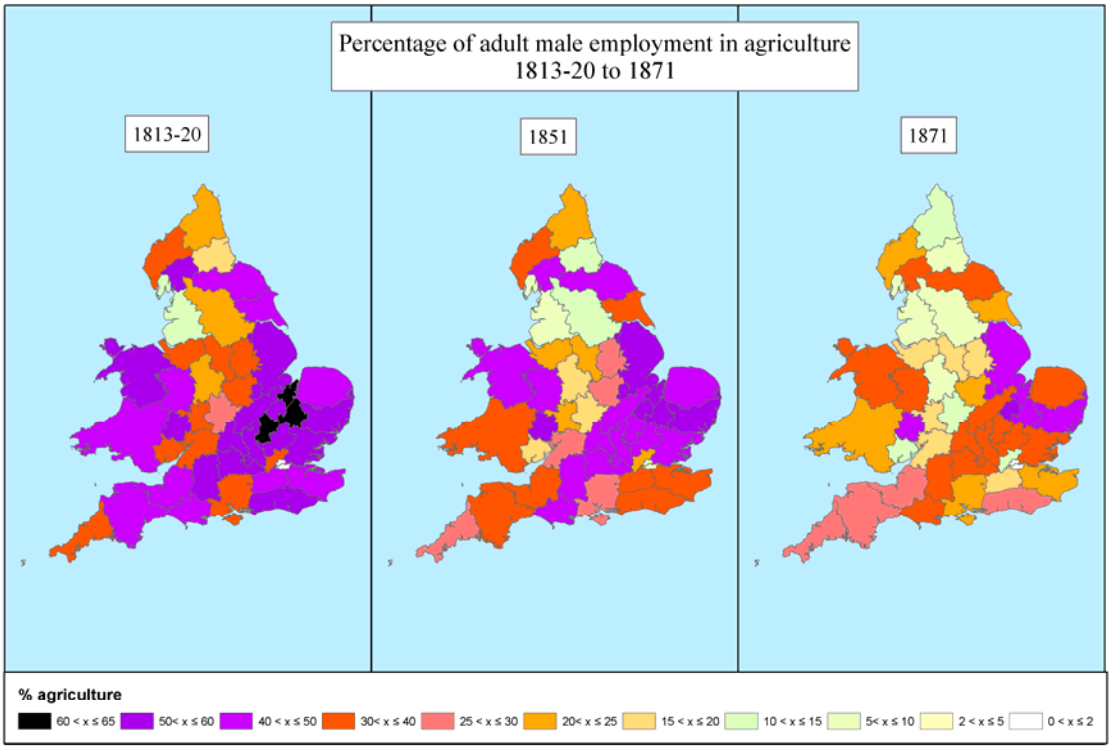


Figure 8
Mining employment by registration county 1813-20 to 1871

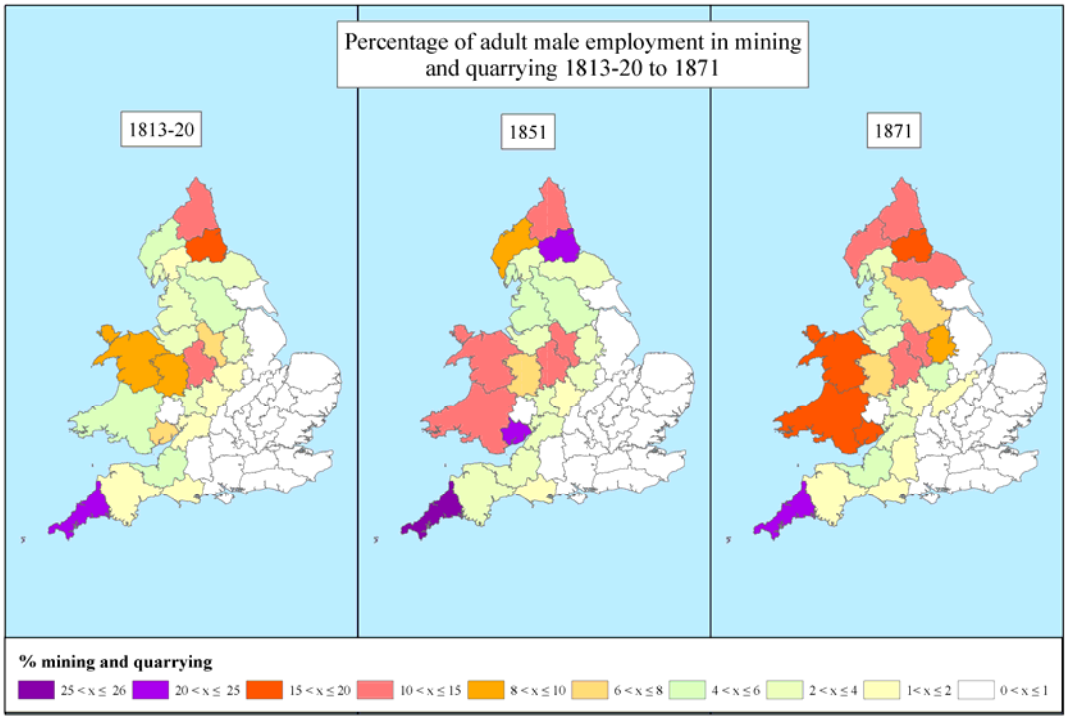


Figure 9
Secondary employment (excluding mining) by county 1813-20 to 1871

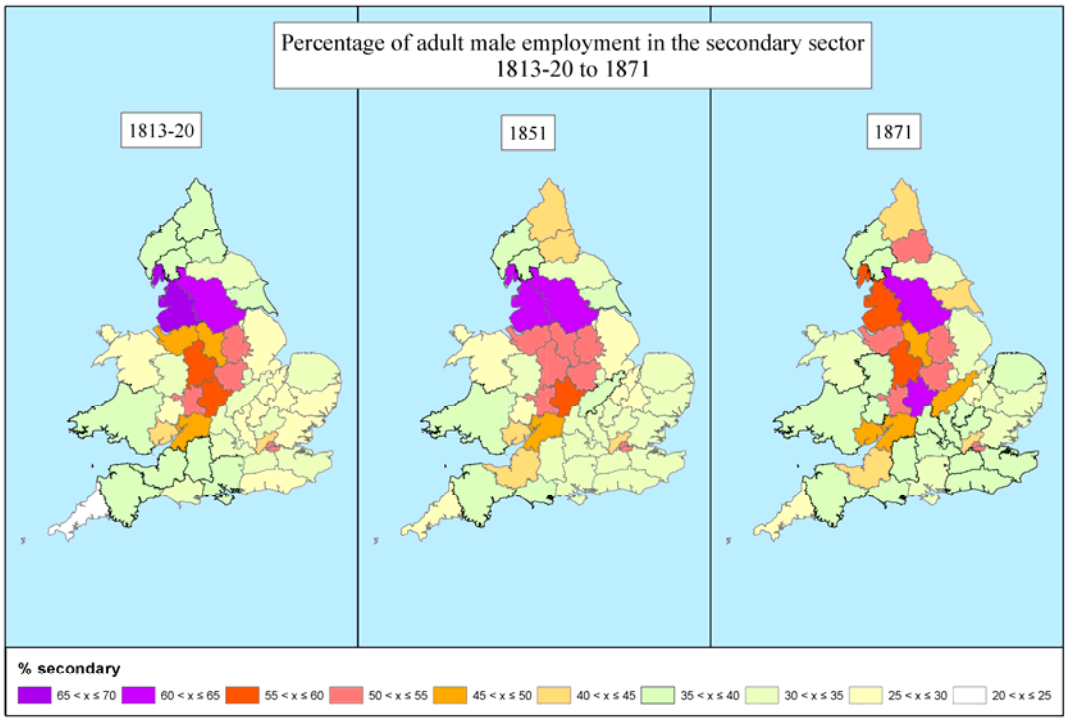


Figure 10
Tertiary Sector employment by registration county 1813-20 to 1871

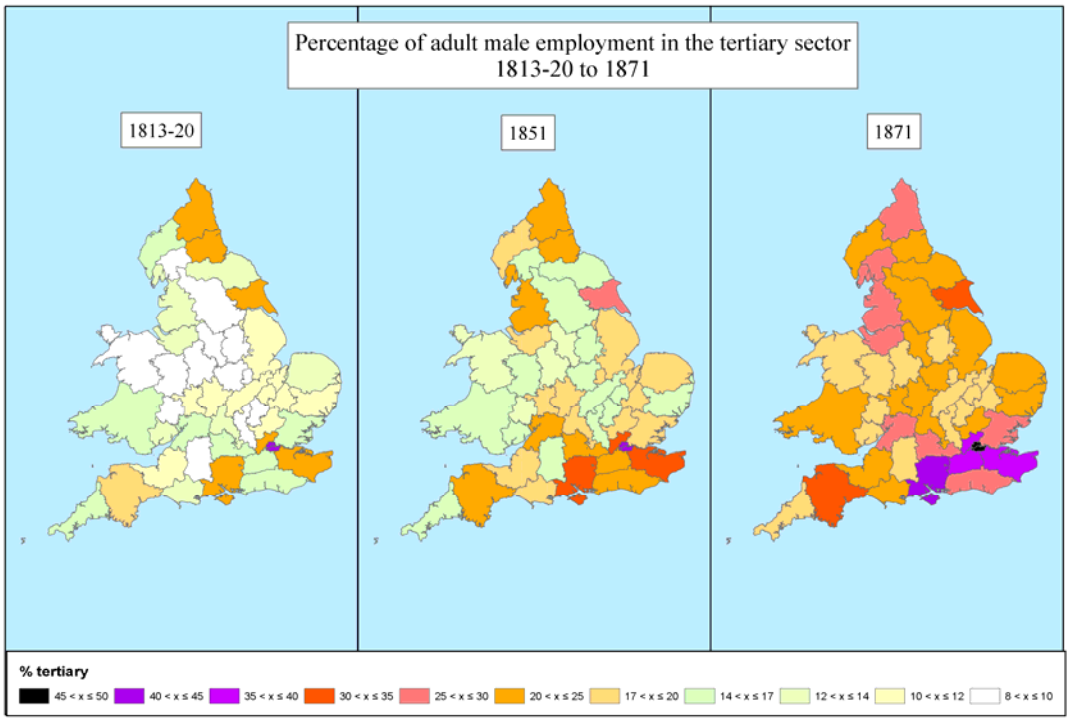
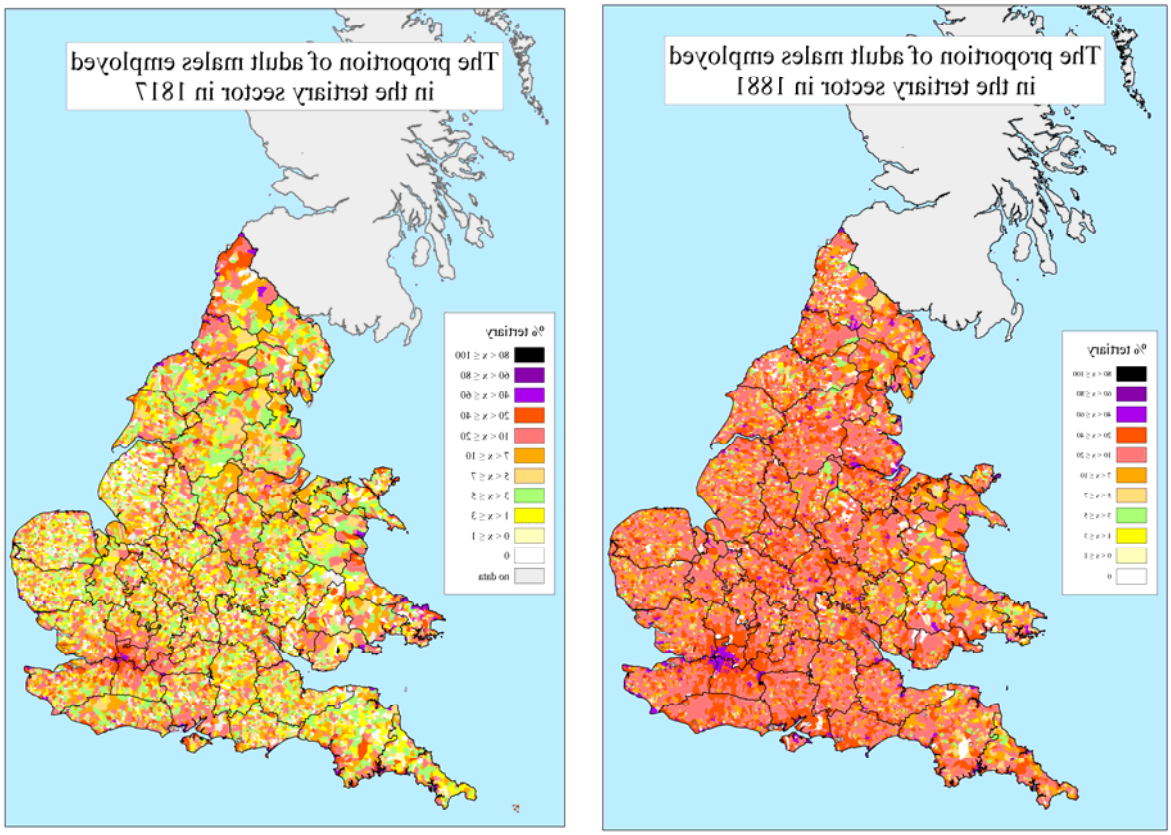


Figure 11
Tertiary Sector employment by parish 1817 and 1881



IX

The occupational structure of England c.1755 to 1813-20

We do not have spatially comprehensive data available for the period before 1813-20. What we have are male data covering all or part of certain counties. Figures twelve to sixteen show our current estimates of the male occupational structures for Lancashire, the West Riding of Yorkshire, Hertfordshire, Northamptonshire and London. See the appendix for the location of these counties.

The cotton textile industry was primarily located in south-eastern Lancashire, though parts of the industry where to be found in north-eastern Cheshire and north-western Derbyshire. What figure 12 shows is that here, in the very heartland of the Industrial Revolution, there was no increase in the secondary sectors share of the adult male workforce between the middle of the eighteenth century and the late nineteenth century. The secondary sector accounted for two-thirds of all adult male employment as early as c.1755 and actually fell gently thereafter.

Figure 13 shows an astonishingly similar picture on the other side of the Pennines in the West Riding of Yorkshire, where employment was dominated by the wool and worsted textile industries. In both these northern industrial counties any growth in the tertiary sector was very muted until after 1813-20.

Figure 12
The male occupational structure of Lancashire c.1755 to 1871

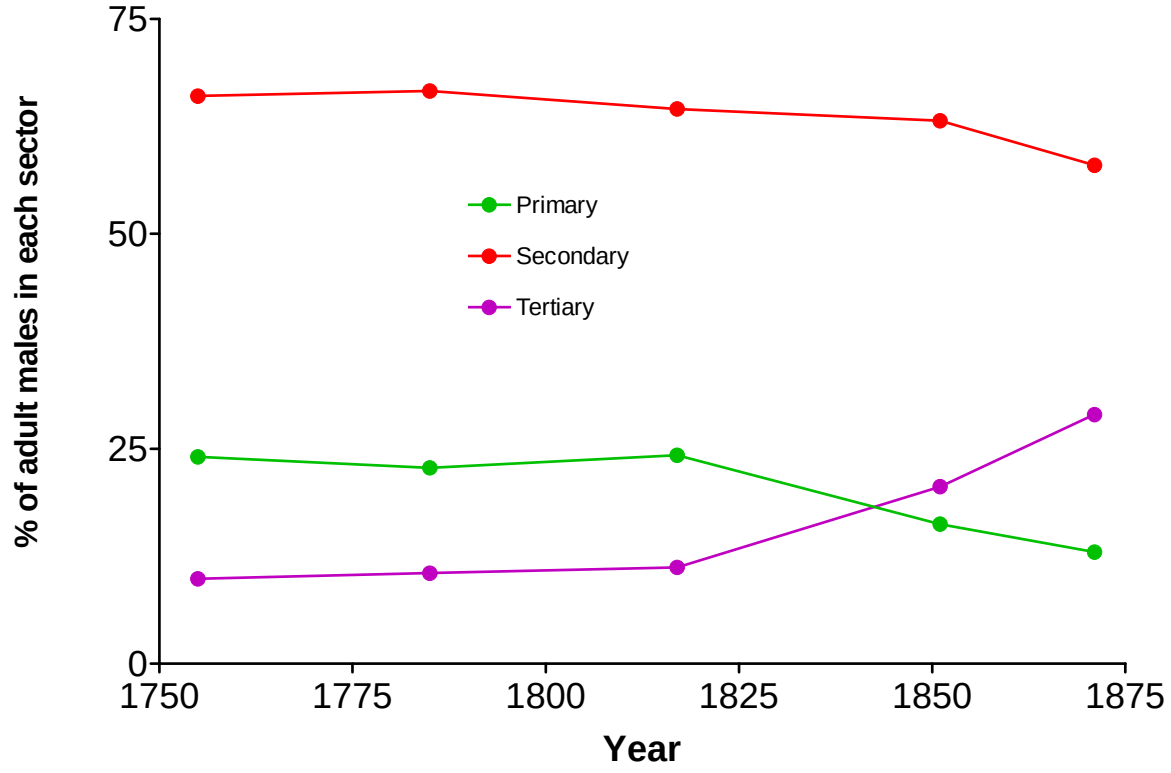


Figure 13
The male occupational structure of the West Riding of Yorkshire c.1755 to 1871

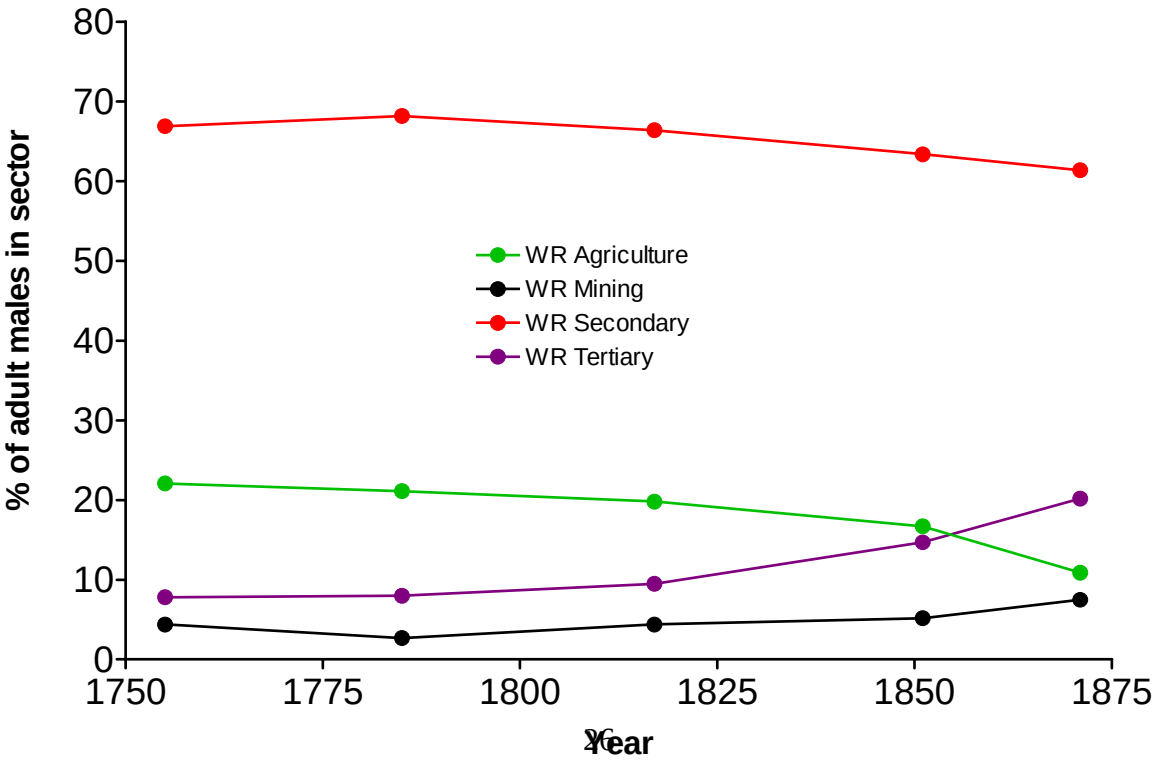


Figure 14
The male occupational structure of Hertfordshire c.1758 to 1871

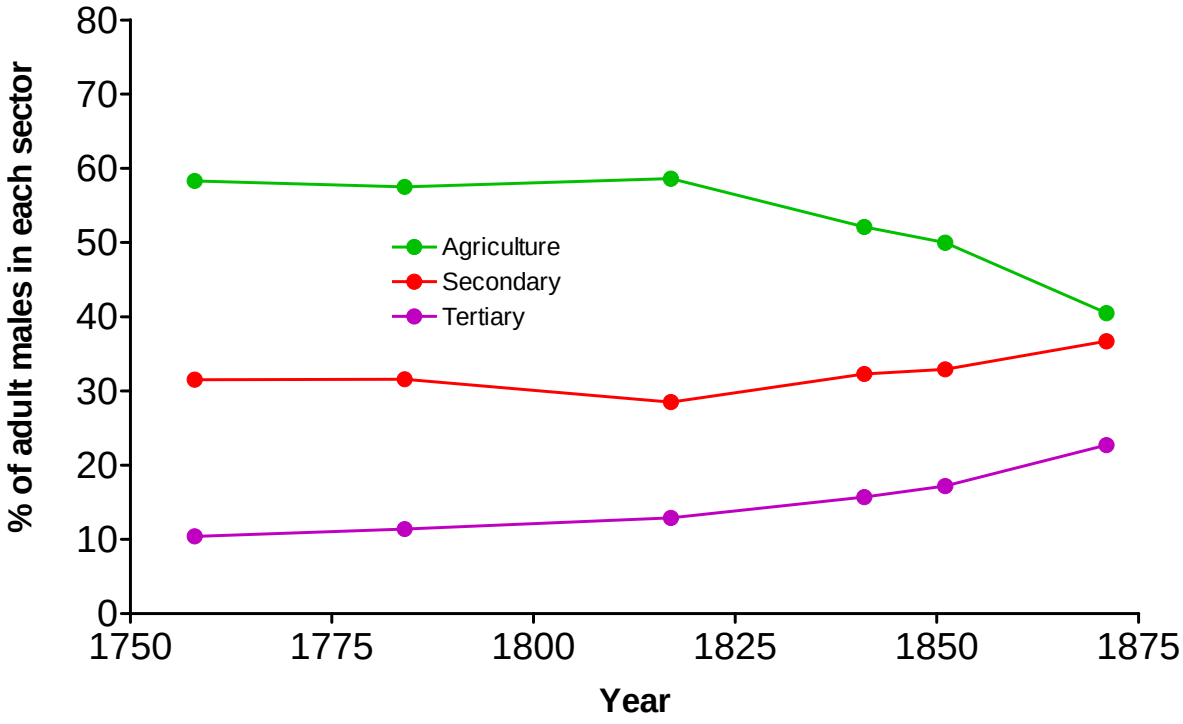


Figure 15
The male occupational structure of Northamptonshire c.1777 to 1871

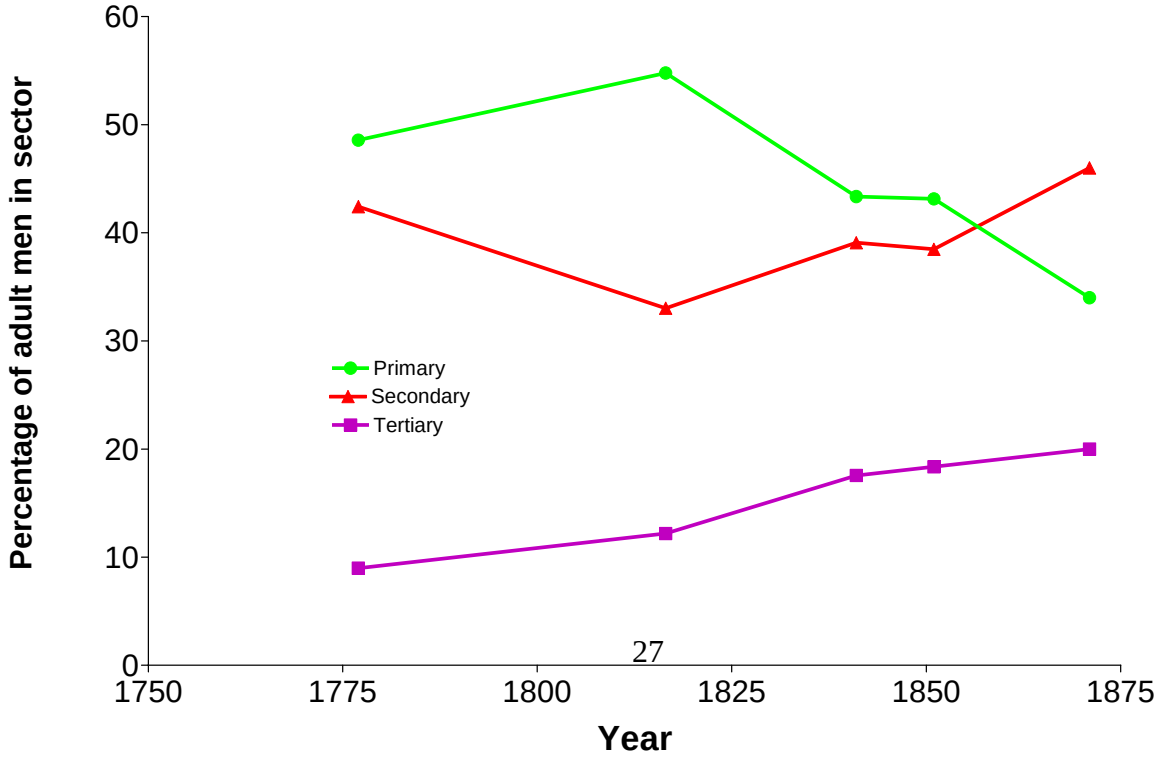
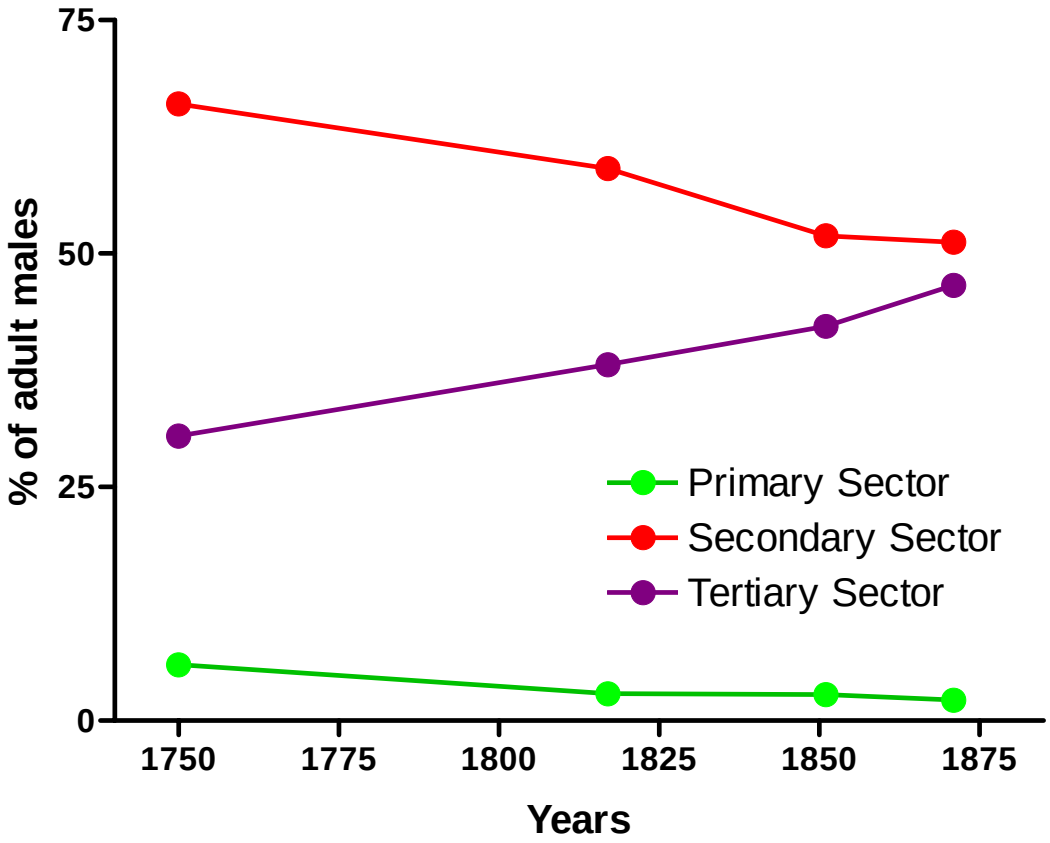


Figure 16
The male occupational structure of London c.1750 to 1871



The occupational structure of Hertfordshire, a very agricultural (by English rather than international standards) county just north of London, and shown in figure 14, was strikingly different. Here agriculture accounted for just under 60 per cent of all male employment in 1757, a figure in which there was very little change until after 1813-20 when agriculture's share of the male workforce began to fall sharply. Secondary sector employment was relatively stable across the late eighteenth century. The small decline around the turn of the eighteenth and nineteenth centuries may be attributed to the sudden collapse of the county's wool textile industry, no doubt in the face of increasingly intense competition from the mechanising West Riding industry. Service sector growth in the second half of the eighteenth century was more pronounced than in Lancashire and the West Riding, and from a higher base, albeit slower than in the nineteenth century. Whilst we currently have insufficient data for certainty on this point it is likely that this pattern was typical of most of southern and eastern England in the eighteenth century. The sharp upward rise in the secondary sector after 1813-20 is, as can be seen by reference to figure nine, is typical of south-eastern England, and some other agricultural areas, in the nineteenth century.

Northamptonshire's occupational structure, shown in figure 15, presents an interesting contrast. As with Hertfordshire tertiary sector growth clearly goes back to the second half of the eighteenth century. But Northamptonshire differed from Hertfordshire in having two industries producing for non-local markets each with substantial shares of total male employment in the late eighteenth century. One of these was the worsted

textile industry, which accounted for over ten per cent of adult male employment in the late eighteenth century. This collapsed dramatically in the years around 1800 again presumptively in the face of competition from mechanised spinning in the West Riding. This de-industrialisation led a sharp fall in secondary sector employment and a substantial rise in agriculture's share and it seems likely that unemployed weavers flooded the agricultural labour marker for a time. The shoe-making industry in Northampton and in the proto-industrial villages along the river Nene experienced rapid growth in the nineteenth century and developed into a factory industry following the invention of the sewing machine in 1859. Shoe-making accounts for the sustained industrialisation visible after 1813-20.

Before considering figure 16 it should be noted that we are currently uncertain how representative the London 1750 data are. As mentioned above, these data derive from the marriage registers of the Fleet prison which contain about half of all London marriages at that date. The graph looks highly plausible. Tentatively these estimates are quite likely to be about right. We hope, in the near future, to be able to test this proposition empirically and push the data back to 1700.[37]

For the moment it appears that the tertiary sector was giving way, in relative terms, to the secondary sector from at least 1750. That should not be equated with suggesting that London was declining in importance as a manufacturing centre. London experienced explosive population growth and the numbers of men in the secondary sector will have risen even though their share in total employment was falling. As Schwartz has noted, London was the world's pre-eminent manufacturing city in the mid nineteenth century.

Whilst we also have datasets for a number of other counties for c.1755 and c.1785 we have not yet fixed on an optimal procedure for making national estimates for those two dates. Table 10 shows one set of possible estimates for most of northern England based on data for the counties of Durham, Cheshire, Lancashire, the East, West and North Ridings of Yorkshire. We hope to have firmer estimates in the next few months but they are unlikely to differ dramatically from these.

Table 10
Preliminary estimate of male PST shares for Northern England[38]

	1755 %	**1785 %**	**1817 %**
Primary	32	26	22
Secondary	57	62	64
Tertiary	11	12	14

For England (or England and Wales) as a whole we are further from being able to make final estimates for the second half of the eighteenth century and some data collection is still underway. For the moment we can only present conjectural figures which seem plausible in the light of our existing datasets and these are shown in the

[37] The empirical test will consist two parts. Firstly, by comparing occupational data from a number of London registers parishes with the occupations in the Fleet registers for men from the same set of parishes. Secondly by comparing the numbers of marriages by parishes in the Fleet with the numbers of marriages recorded in the parish registers.

[38] Preliminary estimates made by Peter Kitson and presented to the Economic History Society in 2008 (method 2a).

first column of table 11. However, it is unlikely that any of the current guesstimates for 1755 will need to be adjusted up or down by more than two, or perhaps three percentage points. Again we hope to have firmer estimates in the near future. Robust estimates for female employment or for both sex employment in 1755 are a more distant prospect.

Table 11
PST share for adult male employment in England and Wales 1755-1911

	1755	1813-20	1851	1861	1871	1881	1891	1901	1911
Primary	***44***	**35.4**	**27.2**	**24.4**	**19.8**	**16.8**	**13.9**	**11.6**	**11.2**
Secondary	***42***	**47.4**	**50.1**	**49.6**	**52.6**	**54.1**	**53.6**	**52.8**	**51.1**
Tertiary	***14***	**17.2**	**22.7**	**26.0**	**27.6**	**29.2**	**32.6**	**35.6**	**37.7**

Note: the figures for 1755 are currently no more than plausible guesses

X

By-employments

It is well known that in pre-industrial economies it was not uncommon for an individual to work in more than one economic activity. These multiple activities are often known as 'by-employments.' The ubiquity of by-employments in early modern England is a common place. Whilst I would emphatically not wish to argue that by-employments were not important in early modern England there are a number of reasons why their importance may have been exaggerated in the historiography:[39]

(1) By-employments have often been defined in ways which exaggerate their importance. Thus Allan Everitt argued that where a spinning wheel was present in a house with evidence of some other form of economic activity this should be seen as evidence of by-employment.[40] In most cases this seems merely to be evidence that one or more women of the house span while the male household head did something else. If this is taken to be by-employment then most households in the modern developed world are by-employed and the term offers little analytical insight into the pre-modern world. For the term to be useful it needs to refer to individuals not households. More recently Overton et al adopted a whole series of definitions likely to exaggerate the importance of by-employment. For instance they argued that involvement in both arable and pastoral farming should be considered by-employments.

(2) The most influential study of the subject has been Everitt's study of early modern farm labourers based on surviving probate evidence. Unfortunately Everitt could not find a sufficiently large sample of inventories positively identified as belonging to labourers and therefore used inventories of poor individuals without occupational descriptors who he presumed to be labourers. When he found blacksmith's or carpenter's tools in the inventories he interpreted this as evidence of by-employment. However, where inventories do explicitly record individuals as 'labourers' the level of non-agricultural by-employments is minimal and it is much more likely that Everitt was examining the inventories of blacksmiths and carpenters.

[39] Much of what follows is elaborated at greater length in Shaw-Taylor, L., 'The cottage economy.' Available as paper 15 at: http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/
[40] Everitt 'Farm labourers'

(3) Most studies are based on probate inventories and fall into a basic methodological trap. Labourers, carpenters, blacksmiths and other relatively poor individuals were much more likely to leave an inventory if they owned an animal such as a cow. The fact that a very high proportion of probated individuals from such groups did own animals cannot be taken as evidence that a similarly high proportion of the same groups did in fact employ animals. In other words probate evidence is inherently biased towards the by-employed and this has not been recognised in existing historiographical work.

Much more systematic work is required before we have a systematic understanding of by-employment. It is my own view that by-employments certainly remained important in northern England until at least the first half of the eighteenth century but they were probably not very important in southern England by this date.[41] It is most unlikely that by-employments were very important anywhere in England in the nineteenth century and that is why the Census Office, unlike their counterparts in some less developed economies, were not fundamentally very concerned to try and record by-employment. Many regional studies of the midlands and the north-west suggest that by-employments were on the decline in the early eighteenth century in these industrialising regions.[42]

It is clear from a preliminary inspection of probate inventories that a very high proportion of all eighteenth century farmers in Lancashire were indeed by-employed (in the textile industry). Equally, many weavers kept a cow or two, but it was clearly not as common as it was for farmers, husbandmen and yeomen to keep looms. However, it is likely that, for the reasons explained in (3) above weavers' inventories exaggerate the prevalence of cow-keeping by the poor whereas the inventories of farmers are probably more representative. In other words, in the early eighteenth century, it is likely the proportion of farmers involved in the textile sector was much higher than proportion of textiles workers with a sideline in agriculture. In consequence, counts of occupational descriptors are likely to *understate* the importance of industry and *overstate* the importance of agriculture. [43]

The implication of all this for the occupational structures of Lancashire and the West Riding shown in figures 12 and 13 is that the importance of the secondary sector in the early period may have been even more important than these graphs suggest and the decline in the relative importance of the secondary sector may have been somewhat steeper than these graphs suggest. It seems much less likely that that the inability to measure by-employment will have introduced any serious distortion into the data covering southern England.

There is one way in which the by-employments hidden behind occupational descriptors might distort the picture of the north-west in the pre 1813-20 period more seriously. The level of employment in the transport sector in Lancashire and the West Riding in the late eighteenth century appears implausibly low. This could because much road transport was a by-employment of farmers (as in Japan)

[41] See Shaw-Taylor, 'Cottage economy.'
[42] Swain, J.T., *Industry before the Industrial Revolution*; Rowlands, M.B., *Masters and men*, p. 43; Court,W.H.B., *The rise of the Midland industries*, p.42. For further supporting evidence see Saito, O., 'By-employment' which was written after this paper was first drafted.
[43] Swain has made the same point about the north-west in the early modern period. Swain, J.T., *Industry before the Industrial Revolution*, p. 207.

and it is possible that other elements of the tertiary sector are also under-represented. This requires is an issue that will require further investigation but could mean that tertiary growth is somewhat overstated by counts of occupational descriptors. However, the muted nature of tertiary sector growth in the north of England in the late eighteenth century makes it unlikely that this is a very serious problem with the data

XI

Overview

In countries which have industrialised more recently than Britain a dramatic increase in the proportion of the workforce has normally been coincident with the onset of modern economic growth and technological transformation. But in Britain, the world's first industrial economy, this does not appear to have been the case. The great bulk of the rise in the share of the labour force in the secondary sector took place before 1750 and this rise probably took place largely between 1500 and 1750.

If structural change, the onset of continuous technological change and the beginnings of modern (i.e. continuous rather than episodic) economic growth took place in different periods in Britain then trying to shoe-horn all of these changes into something called either the 'industrial revolution' or 'industrialisation' may be problematic. If it is not to be done away with then perhaps the term 'industrial revolution' should be reserved for reference to the period between 1750 and 1850 which still appears as a watershed both with respect to technological change and with respect to economic growth and perhaps the term 'industrialisation' should be used to refer to the structural shift out of agriculture which clearly began very much earlier.

It is clear that the growth of the service sector over the course of industrialisation has been spectacularly neglected by economic historians. It is true that C.H. Lee argued for the importance of the service sector and service sector growth in the late nineteenth century and Max Hartwell put service sector change at the heart of industrialisation. But these individuals are striking exceptions to the general pattern.[44] There is no chapter on the service sector in the 2004 *Cambridge Economic History of Modern Britain 1700-1860, Volume one* or indeed in its 1994 predecessor.[45] That volume two dealing with the period from 1860 onwards and its 1994 predecessor do contain chapters on the service sector captures in a stylised form the acknowledgement of the central importance of services in the modern world and their omission by economic historians from a central role in the history of industrialisation.

Bibliography

Allen, R.C., *The British Industrial Revolution in global perspective* (2009).

Berg, M., 'What difference did women's work make to the Industrial Revolution?', *History Workshop Journal*, 35 (1) (1993), pp. 22-44.

[44] There are a handful of others.
[45] Floud, R., McCloskey, D., *The economic history of Britain since 1700*.

Clapham, JH, 'The transference of the worsted industry from Norfolk to the West Riding', *Economic Journal*., XX, 1910, 195-210

Clapham, J.H., *An Economic History of Modern Britain*, 3 vols. (1926-38).

Crafts, N.F.R., *British economic growth during the industrial revolution* (1985).

Crafts, N.F.R., and Harley, C. K., 'Output growth and the Industrial Revolution: A restatement of the Crafts-Harley view'. Economic History Review (1992) 45, pp. 703-30.

Daniel Defoe's *Tour through the Whole Island of Great Britain*, XXXXX

De Vries, J., *European urbanization 1500-1800* (1984).

Everitt, A., 'Farmworkers XXXXXXX.

Floud, R., McCloskey, D., (eds.) *The economic history of Britain* since 1700 Volume 1: 1700-1860 (1994, 2nd edn.)

Hudson, P., *The Industrial Revolution* (1992).

Lindert, P.H., and Williamson, J.G., 'Revising England's social tables 1688-1812', *Explorations in Economic History* 19, 385-408 (1982).

Lindert, P.H., 'English occupations, 1670-1811', *Journal of Economic History*, XL, 4 (1980), pp. 685-712.

Lloyd Prichard, M.F., 'The decline of Norwich' *Economic History Review* (2nd Series, 3 (1950), pp.371-177

Heaton, H., 'The Industrial Revolution', *Encyclopaedia of the Social Sciences*, VIII (1932).

Mitchell, B.R., European Historical Statistics.

Nef, J.U.,'The progress of technology and the growth of large-scale industry in Great Britain, 1540-1640', *Economic History Review*, 5 (1) (1934), p.24.

Randall, A., *Before the Luddites: Customs, community and machinery in the English woollen industry 1776-1809* (1991).

Rowlands, M.B., *Masters and men in the West Midland metalware trades before the Industrial Revolution* (1975).

Saito, O, 'Who worked when? Life-time profiles of labour force participation in Cardington and Corfe Castle in the late eighteenth and mid-nineteenth century', in Goose, N., (ed.) *Women's work in industrial England: Regional and local perspectives* (2007), pp. 209-227.

Shaw-Taylor, L., 'Diverse experiences: the geography of adult female employment and the 1851 census' in Goose, N., (ed.) *Women's work in Industrial England: Regional and local perspectives* (2007), pp. 29-50.

Wrigley, E.A., 'Urban growth' XXXXXXXXX

Wrigley, E.A., *Continuity chance and change: The character of the Industrial Revolution in England* (1988).

Wrigley, 'Rickman revisited' XXXXXXXXXXX

Wrigley, 'English county populations.' XXXXXXXXX

Verdon, *Rural Women*, and,

Wilson, R.G.,

Clapham, J.H., 'Worsted'

Swain, J.T., *Industry before the Industrial Revolution: North-east Lancashire c. 1500-1640* (1986).

Court, W.H.B., *The rise of Midland Industries 1600-1838* (1938).

Unpublished papers

Erickson, A.L., 'Clockmakers, milliners and mistresses: Women trading in the City of London companies 1700-1750.' (2010), unpub. paper available as paper 16 at http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/

Field and Erickson, 'Prospects and preliminary work on female occupational structure in England from 1500 to the national census.' (2009). Available as paper 18 at http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/

Kitson, P.M., Shaw-Taylor, L., Wrigley, E.A., Davies, R.S., Newton, G., and Satchell, A.E.M., 'The creation of a 'census' of adult male employment for England and Wales for 1817' (2010) available as paper 3 at http://www.geog.cam.ac.uk/research/projects/occupations/britain19c/papers.html

Muldrew, J.C., '"Th'ancient distaff' and whirling spindle": Measuring the contribution of spinning to household earnings and the national economy in England 1550-1770', forthcoming *Economic History Review*.

Saito, O., and Shaw-Taylor (eds.), *Occupational structure and industrialization in a comparative perspective*. In progress.

Saito, O., 'By-employment and historical occupational structures in comparative perspective', forthcoming in Saito, O., and Shaw-Taylor, L. (eds.) *Occupational structure*; currently available in draft form at http://www.ehs.org.uk/ehs/conference2010/Assets/SaitoRevisedFullPaper.pdf

Shaw-Taylor L., and Jones, A., 'The male occupational structure of Northamptonshire 1777-1881: A case of partial de-industrialization?' Available as paper 5 at http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/

Shaw-Taylor, L., and Kitson, P., ''The sectoral allocation of labourers c.1710-1911: towards an optimal methodology', forthcoming at http://www.geog.cam.ac.uk/research/projects/occupations/britain19c/papers.html as paper 8.

Shaw-Taylor, L., and Wrigley, E.A., 'The Occupational Structure of England c.1750-1871: A Preliminary Report' available at: http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/ as paper 1.

Shaw-Taylor, L., Wrigley, E.A., Davies, R.S., Kitson, P.M., Newton, G., and Satchell, A.E.M, 'The occupational structure of England and Wales c.1817-1881' available as paper 4 at http://www.geog.cam.ac.uk/research/projects/occupations/britain19c/papers.html

Shaw-Taylor, L., 'The cottage economy.' Available as paper 15 at: http://www.geog.cam.ac.uk/research/projects/occupations/abstracts/

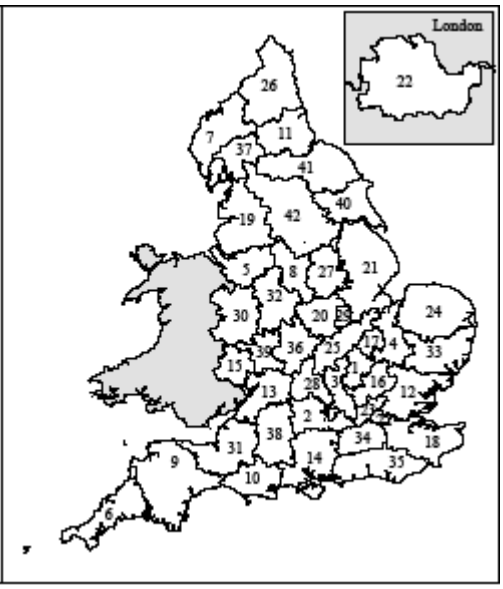
Usami, ‘Change in the workforce’,
Ivanov and Stanev, ‘Structural change and economic growth’ pp.23-4; forthcoming in Saito and Shaw-Taylor

Appendix

Map of English Registration Counties

English registration counties

1. Bedfordshire	22. London
2. Berkshire	23. Middlesex
3. Buckinghamshire	24. Norfolk
4. Cambridgeshire	25. Northamptonshire
5. Cheshire	26. Northumberland
6. Cornwall	27. Nottinghamshire
7. Cumberland	28. Oxfordshire
8. Derbyshire	29. Rutland
9. Devonshire	30. Shropshire
10. Dorset	31. Somerset
11. Durham	32. Staffordshire
12. Essex	33. Suffolk
13. Gloucestershire	34. Surrey
14. Hampshire	35. Sussex
15. Herefordshire	36. Warwickshire
16. Hertfordshire	37. Westmorland
17. Huntingdonshire	38. Wiltshire
18. Kent	39. Worcestershire
19. Lancashire	40. Yorkshire. East Riding with York
20. Leicestershire	41. Yorkshire. North Riding
21. Lincolnshire	42. Yorkshire. West Riding



Appendix 2
Absolute numbers for nineteenth century data