Structural change and economic growth in the British economy before the Industrial Revolution, 1500-1800

By Patrick Wallis[1], Justin Colson, and David Chilosi[1]

Accepted Manuscript, *Journal of Economic History,* October 2017.

Structural transformation is a key indicator of economic development. We present the first time series of male labour sectoral shares for England and Wales before 1800, using a large sample of probate and apprenticeship data to produce national and county-level estimates. England experienced a rapid decline in the share of workers in agriculture between the early seventeenth and the beginning of the eighteenth centuries, associated with rising agricultural and especially industrial productivity; Wales saw few changes. Our results show that England experienced unusually early structural change and highlight the mid-seventeenth century as a turning point.

What happened to the occupational structure of Britain between the start of the sixteenth and the end of the eighteenth centuries? Few other questions have so much impact upon our understanding of the timing and speed of changes in the British economy before the Industrial Revolution. Occupational structure is a key indicator of industrial development, specialisation and economic growth. For an era for which we possess few direct indicators of economic trends, a serial source for occupational structure offers significant opportunities to deepen our understanding of economic change in Britain.

[1] Author's affiliations: Wallis, LSE & Tsinghua University; Colson, University of Essex; Chilosi, University of Groningen. Corresponding author: Wallis, p.h.wallis@lse.ac.uk
The Wellcome Trust funded part of the research underlying this paper (grant 'The Medical World in Early Modern England, Wales and Ireland c.1500-1715'.). Parts of the data were generously shared by Cliff Webb, Michael Scott, Mark Merry and the Centre for Metropolitan History. The PST codes were generously shared by Leigh Shaw-Taylor and the CAMPOP group. We also made use of data provided by the Historic County Borders Project (http://www.county-borders.co.uk). Maureen Wallis generously assisted us with classifying occupations. Liam Brundt, Steve Broadberry, Greg Clark, Giovanni Federico, Chris Minns, Patrick O'Brien two anonymous referees and audiences at Tsinghua University, Copenhagen University and the Economic History Society offered incisive criticisms and suggestions that have much improved this paper.

Our current knowledge of Britain's occupational structure consists of two estimates for the 1520s (drawn from the same source), one estimate for the 1570s, one for the 1650s, several for 1688 (all from the same source), and one for the 1710s. This may appear as an excess of riches compared to the dearth of information in some countries, and it is a large step from the view taken by Deane and Cole that any attempt to identify sectoral shares in this period was likely impossible due to the lack of evidence (Deane and Cole 1962: 3, 137). But several of these estimates are sufficiently different from each other that they suggest mutually irreconcilable accounts of economic change.

Unsurprisingly, the differences between these estimates are related to the varied sources each author has relied upon. Clark, Cummins and Smith's (2012) analysis for the 1570s and 1650s uses evidence drawn from probate records – wills and related documents - to show a stable share of the workforce employed in agriculture in the sixteenth and seventeenth centuries. These two samples both show that the share in agriculture in England hovered around 60 percent (Clark et al. 2012: 378, 381). Clark et al. also highlight that England already had a high share of its workforce outside agriculture from an early period, reflecting a relatively wealthy economy in premodern terms. Indeed, their probate evidence supports Clark's (2007a) view that there is "little sign" of economic growth between 1400 and 1800 (Clark et al. 2012: 387).

Quite different conclusions emerge from the other sources that have been explored to date. Shaw-Taylor, Wrigley, Kitson, Davies, Newton and Satchell (2010: 10) use information from baptism registers to estimate that 43 percent of males were employed in agriculture *circa* 1710, well below Clark et al.'s estimate for the 1650s and indicating a much earlier shift out of agriculture and into services and industry. Broadberry, Campbell and van Leeuwen (2013, 2015: 350-356) generated an alternative set of labour force shares for 1522 (using Muster Rolls) and *circa* 1700 (using Gregory King's 1688 social table). Like Shaw-Taylor et al., they identified a fall in the share of the male labour force in agriculture from 68 percent in 1522 to 46 percent *circa* 1700. This figure for 1700 is somewhat lower than the 55.6 percent in agriculture that Crafts (1985: 13-15) had estimated using the Lindert and Williamson's (1983) revisions to the same source, largely because of a different, and probably more accurate, distribution of labourers across the sectors. Broadberry et al.'s estimates for 1759 and 1801 suggest that this decline continued across the eighteenth century. Their conclusion is, predictably, the opposite of Clark et al.'s. Instead of stability, they conclude that "the critical occupational migration from agriculture to industry commenced some time after 1522 and had already made significant progress by 1700." This was "consistent with considerable dynamism

and growth from the sixteenth century to the point in the nineteenth century when modern economic growth began" (Broadberry et al. 2013: 26).

In this article, we show that the apparent conflict between these estimates is in fact illusory. Using a new, larger and more representative sample of probate records, we find a pattern of structural change that is consistent with *all* existing estimates, once they are appropriately adjusted. We introduce a second new and large source on occupational structure, the occupations of London apprentices' fathers, to benchmark our probate dataset, and show that both sources are broadly consistent with each other. However, while the point estimates produced by earlier authors can be reconciled, the conclusions that have been drawn from them cannot. We show that the English economy saw rapid and significant structural change during the seventeenth century in line with Broadberry et al.'s account. Our data allow us to be more precise on the timing of this development. Movement out of agriculture became visible from c. 1600 when the sector employed around 68 percent of the male labour force, much as it had done a century before. Structural change accelerated from before the middle of the seventeenth century and by the early eighteenth century only around 45 percent of the male labour force were still in agriculture, a remarkably low share compared to other countries in that period. With structural change, productivity rapidly rose across all three sectors, and grew especially fast in industry. England had inherited particularly productive agriculture and developed proto-industry from the Middle Ages and the seventeenth century saw an intensification of these characteristics, with high levels of non-agricultural employment in the countryside. By contrast, the early modern Welsh economy was largely unchanging.

SECTORAL SHARES, 1550-1800: PROBATE AND APPRENTICESHIP DATA

The main estimates of occupational structure that we present here are drawn from a large sample of adult males' occupations reported in English and Welsh wills and related records registered with one of the many church courts that supervised the probate process. To this, we add a second large sample of the occupations of fathers of apprentices whose indentures were recorded by a range of London guilds.

Table 1 summarizes the size and extent of our samples. For our probate sample, we surveyed all extant printed registers of wills and available digital records, and included data if it met several

conditions for completeness (detailed in Appendix 1).[2] Our final sample of male wills with a reported occupation (rather than a status such as 'gentleman') that can be identified with agriculture, industry or services contains nearly 415,000 observations from 23 of 42 English counties and 44,000 from 12 of 13 Welsh counties. Figure 1 shows the geographical extent of our sample. To mitigate the risk that composition effects affect the observed trends, we also analyse a balanced sample of 12 counties with records for at least 10 of the 11 twenty-year periods between 1580-99 and 1780-99.

Table 1: Datasets

	Probate Dataset						Apprentices' Fathers Dataset		
	England			Wales			England		
	Obs.	Counties	Share of male deaths	Obs.	Counties	Share of male deaths	Obs.	Guilds	Counties
	N	N	percent	N	N	percent	N	N	N
1540-59	8,964	11	7						
1560-79	13,093	13	10	54	1	2			
1580-99	22,565	16	16	49	2	3	4,181	16	22
1600-19	35,917	17	18	586	4	5	23,791	29	37
1620-39	40,716	19	18	790	8	5	30,571	38	37
1640-59	27,954	17	13	664	7	6	37,840	46	36
1660-79	46,518	20	15	4,368	12	12	36,038	60	35
1680-99	44,204	18	16	5,469	12	12	38,200	63	34
1700-19	35,556	15	17	5,634	12	13	33,171	68	29
1720-39	48,148	15	19	7,716	12	14	20,167	70	18
1740-59	33,732	14	16	5,894	12	10	7,593	68	11
1760-79	31,750	13	13	6,356	12	10			
1780-99	25,606	12	10	6,455	12	10			
Total	414,723			44,035			231,552		

Note: Columns 2 to7 report the number of probate records with an occupation successfully linked to agriculture, industry or services (see Appendix A), the number of counties with probate records that meet our criteria, and the share of male deaths with a linkable occupation or status (including gentry etc) captured in our sample. Columns 8-10 table reports a count of apprentice records where we have information on the place and occupation of the apprentice's father, and the number of guilds and counties in our analysis for each decade.

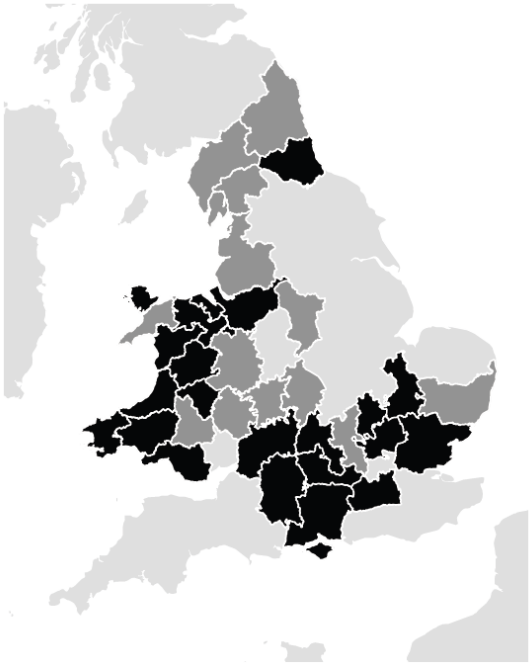
Source: see text and Appendix 1.

[2] The dataset was largely created using OCR software and then cleaning and structuring the data. The conversion process generates losses at two points. First, the scanning and conversion may fail to recognise a line of text. Second, the text may be converted incorrectly. Both types of loss are digital versions of the usual problems we face with historical records: gaps, illegibility, variant spellings. Fortunately, the effect is relatively slight, and thus is unlikely to bias our estimates of occupational shares.

Our sample of apprentices' fathers' occupations is rather different.[3] Large numbers of teenage boys – perhaps one in ten of all English youths by the 1690s - migrated to London to learn a trade (Minns & Wallis 2012: 559). Among the details recorded by the city's guilds when their indentures were registered was their father's occupation or status and location. Mothers were rarely recorded, and almost never with an occupation. Once we exclude counties for which the sample size is low (the rules applied are detailed in Appendix 1), our final sample includes the fathers of 231,552 youths - roughly four to five percent of English teenage males in the seventeenth century – drawn from 37 counties across England. The balanced sample of 20 counties for which coverage in this dataset is complete across the seventeenth century includes just over 70 percent of the English population.

Figure 1: Geographical coverage of probate and guild samples

Probate Sample



Apprentice Fathers Sample

Note: counties shaded dark are in the stable samples; those shaded liightly are in the full samples.

Source: see text. The underlying county map is from the Historic County Borders Project (http://www.county-borders.co.uk).

[3] The dataset is described in Appendix 1.

Probate records are a complicated source with serious biases in coverage (Lindert 1981; Goose and Evans 2000; Keibek and Shaw-Taylor 2013; Keibek 2016a, 2016b). As wills concerned the transfer of property after death, women, dependent males (especially the young), and people with limited wealth and, in particular, few capital goods are under-represented. Moreover, the volume of probate records was also shaped by institutional factors, such as differences in record keeping and activity between courts (which took fees for their services), which intensify regional variations in their coverage and survival. The size and impact of these biases on our results are discussed later. For the present, we focus on trends in sectoral shares, treating our results as an index of structural change rather than a direct estimate of the level of employment in agriculture, industry and services.

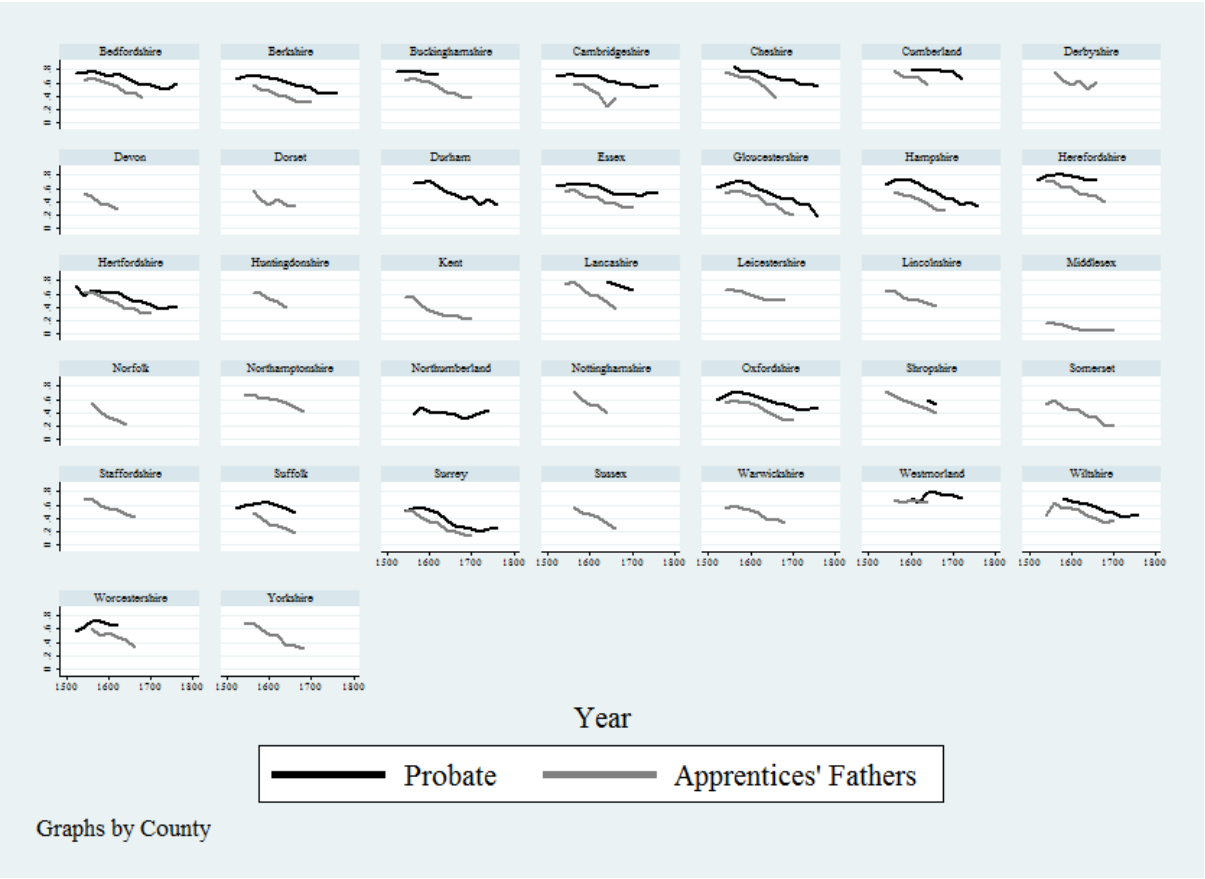
The apprentices' fathers' sample is also affected by bias. It too oversamples the wealthy and the old: we are observing adults who established families and who could afford to invest in their children's human capital. However, in some important respects the biases are different. There is no reason to expect a capital bias (as distinct from wealth) in the apprentice dataset. Even though labourers are rare among parents, the sample's social reach may be deeper: many youths were entering prosaic manual trades such as blacksmithing and shoemaking that might require little or no fee (Minns and Wallis 2013). We do expect the apprentices' fathers' sample to underrepresent agriculture to a particularly high degree. These fathers had no direct experience of the trades learnt through apprenticeship. Their sons may also have a farm to inherit. The central problem of the apprentices' fathers' sample is the impact of the narrowing migration field over the seventeenth century, evident in the falling number of counties meeting our sampling criteria (table 1): for this reason, we regard it as a less reliable indicator of trends than the probate sample.

A good introduction to our main results is given by figure 2, which reports the average of the share of males in agriculture in thirty-seven English counties at twenty-year intervals between 1540 and 1799. The figure reports series for which our data covers more than a decade or two. Here we are primarily interested in the trend, not the absolute level, given the problems with bias in these sources. As expected, the probate sample reports a higher share in agriculture than the apprentice sample. Yet, the shares in agriculture observed in both the probate and the apprentice samples are similar for most counties and move in the same direction; the correlation coefficient is 0.82.

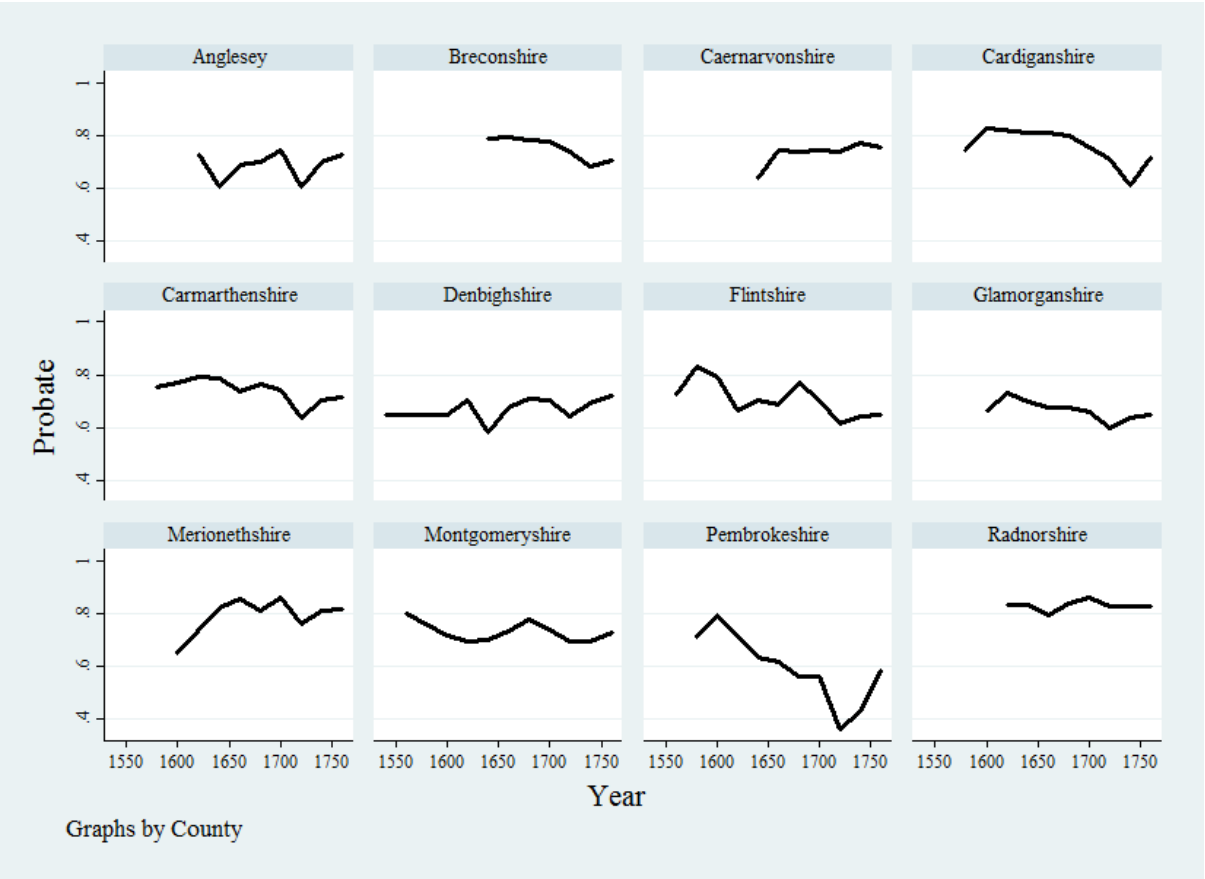
Most of England saw a shift out of agricultural employment after *c.*1600. Three counties in the northernmost parts of England - Cumberland, Northumberland and Westmorland – had more stable shares in agriculture. In Wales, similarly, the agriculture share was high and stable. Only Pembrokeshire, always considered to be culturally set apart from the rest of Wales, appears to have experienced a marked shift out of farming. The initial impression from figure 2 is that Clark et al.'s suggestion that the share of the workforce involved in farming and fishing in England was stable is mistaken.

Figure 2: Share of males working in agriculture by county

A. England: Probate & Apprentice



B. Wales: Probate



Sources: see text.

To address the development of the national economy more fully, we need to convert our county series into national ones. Three adjustments are necessary to do this. We first weight our county sectoral data using county population estimates interpolated in line with national population trends for England and linearly for Wales (Wrigley 2007, 2009; Owen 1959).[4] Second, because our probate dataset omits London, we calculate a population-weighted average of the non-London (from the previous step) and London sectoral shares; our sectoral estimates for London rely on the surviving probate data for Middlesex, which show that around a third of the city's population was employed in industry and two-thirds in services.[5] Finally, because wills were mainly generated near death (on

[4] Before 1600, English estimates are projected in line with national trends.

[5] For simplicity, we fix the results at this level. Middlesex includes some agricultural land, but we concentrate on the London city area and exclude farming. Estimates of London's manufacturing share are similar:

average at age 53), occupational estimates from probate records lag the population as a whole (in which the average worker was aged 39 (Clark et al. 2012, 384)). We therefore adjust for the age structure of our data.[6] We do this simply by advancing our series by two decades, so that, for example, our data for 1620 is taken as representing 1600. We apply the same general approach to the apprentices' fathers' dataset, weighting it by population and adjusting for age structure: apprentices' fathers were on average 52 years old when their son was bound.[7] However, as Middlesex forms a very large part of the apprentice data, we do not need to adjust for London.

In table 2, we report our estimates of sectoral shares for England and Wales from the probate and apprentice samples.

For England, the probate dataset shows that a broadly stable share of the workforce who made wills were engaged in farming and fishing in the sixteenth century, followed by a clear and persistent movement out of agriculture from the start of the seventeenth century onwards. The impact of this movement on the overall share in agriculture in the early seventeenth century was initially modest. The farming share around 1650, 53 percent, was only around ten to fifteen percent lower than at the close of the sixteenth century (66 percent). By the end of the seventeenth century, however, the share of the workforce in agriculture had fallen by around a third to 43 percent. Over the same period, the share of the workforce in industry had grown from 22 percent to 31 percent, while the share in services had nearly doubled from 12 percent to 26 percent. The trends are little changed whether we focus on the balanced or unbalanced samples.

The apprentice dataset, which is richest and most reliable from 1580 to 1680, tells much the same story for the seventeenth century. As we expected, the underlying shares of apprentices' parents in industry and services are higher than in the probate dataset, but the trends move in parallel.

Alexander (1989: 54) estimated 33 percent for the 1690s; Beier (1986: 150-151) suggested 40 percent for the 1601-1700; Schwarz (1992: 23) identifies a third for 1851. We take our London population figures from Wrigley (1985) and Harding (1990); our national population figures are from Broadberry et al. (2015: 20, 29).

[6] People rarely changed occupation over their lifecourse during this period, reducing the risk of later-life changes biasing our results: See Burn (2017).

[7] Based on a sample of 52 apprentice records linked to Family Reconstitution data (for the source, see Klemp et al. 2013).

Table 2: Sectoral distribution of the labour force from probate and guild records

Sample:	Share Balanced			Share Unbalanced		
	Ag.	Ind.	Serv.	Ag.	Ind.	Serv.
England: Probate						
1540-59	0.63	0.22	0.15	0.63	0.22	0.15
1560-79	0.66	0.21	0.13	0.66	0.22	0.13
1580-99	0.66	0.22	0.12	0.65	0.22	0.12
1600-19	0.63	0.23	0.14	0.63	0.23	0.14
1620-39	0.59	0.25	0.17	0.6	0.24	0.16
1640-59	0.53	0.28	0.19	0.56	0.26	0.18
1660-79	0.47	0.3	0.23	0.48	0.29	0.23
1680-99	0.43	0.31	0.26	0.44	0.29	0.26
1700-19	0.42	0.32	0.26	0.47	0.29	0.24
1720-39	0.36	0.33	0.31	0.37	0.33	0.31
1740-59	0.38	0.32	0.3	0.38	0.32	0.3
1760-79	0.35	0.31	0.34	0.35	0.31	0.34
England: Apprentices' Fathers						
1580-99	0.59	0.27	0.14	0.58	0.28	0.14
1600-19	0.51	0.32	0.16	0.5	0.32	0.18
1620-39	0.46	0.34	0.2	0.46	0.33	0.21
1640-59	0.43	0.34	0.22	0.42	0.34	0.24
1660-79	0.35	0.42	0.23	0.35	0.41	0.24
1680-99				*0.32*	*0.45*	*0.24*
1700-19				*0.24*	*0.47*	*0.29*
1720-39				*0.2*	*0.54*	*0.25*
Wales: Probate						
1560-79	0.77	0.15	0.08	0.77	0.15	0.08
1580-99	0.75	0.12	0.14	0.75	0.12	0.14
1600-19	0.74	0.13	0.13	0.74	0.13	0.13
1620-39	0.73	0.13	0.14	0.73	0.13	0.14
1640-59	0.71	0.16	0.13	0.71	0.16	0.13
1660-79	0.71	0.15	0.14	0.72	0.15	0.13
1680-99	0.73	0.13	0.14	0.73	0.13	0.14
1700-19	0.71	0.15	0.14	0.72	0.15	0.13
1720-39	0.62	0.17	0.21	0.64	0.17	0.19
1740-59	0.66	0.17	0.17	0.67	0.16	0.17
1760-79	0.70	0.15	0.15	0.71	0.15	0.15

Note: The probate balanced sample contains 12 counties with records for at least 10 of the 11 twenty year periods between 1580-99 and 1780-99: Bedfordshire, Berkshire, Cambridgeshire, Cheshire, Durham, Essex, Gloucestershire, Hampshire, Hertfordshire, Oxfordshire, Surrey. The two counties with missing observations are Durham (1640-59) and Wiltshire (1600-19). In the apprentices' fathers' dataset the balanced sample

contains 29 counties, the unbalanced sample includes data from 36 counties. For 1680-99 onwards, the apprentice sample unbalanced index is based on a small number of counties, with only 11 in the final period (in italic).
Source: see text and Appendix 1.

Agriculture declines consistently over this period. Industry and services both grow substantially, with services outstripping industry. Compared to the probate data, the share of the workforce in agriculture declines more quickly, while the rate of expansion in industry is somewhat slower in the first half of the seventeenth century, although it reaches a similar level by 1660-79. The growth in services is similar to the probate dataset. This coherence between the results from two independent sources offers a first test of the validity of our findings.

In Wales, we see much less evidence of structural change. The share of those appearing in the probate record who worked in agriculture in the mid eighteenth century, 66 percent, was only about ten percent below the 75 percent seen in the late sixteenth century. The share in services had risen by the same amount. Industry was as small at the end of the period as it was at the beginning, at about 15 percent. These estimates are based on smaller numbers and so are more volatile and less precise than those for England, particularly for the late sixteenth century. Still, they give an impression of a relatively unchanging Welsh economy, and they fit well with the historical consensus that, despite growing prosperity among some farmers, secondary or even mining activity was slow to develop in Wales (Jenkins, 1987: 270-275; Powell, 2007). Williams (1993: 56, 395) suggests that as late as 1700, mining and industry were 'far more like they had been in 1400 than what they would be in 1850'.

We need to ask why our results are so different to those that Clark et al. (2012) derive from their analysis of probate data. It is not because our sample captures different wills. Our data includes all of Clark et al.'s data for the 1650s and most of it for the 1560s. Nor is it because of how we treat the records: our raw statistics on the share of the workforce in agriculture in the counties in which our datasets overlap are basically the same.

The difference between our final results and Clark et al.'s estimates has three main causes. The first is methodological: the adjustments we make for London and for age. Clark et al.'s second data point (for the 1650s) is effectively a sample of the occupational structure circa 1638-45, a time when the change in the agricultural share is only just becoming visible. Their failure to take London into account also leads them to understate structural change. London exploded from around 80,000 inhabitants in 1550 to around 400,000 by 1650, growing from 2.6 percent to 7.5 percent of England's

population. People in London were highly unlikely to be working in farming or fishing. Even if the share of the workforce in agriculture in rural England had remained constant, the growth of London means that the national share in agriculture declined.

The second reason for the difference between our results and Clark's is the dating of our samples. Clark et al.'s first dataset for the 1560s covers a period when the share of workers in agriculture in the probate record was rising in a number of counties (visible in figure 2). This is likely to be a mechanical result of improvements to record keeping by church courts following Henry VIII's probate reforms.[8] We also exclude some of the counties Clark et al. use, as we consider the share of surviving probate records with data to be too low to be reliable.[9] By 1600, the quality of the probate record has improved markedly, and from then onwards it remains good, even as the share of the workforce in agriculture that it reveals begins to decline in most of England. The third reason is that our sample covers a wider and more balanced geographical area. Clark et. al.'s evidence for the 1560s is primarily from the south of England. Only one county in their sample is located in the north, Cheshire, which supplied just 92 wills in that decade, equivalent to around two percent of male deaths in the county. The more agricultural north of England is thus poorly represented in their dataset for this period.

The probate and apprentice datasets do not provide direct estimates of the shares of workers in agriculture, industry and services, but rather indices derived from particular sub-populations. The most obvious test of the value of these indices, and the account of structural change they offer, is the coherence of the series we obtain when they are linked to the various estimates of occupational structure that exist in the literature. This also allows us to confirm which of the estimates in the literature are accurate.

The existing estimates for the period before the mid-eighteenth century apply only to England so we omit Wales from our discussion. In figure 3, we explore what happens if we tie our probate and

[8] Henry VIII passed several acts of parliament regulating the probate process, the most significant of which was Cap.5 21 Henry VIII (1529) (*Statutes of the Realm*, v.3, 285-288), which set out a standardised scale of fees, and crucially compelled ecclesiastical courts to process all correctly presented cases, even where the value of the estate was below the level where the only fee liable was that due to the scribe. The recording of the wills of poorer testators consequently increased in many jurisdictions after this date.

[9] The following counties were studied by Clark et al. for 1560-79, but are excluded from our unbalanced sample for this period because they do not meet one of our inclusion criteria for data quality: Cheshire; Dorset; Kent; Sussex; and Warwickshire (all fall below our threshold of 10% of deaths generating a probate record); for Norfolk and Wiltshire the data available for 1560-79 lacked one of the 'levels' of jurisdiction for a substantial part of the county.

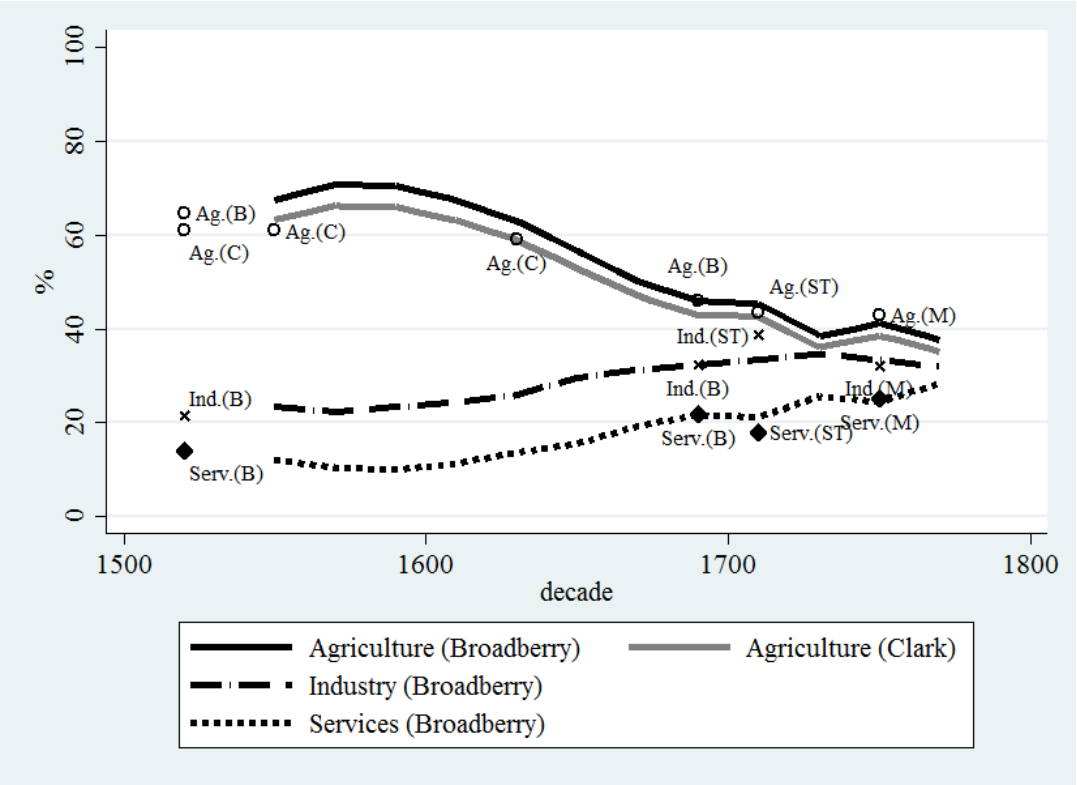
apprentice indices to two of the three main published estimates for the seventeenth and early eighteenth centuries. The time series in figure 3 have been constructed by linking to Broadberry et al.'s benchmark for 1688/1700 and Clark et al.'s benchmark for 1630 (for clarity, we do not show a separate series tied to Shaw-Taylor et al.'s figures here, as the results are very close to those tied to Broadberry et al.'s estimates). For example, the 1650 estimate for the agricultural share in the Broadberry estimates have been calculated by multiplying Broadberry et al.'s benchmark for 1690 by the ratio of the 1650 probate estimate in Table 2 to the 1690 probate estimate. Other dates and series are constructed in an analogous manner. Put simply, we show how the sectoral shares would look if the estimates by other scholars correctly measured the levels and our series rightly identified the trends. For comparison, we also show Broadberry et al.'s estimates from the muster rolls for 1522 and for 1759 from Massie, and Shaw-Taylor et al.'s estimates for the 1710s. We treat Clark et al.'s estimate for 1653-60 as reflecting the 1620-39 occupational structure, because of the age profile of the probate sample it contains.

The result of linking our probate indices to the existing estimates is striking. On this measure, in panel A there is essentially no historically meaningful conflict between Clark et al.'s, Broadberry et al.'s, or Shaw-Taylor et al.'s estimates of the agricultural share. Both fit on what is essentially the same trend line. The differences between the series we construct here are in the order of one or two percentage points in any one decade, surely within any reasonable margin of error. The lines also fit well with estimates for the early sixteenth century that have been calculated from the Muster Rolls, and they also match tidily with Broadberry et al.'s reinterpretation of Massie's figures for agriculture.

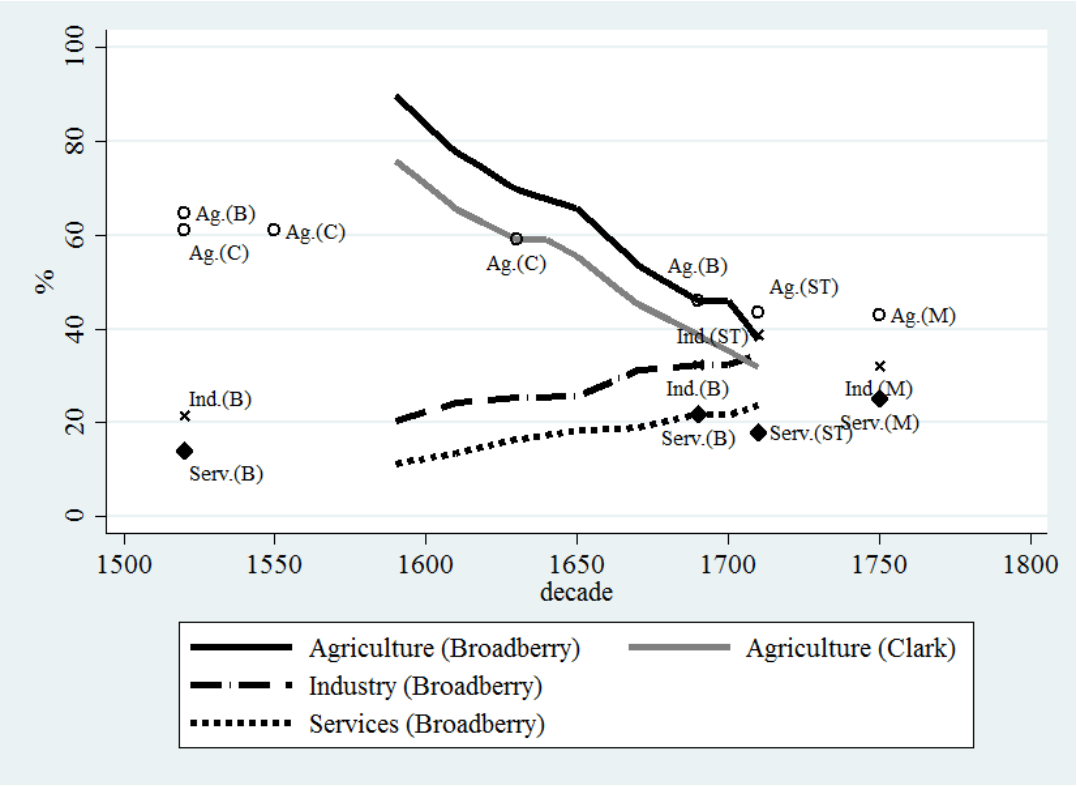
By comparison, the index we construct from the apprentices' fathers data, given in Figure 3, panel B, shows too steep a decline in the share of workers in agriculture to be plausible. In part, the weakness of the series reflects the necessary projection to bridge the gap between the end of the series and Broadberry et al.'s estimates; the linear decline that we find in the apprenticeship series is innately unsustainable when extended too far. But equally important is the failure to capture the stability of the share in agriculture in the late sixteenth century.

Figure 3: Sectoral distribution over time, indices tied to existing estimates

A. Probate



B. Apprentices' Fathers



Note: The figures report sectoral trends for England estimated by linking the indices derived from the probate and apprentice father datasets, balanced sample of counties, to two existing benchmarks. The lines labelled "Broadberry" are tied to the 1688/1700 estimate from King's social table in Broadberry et al 2015: 350. The

line labelled "Clark" is tied to the weighted 1653-60 estimate of agricultural share from probate data in Clark et al 2012: 378. Additional point estimates for male employment are also reported for the 1522 Muster list from Broadberry et al 2015: 353 (labelled "B"), and Clark 2013: 9 (labelled "C"); for 1560-79 from Clark et al 2012: 381 (labelled "C"); for the 1710 estimate from baptismal registers in Shaw-Taylor et al 2010 (labelled "ST"); and for c.1750 from Massie in Broadberry et al 2015: 356 (labelled "M"). To link with the Broadberry estimates the apprentice father dataset was projected linearly to 1700. Sources: see text and Appendix 1.

It seems reasonable to conclude that the probate series is likely to give a more accurate reflection of the distribution of occupations in the male population as a whole. The apprenticeship series provides an independent confirmation that the trends in the probate series are moving in a plausible way, but it is not as good a guide to sectoral change in its own right.

An initial examination of our datasets suggest two main results. Firstly, we find strong evidence of substantial structural change in England between 1550 and 1700. Secondly, we date the start of this movement out of agriculture to the early seventeenth century, rather than the late seventeenth to early eighteenth centuries, as suggested by Crafts (1985:11-15).

PROBLEMS OF BIAS IN PROBATE DATA

How robust is our account of structural change? To address this question we now discuss the four main potential sources of error that affect our probate and apprentice datasets: geographical gaps; lifecycle bias; different death rates; and, most important of all, wealth and capital bias. Other concerns with probate evidence, notably the impact of by-employment, have been extensively discussed – and largely laid to rest - in recent works by Keibek (2016c), Keibek and Shaw-Taylor (2013) and Clark et al. (2012).

The first issue is geography. Although our probate dataset covers a broader geographical sample than Clark et al.'s, it misses some important parts of the country, notably in the Midlands and Yorkshire (see figure 1). There is no easy way to be sure about how well our sample represents the sectoral distribution of the whole country, but Wrigley's (2007, 2009) county population estimates for 1600 onwards suggest one test. Economic growth is expected to cause population growth, which is thus often used as a proxy for it. Therefore, we would expect that estimates based upon our sample will underestimate sectoral change at a national level if the population of the sampled counties grows more slowly than the population of counties left out, or vice versa. From 1600 to

1700, the average increase in the population of counties in our probate sample was 23 percent, compared to 22 percent for counties outside our sample. Between 1700 and 1750, the populations of the counties in our sample grew substantially faster than those outside the sample (18 percent vs 11 percent), while after 1750 the populations of the counties in our sample lagged those outside (34 percent vs 46 percent). If we apply the same test to the stable sample in the apprentice dataset, we find that their populations grew slightly more quickly than counties outside (22 percent vs 21 percent). On this basis, we feel relatively confident about the validity of both samples for the seventeenth century, the period we are most concerned with, because the counties in our samples grew at close to the same speed as the country as a whole. We are less confident about the representativeness of the probate series after 1700.

The second issue is lifecycle bias. Because death and being a father of teenage boys are more common among older adults, our datasets will under-represent young workers, such as domestic servants, servants in husbandry and apprentices. They will also tend to under-record groups who are highly mobile, and may at times die overseas, such as soldiers and sailors. However, there is no reason to believe that the sectoral distribution of workers' early years of employment changed sufficiently to affect trends during this period. Agriculture and industry both consistently employed large numbers of young workers (Kussmaul 1981; Minns and Wallis 2012: 559; Field 2013). Before the arrival of factories in the late eighteenth century, neither group experienced an institutional or technological shock that substantially shifted the age-structure of the workforce.

Soldiers and sailors are relatively rare in probate data, only exceeding 1 percent of the sample for a few periods in the later seventeenth and eighteenth centuries. By contrast, estimates of mustered naval manpower alone equal roughly 3 – 5 percent of the English adult male population in the first half of the eighteenth century (Rodgers 2004: 636-7).[10] Mariners outside the navy were common in the probate record, though, peaking at 6 per cent of males in 1740-59, and may encompass some men serving in the navy (the occupational terminology is sometimes vague). Aside from short periods of intense conflict, notably in the civil wars and Napoleonic wars, the impact of these omissions is likely to be modest, and they are unlikely to change the implications of our findings. Servants, soldiers and sailors are all part of the service sector. Hence, because our results indicate that England had a high and growing share of males working in services, if we are under-estimating

[10] Rogers provides annual totals for naval manpower, compared here against the English adult male population; the actual share would be lower if we knew the share recruited from outside England.

military employment then a correction to account for this would probably only further strengthen the case for identifying structural change in this period.

The third issue is that if death rates significantly differed across sectors then the probate record would under-represent sectors with relatively low death rates, as compared to society at large. How big was this bias in early modern Britain? Existing estimates of urban and rural adult life expectancy suggest that correcting for the effect of the urban mortality penalty would require an upward adjustment to the agricultural share of an average of less than 2 percentage points (see Appendix 3). It is therefore safe to neglect the urban mortality penalty for the purpose of this analysis.

Finally, the biggest issue with using probate records (and to some extent the occupations of apprentices' fathers) is the bias towards those with wealth and capital: wills were devices to transfer property after death, and so were much more frequently written by the wealthy and asset-rich than the poor.[11] The potential impact of this type of selection bias is most obvious in estimates of occupational shares, where better-rewarded occupations, such as merchants or millers, will be over-represented compared to bricklayers and shepherds. But trends can potentially be biased, too. The share of individuals leaving a will varied over time. Economic growth might push up this share, if growth translated into greater individual wealth. Moreover, if productivity grew more rapidly in one sector than others, then workers in the expanding sector might leave more wills and produce a higher share of probates than previously, even if the number actually employed was unchanged. On the other hand, if inequality increased in a sector, as we would expect with proletarianization or enclosure, then the share of workers leaving wills could decline.

It is difficult to tell *a priori* whether the representation of industry or agriculture will be distorted more as a result of this selection bias, and there are some reasons to think that selection had broadly stationary effects, mainly affecting levels rather than trends. Clark et al. (2012: 374) find that probates were generated roughly in proportion to the population in rural and urban areas, and they only 'modestly oversample' rural areas because farming was capital intensive. The capital intensity of agriculture and hence its effect on the probability of making a will did not change greatly between 1550 and 1750. Animals made up a large share of the agricultural capital stock and livestock intensity in farming remained roughly stable in early modern England (Allen 2005: 8; Broadberry 2013: 11).

[11] Zell 1984: 111-2. A related concern is that the share of wills with a recorded occupation might vary with wealth, too. However, a regression analysis of the share of "gentlemen" in the probate record on the share of wills with an occupation suggests that the two variables are unrelated.

Implements, the other main capital component of pre-modern farming, appear to have increased significantly in importance only after 1750 (Allen 2004: 109, 2005: 8). As for industry, it continued to be labour-intensive for most of the period under analysis. Until the Industrial Revolution, manufacturing mainly relied on hand tools and human energy (Broadberry et al. 2015: 366). The kinds of increase in the concentration of capital and income inequality that might bedevil our estimates were rare before the later eighteenth century, so far as we can tell.

That said, there are some signs of changes in the relative productivity of sectors that might undermine this assumption. In Clark's (2005, 2007b) wage data, building workers' incomes start to pull away from the 1620s, and from the 1680s masons consistently earn around a fifth more than agricultural labourers. In Allen's (2001) wage data, the early seventeenth century is a period of relative prosperity for agricultural workers, and it is not until the 1680s that their earnings fall below those of building labourers. Higher earnings in construction might signal a wider rise in urban incomes that could lift the chance that industrial and service workers appear in the probate record. However, it is hard to imagine that a twenty percent shift in day wages, even if this mapped over onto the workforce more generally, would have a very large effect on the relative distributions of wealth and capital at death. Moreover, the extent to which these wages mirror incomes in other occupations within each sector is an open question. According to Broadberry et al.'s (2015: 365-7) estimates, between 1522 and 1801 productivity growth in industry was about the same as in services and lower than in agriculture. It is only in the nineteenth century that differences in the rates of growth across sectors grew large. We therefore view the weight of evidence as suggesting that wealth and capital bias had a relatively stationary effect over this period.

ADJUSTMENTS FOR BIASES IN PROBATE COVERAGE

We now examine how we can use the limited share of deaths generating wills to address the wealth and capital bias of the probate record. This serves as a test of the validity of our indices and produces independent estimates of sectoral shares from the probate record.

For both institutional and economic reasons, the share of deaths that generated a probate record varied over time and between counties (see figure S1). Partial coverage in the probate records implies that changes in the shares of the deaths that generated wills could significantly affect trends in sectoral shares. If the wealth distribution of testators differed between sectors, then the share we calculate from our sample would vary depending on the share of deaths that generated a probate

record. For example, if the probate record contained 5 percent of deaths we would capture many of England's merchants, who were among the wealthiest individuals outside the aristocracy, but few of its far more numerous farmers, many of whom had relatively modest levels of wealth. However, if 50 percent of deaths appeared in the probate record, we would add a few additional merchants, but very many more farmers.[12] Our estimates of the size of the agricultural share would be much larger in the second scenario, purely because of the change in the share of deaths that generated a will.

We therefore estimate the effect of changes in these shares econometrically and use the results to examine how the series might look like if all deaths were recorded in probate. This is a strong robustness check for the indices just presented, as it estimates them keeping constant the share of deaths recorded across space and time. However, as with all out of sample predictions, it should be taken as a best guess for the levels.

To estimate how occupational shares respond to changes in coverage we employ the generalised linear model developed by Papke and Wooldridge (1996), which is designed to fit proportional data, such as sectoral shares: the predicted values are bounded between 0 and 1 and the effect of a change in the share of deaths with a will decreases as a sectoral share approaches the boundaries. A positive coefficient on the coverage variable indicates that an increase in coverage is expected to increase the sectoral share in question. In other words, a positive coefficient signals that the sector is under-represented in the probate record and a negative one that it is over-represented.

Differences in levels are expected across counties depending on their specialisation. As we saw, figure 2 revealed differences and non-linearity in the county trends. We therefore include county/sector dummies and county/sector-specific quadratic trends as independent variables, together with the share of deaths recorded. As the marginal effects, by definition, cancel themselves out across sectors, they are constrained to sum to zero, both for the share of the wills and time. These constraints hold exactly at the sample mean of the dependent variable, which by definition is one third, and approximately for other values (details are in Appendix 2). They ensure that the sum of the fitted values across the three sectors is approximately equal to one for all counties and time. Formally:

$$\vartheta_{sit}=exp(\alpha+d_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})/[1+ exp(\alpha+d_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})]+u_{sit} \quad (1)$$

[12] Sebastien Keibek is currently working on an alternative approach (cf. Keibek 2016a, 2016b) to identifying levels from probate data for his Cambridge PhD thesis.

Where ϑ_{sit} is the sectoral share from the probate record in sector *s* (agriculture, industry and services, respectively), county *i* and time *t*, α is a constant, d_{si} is a county/sector dummy, β_{1si} and β_{2si} are the coefficients of the county/sector quadratic trends, β_{3s} is the main coefficient of interest and δ_{it} is the share of deaths covered by the probate record. We present the results in table 3.

Table 3: Shares of deaths covered and sectoral shares in the probate record: generalised linear regression analysis for fractional response variables

Sector	Coefficient	Average marginal effect
Agriculture	0.586	0.098
	(6.01)***	(6.03)***
Industry	0.320	0.053
	(2.53)**	(2.54)**
Services	-0.906	-0.151
	(-6.66)***	(-6.68)***
County/sector fixed effects	Yes	
Quadratic county/sector trends	Yes	
N	1809	

Note: ***=significant at the 1 percent level, **=significant at the 5 percent level and *=significant at the 1 percent level, *N*=sample size. Clustered standard errors allow for arbitrary correlation within sectors; the *z-statistics* are in parentheses.

Sources: see the Appendix 2 and the text.

The relevant coefficients have the expected signs – agriculture and industry are positive, while services is negative - and are statistically significant at conventional levels.[13] An increase in the shares of deaths producing a will increases the shares of agricultural workers more than that of industrial workers, at the expense of the share in services. On average, an increase by 1 percentage point in the share of deaths covered within the probate process increases the shares of agriculture

[13] This applies to almost all of the controls as well.

and industry by 0.098 percentage points and 0.053 percentage points, respectively, and decreases the share of services by 0.151 percentage points. For example, the results imply that the sectoral estimates for Herefordshire in the 1650s, when just over 10 percent of deaths appear in probate, should be increased by 8.66 percentage points for agriculture if we are seeking to predict the share across the entire male working age population (assuming we knew the occupations of all males). Likewise, the agricultural share for Cambridgeshire in the 1590s where 56 percent of the population is in the probate record would be increased by 4.56 percentage points to be comparable to full coverage.

The baseline specification for the effect of coverage upon occupational shares assumes that the coefficients are stationary. However, as we discussed earlier, if the distribution of wealth and capital significantly changed between (or even within) sectors, the assumption of stationarity is violated, because the probability of an individual appearing in the probate record for each sector and any given level of coverage changes over time. This is a key concern for us. For instance, during the Industrial Revolution one might expect that the likelihood of being probated changed for people working in industry, reflecting growing productivity, increased capital intensity and rising income inequality in this sector. In consequence, even the adjusted estimates may identify spurious trends. Thus, if wealth was distributed away from agriculture to industry and services, or if agriculture became less capital intensive relatively to industry, the probate record would show a fall in the agricultural labour share even if there were none in society at large.

To address this issue we run two alternative specifications. The first specification allows the effect of changes in probate coverage to vary across decades. While this approach directly addresses potential violations of the assumption of stationarity, it has the downside that each coefficient is estimated on the basis of relatively few data points, those forming each cross-section. We therefore also run a regression including only data from records from before the Industrial Revolution (stopping our analysis in 1750) to evaluate the effect of excluding the period where violations of the stationarity assumption may become a larger problem. Figure 4 compares the average marginal effects of the share of deaths covered for each of the three specifications.

Figure 4: Average marginal effect of the share of deaths covered on the agricultural share (in percentage points)

Sources: see the Appendix 2 and the text.

The specification with time-variant coefficients detects an overall stable and low level of responsiveness of the agricultural labour share to changes in coverage until the mid-eighteenth century, confirming our earlier contention that selection in the probate record was broadly stationary before the Industrial Revolution. From the 1760s onwards, we see an upward turn in the time-variant series shown in figure 4. This rise in the marginal effect of an increase in the share of deaths on the share of the workforce in agriculture indicates that farming became significantly under-represented, to an extent that was increasing at a very rapid pace. The coefficients for the other sectors imply that while the representation of both industry and services increased as a result, the gains were concentrated in services.[14] This suggests that either it was mainly financial and commercial wealth, rather than industrial capitalists' that increased in the early decades of the

[14] The coefficients for agriculture and industry are in table A3 in the Appendix 2. In each decade, the coefficient for services is equal to minus the sum of the coefficients in the two other sectors.

Industrial Revolution, or that factory and other industrial equipment owners were recorded under occupations classified as services rather than industry. The third 'until 1750' specification finds that excluding data from the 1760s onwards has no effect on the sign and a very minor effect on the size of the marginal effects compared to the 'baseline' specification. We therefore rely on the baseline coefficients to compute the adjusted estimates, understanding that a negative bias in the agricultural labour share is expected from the mid-eighteenth century.[15]

The adjusted sectoral shares are computed with the predicted values under the assumption of universal male coverage for the wills plus the errors. In other words, we let δ_{it} be equal to 100 percent in the regression equation for all counties and time periods (cf. equation (1)).[16] The aggregation across counties follows the same method used for the observed sectoral shares.[17] Table 4 shows the results. Figure 5 compares them to previous estimates for England. County-level results are reported in the Appendix 3.

As with our baseline results, the unbalanced and the balanced sample agree, both on trends and levels. Clearly the adjusted estimates strongly corroborate the results from the un-adjusted series: agricultural shares went down, while both industry and services went up; the decline of agriculture was slow between the later sixteenth and the early seventeenth centuries and became more rapid from then until the early eighteenth century.

[15] This implies that some counties were under-going de-industrialization at the time and is consistent with Keibek's (2016d) findings. He argues that the eighteenth century saw increased specialization across counties.
[16] On average the absolute difference between the sums of the fitted values by county and decade and 1 is less than 1 percentage point. However, the constructed sectoral shares tend to slightly over-predict their sizes: on average by a total of about 6 percentage points. The constructed labour shares are therefore scaled to sum up to 1 for each county and decade before they are aggregated.
[17] Note, however, that in order to exploit variation in probate coverage the econometric analysis is carried out on 10-year intervals rather than the 20-years samples used previously. To improve its power, we also include in the regression data from the 1540s and 1790-1809. The coefficient of variation of the sectoral shares is 72 percent (range: 0 to 89 percent) and that of the share of deaths recorded is 40 percent (range: 10 to 56 percent).

Table 4: Sectoral distribution of the labour force, adjusted probate estimates

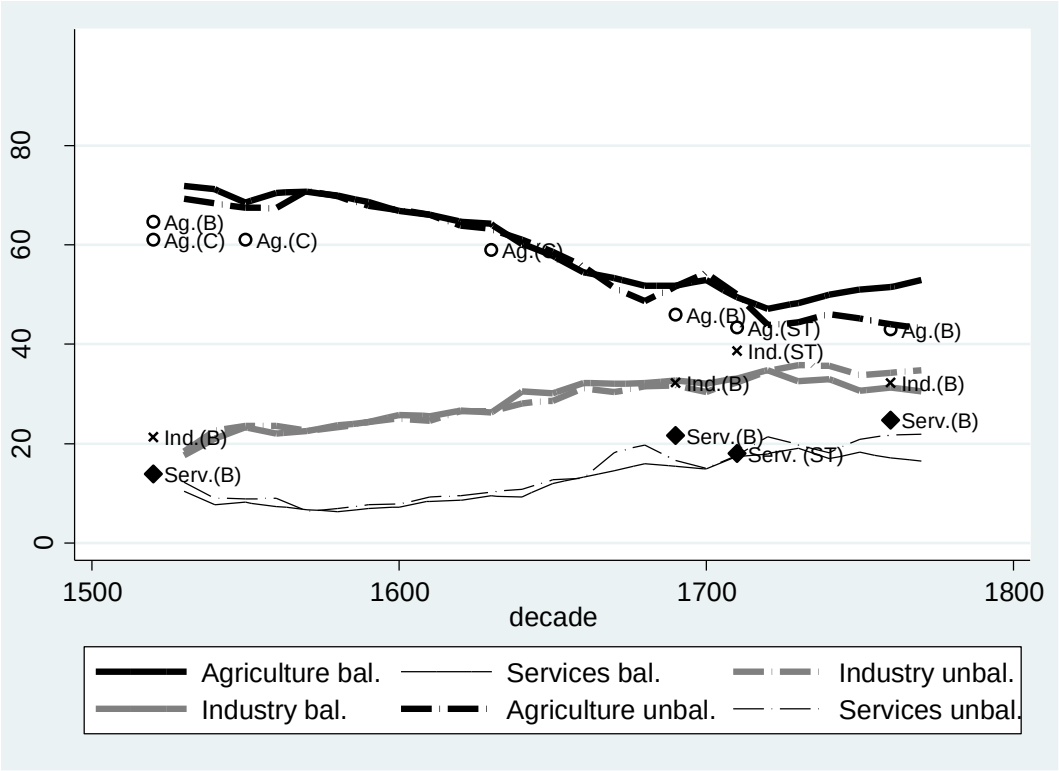
Sample:	Share Balanced			Share Unbalanced		
	Ag.	Ind.	Serv.	Ag.	Ind.	Serv.
		England				
1540-59	0.72	0.19	0.09	0.69	0.21	0.11
1560-79	0.69	0.23	0.08	0.67	0.24	0.09
1580-99	0.70	0.23	0.07	0.70	0.23	0.07
1600-19	0.68	0.25	0.07	0.67	0.25	0.08
1620-39	0.65	0.26	0.09	0.65	0.26	0.09
1640-59	0.62	0.28	0.09	0.62	0.27	0.11
1660-79	0.56	0.31	0.13	0.57	0.30	0.13
1680-99	0.53	0.32	0.15	0.50	0.31	0.19
1700-19	0.52	0.32	0.15	0.53	0.31	0.16
1720-39	0.48	0.34	0.18	0.47	0.33	0.20
1740-59	0.49	0.33	0.18	0.45	0.36	0.19
1760-79	0.51	0.31	0.18	0.45	0.34	0.21
		Wales				
1560-79	0.79	0.17	0.04	0.77	0.09	0.14
1580-99	0.79	0.13	0.07	0.80	0.17	0.03
1600-19	0.80	0.14	0.06	0.82	0.11	0.07
1620-39	0.79	0.15	0.06	0.81	0.12	0.07
1640-59	0.75	0.18	0.07	0.80	0.14	0.06
1660-79	0.77	0.17	0.07	0.77	0.15	0.08
1680-99	0.78	0.15	0.07	0.81	0.13	0.06
1700-19	0.77	0.17	0.06	0.77	0.18	0.04
1720-39	0.70	0.19	0.11	0.68	0.22	0.09
1740-59	0.73	0.19	0.09	0.73	0.20	0.07
1760-79	0.76	0.17	0.06	0.74	0.19	0.06

Note: The figure reports adjusted sectoral trends for England estimated assuming that all male deaths were included in the probate records of the counties in our sample. Unbalanced sample use all available data. The balanced sample uses a constant sample of counties for which we have data in all decades.

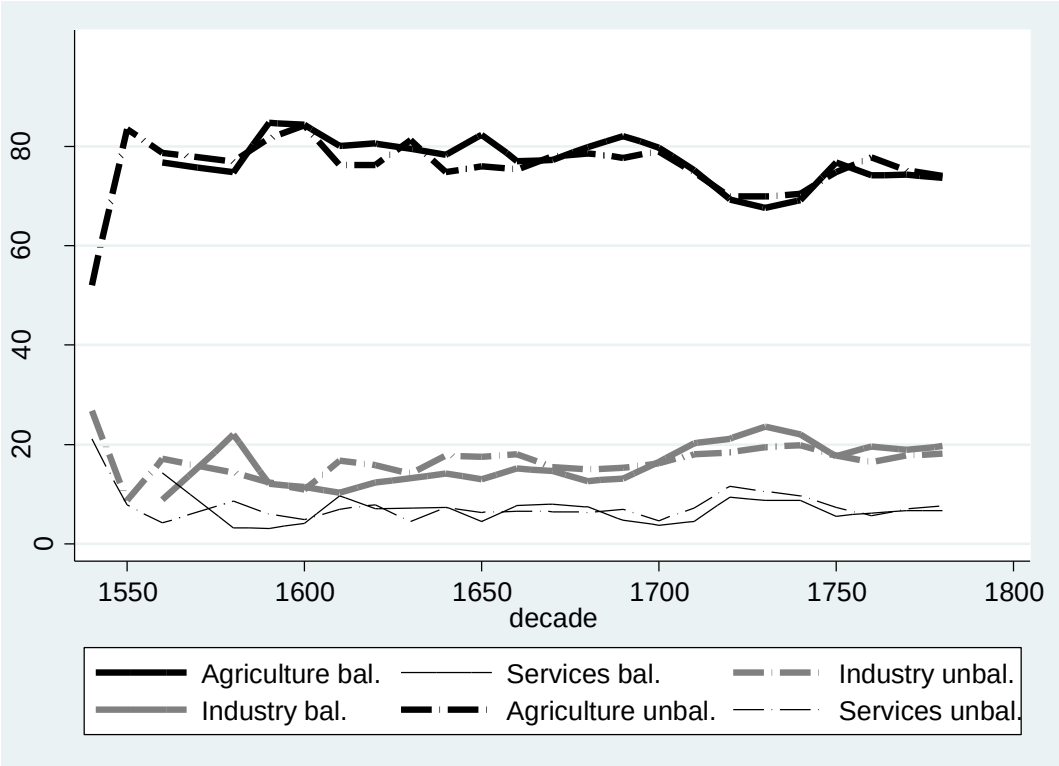
Sources: see the Appendix 2 and the text.

Figure 5: Sectoral distribution over time

a. England, adjusted probate estimates



b. Wales, adjusted probate estimates



Notes: The figure reports adjusted sectoral trends for England and Wales estimated assuming that all male deaths were included in the probate records of the counties in our sample. The lines coded "unbal." use all available data. The lines coded "bal." uses a constant sample of counties for which we have data in all the decades. The point estimates in 6a are as in figure 3. Sources: see the Appendix 2 and the text.

Caution is in order, not least because after 1700, as we said before, it is likely that both our counties and the probate record become less representative of England. Yet, reassuringly, there is a very close match with both the previous point estimates in the literature and our indexed series linked to those estimates. The trend apparent in figure 5a is in all essential respects the same as that in figure 3a: our correction for sample bias thus supports our initial description of English structural change. If we look at the estimates of shares employed, we can see that across the three sectors, there is a strikingly close match with Broadberry's et al.'s estimates. Our estimates of agricultural share in the eighteenth century are only little above that of Shaw-Taylor et al. Clark et al.'s agricultural shares are significantly different from ours only at the beginning of the period. In the 1530s, our estimate is closer to Broadberry et al.'s revised estimate from the Muster list. Clark et al.'s figure for 1560-79, which is based on un-adjusted probate records at a time when the quality of record-keeping was low, seems to under-estimate the agricultural share. Our estimates for services in the eighteenth century are in line with, albeit somewhat lower than, those of Broadberry et al., and are very close to those of Shaw-Taylor et al.

There is very little difference between the unbalanced and balanced samples in Wales (figure 5b). As with the unadjusted series, we find much less evidence of structural change there: we detect only a slight fall in the agricultural share between the late seventeenth and early eighteenth centuries. That correcting our estimates for bias leaves the trajectory of Wales unchanged offers further reassurance about the robustness of both national series.

CONSISTENCY WITH URBANIZATION AND ECONOMIC GROWTH

As an additional test of their validity of our results, we compare them with urbanization rates, estimates of demand elasticity, and GDP per capita. Urbanization figures provide a natural benchmark as they are widely used to gauge the size of industry and services in premodern societies, in that they reflect overall agricultural productivity and give some indication of non-farming employment.

The level of urbanization in England grew fairly steadily from 1550 to 1750, increasing from around 5 percent of the population to between 20 to 30 percent, depending on the threshold used to define a

city (see figure S2).[18] The trend of continuous growth in urbanization was thus quite similar to the trend we identify in the share of the male labour force in industry and services, and is consistent with the idea that this period witnessed structural transformation. However, the difference in levels is striking: urbanization rates were twenty to thirty percentage points lower than the employment rates we find in services and industry. If we assume that urban residents were not employed in farming, then the gap between the levels implies that in the 1530s about a quarter of the males in the country-side were employed in industry and services; by the 1720s, this had risen to over 40 percent.[19] If we take into account female labour shares, then this implies that already in the 1530s over 35 percent of the rural labour-force was employed outside agriculture.[20]

As noticed by Federico (2016: 127), England differed sharply from Holland, where in 1514, even after a precocious structural transformation had lifted the share in industry and services to 60 percent, more than 85 percent of labour in the countryside was in agriculture. Elsewhere in Europe, in 1800 between three and four-fifths of rural labour was in farming (Allen 2000: 7). Rural proto-industry and commercial agriculture appears to have played a peculiarly important role in the development of the pre-modern English economy.

When we consider GDP and demand elasticity, Engel's law predicts that the primary labour share declines with income per capita. If our figures are correct, then the English agricultural labour share was exceptionally low – just over half the size one would expect given its income.[21] However, Crafts (1984) finds that in the nineteenth century, too, England was an outlier on this measure: its proportion of primary workers was lower than expected by a similarly large margin, a situation he explains by farming's high productivity. In fact, even after adjusting for food imports the gap remains large.[22] The English peculiarity that we observe is thus consistent with an early lead in agricultural productivity. Our figures are also consistent with a progressive increase in the per capita yearly expenditure on primary products, from £ 3.78 in the early sixteenth century to £ 5.37 in the mid-

[18] Balanced sample; henceforth, this series is used.
[19] We also assume that employment rates were the same in urban and rural areas. Under our assumptions, the rural agricultural share is equal to the agricultural share divided by the rural fraction (Allen 2000: 7).
[20] We assume that the gender distribution was the same in cities and in the country-side. Here and below the female figures are from Broadberry et al. (2015: 362) and are linearly interpolated between benchmark years.
[21] This point is made by Clark (2013: 12-13), using modern data to predict the agricultural share with income per capita, in relation to Broadberry et al.'s (2013, 2015) estimates of sectoral shares and GDP. Given the close match with our sectoral shares, it applies here as well. Below, too, the GDP figures are from Broadberry et al.'s (2015) online database.
[22] Following Allen (2000: 2) we adjust the agricultural share dividing it by the ratio between agricultural production and consumption. Using Clark et al.'s (1995: 220) data on food imports to estimate this parameter in 1850 the adjusted agricultural share was 31 percent as compared to an expected one of 47 percent.

eighteenth century and £ 6.52 in the mid-nineteenth century (at 1700 constant prices). During the same intervals there was a decline in the share of income spent on primary products, from 43 percent to 37 percent and 25 percent, respectively.[23] Notably, the shares of income spent on primary products were well below those spent on food. For instance, we estimate that the share of income spent on food in 1850, when the data are comparatively reliable, was 58 percent and we expect the figure to be higher in earlier times.[24] This suggests that food was often processed (e.g. baked or converted from milk into cheese) and traded over substantial distances in England. This sits well with the idea that early modern England is better described as a proto-industrial and commercialised society, rather than a Malthusian society strongly tied to the constraints of an inelastic agricultural production.

The implied income elasticities of demand are very much in line with other estimates. Clark et al. (1995: 216) assume that the income elasticity of demand for food in England during the Industrial Revolution was 0.6; Floud et al. (2012: 105) recommend a downward revision and argue for an income elasticity of demand for calories of 0.26. We find that income elasticity at the mid-point between 1750 and 1850 was 0.34. We also confirm a sharp decline in food demand elasticity with income (Clark et al. 1995): between the 1530s and the 1750s, when income was lower, the demand for primary products was still inelastic, but the value of the mid-point elasticity, 0.70, was substantially higher.[25]

As a final cross-check, we utilize Groth and Persson's (2016) model, which exploits Engel's law to produce micro-founded estimates of macroeconomic series, on the basis of sectoral shares in self-

[23] The expenditure is equal to the share of income spent on primary products times the income per capita, where the latter has been computed assuming that the rate of growth between the eighteenth and the mid-nineteenth century was the same in England and the UK as a whole (as mentioned before the income figures are from Broadberry et al.'s 2015 online database; we use the same source for the English population together with Wrigley et al. 1997: 614-615). The share of expenditure on primary product is equal to the productivity of agriculture relative to that of the economy as a whole times the labour share in agriculture divided by the share of food that is not imported (Nuvolari and Ricci 2013). The productivity figures and the mid-nineteenth century agricultural labour share are from Broadberry et al. (2015: 344, 362) (assuming that from 1700 onwards there is a match between England and the UK); the shares of imported food are from Clark et al. (1995: 220) (linearly interpolating for the mid-eighteenth century and assuming that the British share in the mid-nineteenth century applied in England as well).

[24] This share is equal to the value of the food consumption divided by the GDP in Britain. The food consumption is from Clark et al. (1995: 220).

[25] An implication of Engel's law is that the income demand function for food is concave. It follows that the linear approximation

sufficient economies, to construct a GDP per capita indexed series until the 1750s.[26] We use their baseline assumptions with our constructed sectoral shares.

Overall, there is a close match between the two series. The correlation coefficient is 91 percent. Both series detect sustained economic growth, particularly marked in the decades around 1650. (Figure S3 compares the results with Broadberry at al's (2015) output-based GDP per capita series.) This is essentially the same time period over which structural transformation became rapid. It is also the time when Palma (2016) argues that the economy was becoming increasingly monetized. In line with the available evidence, Groth and Persson's (2016) model assumes that there was an increase in the number of days worked in a year from 210 to 293, thanks to an "industrious revolution" (de Vries 2008).[27] This assumption also underlies Broadberry et al.'s (2015) interpretation of what drove English economic growth at the time. However, this growth in days worked is not sufficient to reconcile the figures on growth with those on stagnating real wages. The model endogenously estimates wage trends across sectors thus implicitly relaxing one of the most counter-intuitive aspects of Broadberry et al.'s (2015) preferred interpretation: that productivity and income per capita but not wage rates were growing in early modern England. Relaxing this assumption implies casting doubts on the extent to which building and agricultural labourers' wages were representative of their sectors' incomes as a whole (Stephenson 2016). It also implies that economic growth was accompanied by increasing inequality – a claim that is consistent with Broadberry et al.'s position (2015: 329), as well as Milanovic et al.'s (2011) analysis of social tables.

IMPLICATIONS FOR PRODUCTIVITY

By definition, sectoral labour productivity is equal to the total output in each sector divided by the number of people employed in that sector. It follows that our estimates of sectoral occupational shares can be used to construct new series of sectoral labour productivity when combined with consumption or production data. In relatively closed economies, the simplest measure of agricultural productivity is the number of households each farming household is supporting. On this measure, in the 1530s each agricultural household in England was supporting 1.7 households, rising to 2.3

[26] After that date the assumption of self-sufficiency become increasingly dubious.
[27] Using figures in line with Humphries and Weisdorf's (2016: 22) recent estimates instead, i.e. 150 days in the sixteenth century rising to 250 days by c. 1700 does not affect the GDP per capita series. However, it implies a substantial downward revision of the growth of wage rates relative to that of income per capita, from 56 percent to 21 percent.

households by 1700; the figure was 2.4 in the Netherlands, 1.7 in Italy and 1.6 in France in 1700.[28] This comparison suggests that the levels of productivity of English agriculture were high but by no means extraordinary.

This number of households is, however, a rough measure of agricultural productivity, as it neglects variations in consumption per capita and the important role played by international trade in food in early modern countries such as Poland and the Netherlands. Taking into account the effects of food trade and of income differences on the size of demand, agricultural productivity in England was over a fifth above the average level in other European countries in the 1530s, rising to over three fourths above the European average by the 1750s (illustrated in figure S4).

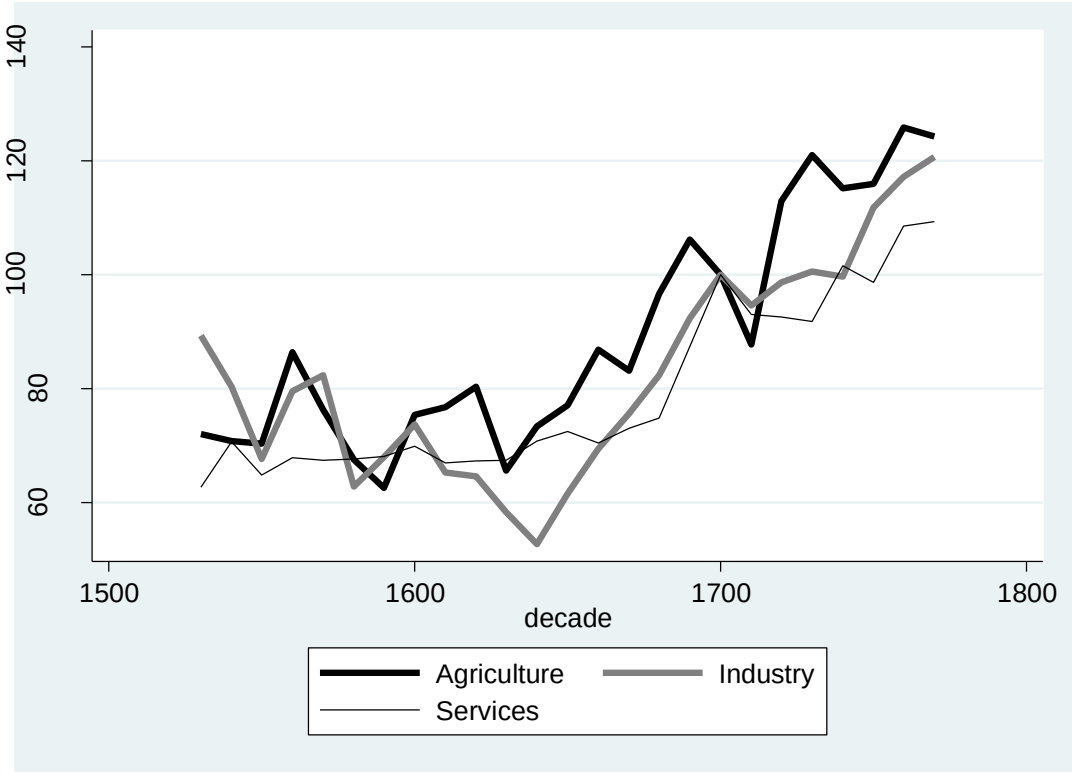
In other words, our figures imply that English agricultural productivity took a lead in Europe at an earlier date than detected by Allen (2000). Comparatively high productivity in agriculture from an early stage is consistent with the medieval commercialization and improvement in this sector (Britnell 1997, Campbell 2006), as well the precocious integration of the English wheat market (Chilosi et al. 2013; Clark 2015).

Perhaps the most significant implication of our estimates is that they show that industry was much more central to the economy's take-off from the mid-seventeenth century than argued by Broadberry et al. (2015: 364-369). Combining Broadberry et al.'s data on population and sectoral output and our adjusted series of sectoral shares, figure 6 maps out the development of productivity in agriculture, industry and services at ten-year intervals.[29]

Figure 6 shows that all three sectors experienced rapid rises in labour productivity between the 1630s and the beginning of the eighteenth century. In other words, agriculture, industry and services all contributed to bringing about sustained economic growth in England, for the first time since the aftermath of the Black Death (Broadberry et al. 2015: 208). By the early eighteenth century, however, diminishing returns set in and productivity growth slowed down across the three sectors. Not until the first of half of the nineteenth century did the English economy again see rates of productivity growth as fast as those of the 1630s-1700s (Broadberry et al. 2015: 367).

[28] The number of households is simply the reciprocal of the agricultural labour share. The agricultural shares in Europe are derived from Allen (2000: 11), linearly interpolating between 1500 and 1750.
[29] Since Broadberry et do not provide separate sectoral output figures for England, here and below we assume that in the eighteenth century English GDP per capita grew at the same rate as that of Britain.

Figure 6: Indexed trends in output per worker in England (1700-09=100)



Sources: see the Appendix 2 and the text.

The shift in the pace and direction of change that occurred around 1630 mean that it makes sense to break the 1522-1700 period, that Broadberry et al. were forced to treat as a single unit because of the dearth of sectoral estimates, into two parts: one part covers the period before 1630, the other runs from then until the first decade of the eighteenth century. Table 5 reports the yearly rates of growth in labour productivity in these two periods.

Our overall labour productivity estimates for 1530-1700 are essentially the same as those given by Broadberry et al., as they should be, given that we use their output estimates and largely agree on sectoral shares at the start and end of this period. Like them, we find that between the 1530s and the 1700s labour productivity growth was fastest in agriculture.

Table 5: Yearly rates of growth in labour productivity in England (in percentages)

	Beta*100		
	1530s-1700s	1530s-1620s	1630s-1700s
Agriculture	0.184***	0.049	0.647***
Industry	0.025	-0.283**	0.899***
Services	0.152***	0.038	0.471***
Total	0.175***	-0.021	0.755***

Note: Beta is the yearly rate of growth and is derived by regressing the natural logarithm of the productivity index against time; ***=significant at the 1 percent level, **=significant at the 5 percent level and *=significant at the 1 percent level.

Sources: see the Appendix 2 and the text.

However, when we look at the period after 1630, then we find that the rate of productivity growth in industry between the 1630s and the 1700s was significantly higher than in any other sector. Indeed, a rate of 0.90 was about as large as that seen during the Industrial Revolution: between 1759 and 1851 the corresponding figure was 0.93 (Broadberry et al. 2015: 367). This parallel is missed in Broadberry et al.'s longer periodization (1522-1700), which obscures a period of particularly poor performance for industry in the decades before the 1630s. These decades saw long bouts of depression for textile exports, as old trade routes in the North Sea closed and new ones in the Mediterranean Sea only slowly opened up, leading to waves of crises in industrial districts (Fisher 1940; Supple 1959; Lowe 1972; Munro 2007). While not denying the impressive gains made in agricultural productivity at the same time, our results suggest that so many Englishmen were willing to move into industry after 1630 because incomes in that sector were rising very rapidly.

CONCLUSION

In this paper we presented new estimates for the share of the male workforce in agriculture, industry and services in England and Wales from the 1530s to the 1780s based on probate records and apprenticeships. Both series show substantial declines in the share of the workforce in agriculture in England during the seventeenth century. Our econometric estimates indicate that the changing share of the population captured in the probate series is not driving our results: the results

are very close to those we generate with our baseline index linked to independent estimates. Moreover, our results are consistent with existing point estimates of sectoral distribution, trends in urbanization, and recent GDP estimates. They are internally consistent, mutually coherent, and can be successfully triangulated against other indicators. Broadberry et al. recently observed that 'the critical occupational migration from agriculture to industry commenced some time after 1522' (Broadberry et al. 2015: 369). Our estimates locate the start of this shift in the first half of the seventeenth century.

We argue that it is unlikely we are mistaken in identifying a substantial decline in the share in agriculture in the seventeenth century. Our data contains around 30 to 40 percent of deceased adult males in the seventeenth century. If the overall share of male workers in agriculture was to remain stable, as Clark et al. (2012) argued, then the share in agriculture among the poorer, less capital-rich section of society whom we do not observe in the probate or apprenticeship records would have to increase substantially. Assuming that the same share of the observed and the unobserved were in agriculture in 1600, then the share of the unobserved employed in agriculture would have to rise by twenty percent from 0.63 to 0.75 to keep the overall share in agriculture stable in 1700. At the same time, the "agricultural revolution" was transforming the rural economy of England, as capitalist relations of production and exchange asserted themselves. Moreover, the available evidence points to a gradual movement away from agriculture in continental Europe, too, during the early modern era. A dramatic shift into agriculture on the part of the unobserved part of the English labour force is therefore implausible.

Nonetheless, given the underlying issues with our data, it is useful to discuss the main implications of the paper in order of their reliability. First, given that we utilize a much expanded collection of the same data examined by Clark et al. (2012), we are confident that their argument that the share of England's workforce employed in agriculture remained largely stable during the sixteenth and seventeenth centuries was mistaken. Second, both our series show that a major decline in the agricultural share of the male workforce began soon after 1600 and quickened around the middle of the century. Taken purely as proxies for occupational trends, they provide strong evidence for the timing of this inflection point in English structural change. Third, our adjusted probate estimates (table 4) offer a new set of independent estimates for occupational shares that indicate a decline in the share of the male workforce in agriculture in England from around 68 percent in 1600, to around 48 percent in the early eighteenth century. People left farming in most parts of England, both in the North and South, but not all went to cities. The share of the workforce employed in industry and

services increased substantially in both rural and urban areas. Most of England's transition out of agriculture was complete by the end of the seventeenth century. During the English economic take-off of the mid-seventeenth century, productivity was rising in all sectors, but industry was the sector with the fastest growth. Indeed, its pace of change was as high as during the Industrial Revolution. Our figures also suggest that growth in the seventeenth century was built upon earlier developments: England had inherited a particularly commercialized and productive agriculture, as well as a developed rural proto-industry, from the middle ages.

Needless to say, our results fit poorly with the argument that England was in some ways stuck in a stagnant, barely changing equilibrium. However, our account of Wales is perhaps not too far from that image. Certainly, there is little sign that Wales experienced a transformation of the kind apparent in England, implying that British economic development was accompanied by divergence across the island.

REFERENCES

Alexander, James. “The economic structure of the City of London at the end of the seventeenth century”. *Urban History Yearbook* (1989): 47-62

Allen, Robert C. "Economic Structure and Agricultural Productivity in Europe, 1300-1800". *European Review of Economic History* 4, no. 1 (2000): 1-25.

———. "The Great Divergence in European Prices and Wages from the Middle Ages to the First World War." *Explorations in Economic History* 38, no. 4 (2001), pp. 411-447.

———. 2004. Agriculture during the industrial revolution, 1700-1850. In *The Cambridge Economic History of Modern Britain, Volume 1: Industrialisation 1700-1861*, edited by Roderick Floud and Paul Johnson, 96-115. Cambridge: Cambridge University Press, 2004.

———. 2005. English and Welsh Agriculture, 1350-1800: Output, Inputs, and Income. Mimeo.

Bairoch, Paul. *La Population des Villes Européennes 800-1850: Banque de Données et Analyse Sommaire des Résultats*. Genève : Droz, 1988.

Beier, A. L. "Engine of Manufacture: The Trades of London." In *The Making of the Metropolis: Essays in the Social and Economic History of London, 1500-1700*, edited by A. L. Beier and Roger Finlay, 141-67. London: Longman, 1986.

Britnell, Richard. *The Commercialisation of English Society, 1000-1500*. Manchester : Manchester University Press, 1997.

Broadberry, Stephen., Bruce M. S. Campbell, Alexander Klein, Mark Overton, and Bas van Leeuwen. *British Economic Growth, 1270-1870*. Cambridge: Cambridge University Press, 2015.

Broadberry, Stephen, Bruce M. S. Campbell, and Bas van Leeuwen. "When Did Britain Industrialise? The Sectoral Distribution of the Labour Force and Labour Productivity in Britain, 1381–1851." *Explorations in Economic History* 50, no. 1 (2013): 16-27.

Broadberry, Stephen. Accounting for the Great Divergence. LSE Economic History Working Paper No. 184/2013, 2013.

Andy Burn, “Wage Labour, Wealth and the Power of a Database: Unlocking Communities of Work Outside Urban Guilds in Newcastle upon Tyne,” in *Cities and Solidarities: Urban Communities in Pre-Modern Europe*, edited by Justin Colson and Arie van Steensel (Abingdon: Routledge, 2017).

Campbell, Bruce M. S. *English Seigniorial Agriculture*. Cambridge: Cambridge University Press, 2006.

Chilosi, David, Tommy E. Murphy, Roman Studer, and A. Coşkun Tunçer. "Europe’s Many Integrations: Geography and Grain Markets, 1620-1913. " *Explorations in Economic History* 50, no. 1 (2013): 46-68.

Clark, Gregory. "The Condition of the Working Class in England, 1209-2004. " *The Journal of Political Economy* 113, no. 6 (2005): 1307-1340.

———. *A Farewell to Alms : A Brief Economic History of the World*. Princeton, N.J.: Princeton University Press, 2007a.

———. "The Long March of History: Farm Wages, Population and Economic Growth, England, 1209-1869. " *The Economic History Review* 60, no. 1 (2007b): 97-135.

———. "1381 and the Malthus Delusion." *Explorations in Economic History* 50, no. 1 (2013): 4-15.

———. "Markets before Economic Growth: The Grain Market in Medieval England." *Cliometrica* 9, no. 3 (2015): 265-287.

Clark, Gregory, Michael Huberman, and Peter H. Lindert. "A British Food Puzzle, 1770-1850." *The Economic History Review* 48, no. 2 (1995): 215-237.

Clark, Gregory, Joseph Cummins, and Brock Smith. "Malthus, Wages, and Preindustrial Growth." *Journal of Economic History* 72, no. 2 (2012): 364-92.

Crafts, Nicholas F. R. "Patterns of Development in Nineteenth Century Europe."*Oxford Economic Papers* 36, no. 3 (1984): 438-458.

———. *British Economic Growth During the Industrial Revolution*. Oxford: Clarendon, 1985.

De Vries, Jean. *Eureopean Urbanization, 1500-1800*. London : Methuen, 1984.

———. *The Industrious Revolution: Consumer Behavior and the Household Economy, 1650 to the Present*. Cambridge, UK and New York: Cambridge University Press, 2015.
Deane, Phyllis, and W. A. Cole. *British Economic Growth, 1688-1959*. Cambridge: Cambridge University Press, 1962.
Federico, Giovanni. "The Holy Grail of Economic History: Long-Run Economic Growth and the Industrial Revolution in Britain." *Rivista di Storia Economica* 32, no. 1 (2016), 119-133.
Field, Jacob F. "Domestic Service, Gender, and Wages in Rural England, C.1700–1860." *The Economic History Review* 66, no. 1(2012): 249-272.
Fisher, Frederick J. "Commercial Trends and Policies in Sixteenth-Century England." *The Economic History Review* 10, no. 2 (1940): 95-117.
Floud, Roderick, Robert W. Fogel, Bernard Harris, and Sok Chul Hong. *The Changing Body: Health, Nutrition, and Human Development in the Western World since 1700*. Cambridge: Cambridge University Press, 2012.
Goose, Nigel, and Nesta Evans. "Wills as an Historical Source." In *When Death Do Us Part: Understanding and Interpreting the Probate Records of Early Modern England*, edited by Tom Arkell, Nesta Evans and Nigel Goose, 38-72. Oxford: Leopard's Head Press, 2000.
Groth, Christian, and Karl Gunnar Persson. Growth or Stagnation in Pre-Industrial Britain? A Revealed Income Growth Approach. University Of Warwick CAGE ESRC Working Paper no. 264, 2016.
Harding, Vanessa. "The population of London, 1500-1700: a review of the published evidence." *London Journal* 14, no. 2 (1990): 111-128
Humphries, Jane, and Jacob Weisdorf. Unreal Wages? A New Empirical Foundation for the Study of Living Standards and Economic Growth in England, 1260-1860. University Of Warwick CAGE ESRC Working Paper no. 310, 2016.
Jenkins, Geraint H. *The Foundations of Modern Wales: Wales 1642-1780*. Oxford: Oxford University Press, 1987.
Keibek, Sebastian A. J. Using Probate Data for Estimating Historical Male Occupational Structures. University of Cambridge Occupations Project Paper 27, Cambridge: Cambridge Group for the History of Population and Social Structure, 2016a.
———. From probate inventories to households: correcting the probate record for wealth bias. Occupations Project Paper 29, Cambridge: Cambridge Group for the History of Population and Social Structure, 2016b.
———. By-employments and Occupational Structure in Pre-industrial England. Occupations Project Paper 30, Cambridge: Cambridge Group for the History of Population and Social Structure, 2016c.
Keibek, Sebastian A. J., and Leigh Shaw-Taylor. "Early Modern Rural by-Employments: A Re-Examination of the Probate Inventory Evidence." *Agricultural History Review* 61, no. 2 (// 2013): 244-81.
Kussmaul, Ann S. *Servants in Husbandry in Early Modern England*. Cambridge: Cambridge University Press, 1981.
Langton, John. "Urban Growth and Economic Change : From the Late Seventeenth Century to 1841." In *The Cambridge Urban History of Britain, Vol. 2: 1540-1840*, edited by Peter Clark. Cambridge: Cambridge University Press, 2000.
Leunig, Tim, Chris Minns, and Patrick Wallis. "Networks in the Premodern Economy: The Market for London Apprenticeship, 1600-1749." *The Journal of Economic History* 71, no. 2 (2011): 413-443.
Lindert, Peter H. "An Algorithm for Probate Sampling." *The Journal of Interdisciplinary History* 11, no. 4 (1981): 649-68.
Lindert, Peter H., and Jeffrey G. Williamson. "Revising England's Social Tables 1688–1812." *Explorations in Economic History* 19, no. 4 (1982): 385-408.

Lowe, Norman. *The Lancashire Textile Industry in the Sixteenth Century*. Manchester: Chetham Society, 1972

Milanovic, Branko, Peter H. Lindert, and Jeffrey G. Williamson. "Pre-industrial Inequality." *The Economic Journal* 121, issue 551 (2011): 255-272.

Minns, Chris, and Patrick Wallis. "The Price of Human Capital in a Pre-Industrial Economy: Premiums and Apprenticeship Contracts in 18th Century England." *Explorations in Economic History* 50, no. 3 (2013): 335-50.

———. "Rules and Reality: Quantifying the Practice of Apprenticeship in Early Modern England." *Economic History Review* 65, no. 2 (2012): 556–79.

Munro, John H. Entrepreneurship in Early Modern Europe (1450-1750): An Exploration of Some Unfashionable Themes in Economic History. Mimeo, 2007.

Nuvolari, Alessandro, and Mattia Ricci. "Economic Growth in England, 1250-1850: Some New Estimates Using a Demand Side Approach". *Rivista di Storia Economica* 29, no. 1 (2013): 31-54.

Owen, Leonard. "The population of Wales in the sixteenth and seventeenth centuries". *Transactions of the Honourable Society of Cymmrodorion* (1958): 99-113.

Palma, Nuno. Money and Modernization: Liquidity, Specialization and Structural Change in Early Modern England. EUI Max Weber Programme Working Papers no. 2016/11, 2016.

Papke, Leslie E., and Jeffrey M. Wooldridge. "Econometric Methods for Fractional Response Variables with an Application to 401(K) Plan Participation Rates." *Journal of Applied Econometrics* 11, no. 6 (1996): 619-632.

Rodgers, N.A.M. *The Command of the Ocean: A Naval History of Britain, 1649-1815*. London: Penguin, 2004.

Shaw-Taylor, Leigh, Anthony E. Wrigley, Peter M. Kitson, Ros Davies, Gill Newton, Max Satchell. The Occupational Structure of England, *c.* 1710-1871. Occupations Project Paper 22, Cambridge: Cambridge Group for the History of Population and Social Structure, 2010.

Schwarz, Leonard D. *London in the Age of Industrialisation: Entrepreneurs, Labour Force and Living Conditions, 1700-1850*. Cambridge: Cambridge University Press, 1992.

Stephenson, Judy Z. "'Unreal Wages?' Contractors, workers and pay in London building trades, 1650-1800." *Economic History Review*, online early (2017)

Supple, Barry E. *Commercial Crisis and Change in England, 1600-42: A Study in the Instability of a Mercantile Economy.* Cambridge: Cambridge University Press.

Williams, G. *Renewal and Reformation: Wales C.1415-1642*. Oxford: Oxford University Press, 1993.

Wrigley, E. Anthony. "Urban Growth and Agricultural Change: England and the Continent in the Early Modern Period." *Journal of Interdisciplinary History* 15, no. 4 (1985): 638-728.

———. *Poverty, Progress, and Population*. Cambridge, UK and New York: Cambridge University Press, 2004.

———."English County Populations in the Later Eighteenth Century." *The Economic History Review* 60, no. 1 (2007): 35-69.

———. "Rickman Revisited: The Population Growth Rates of English Counties in the Early Modern Period1." *The Economic History Review* 62, no. 3 (2009): 711-35.

Wrigley E. Anthony, and Roger S. Schofield. *The Population History of England 1541-1871: A Reconstruction*. Revised ed. Cambridge: Cambridge University Press.

Zell, Michael L. "The Social Parameters of Probate Records in the Sixteenth Century," *Bulletin of the Institute of Historical Research* 57, no. 135 (1984): 107–13.

Appendix 1: The Probate and Apprenticeship Datasets

To construct our probate dataset, we utilized the range of published and digital data listed below. We include data from a county if we can meet three criteria. First, we possess probate records for over 75 percent of the county's geographical area for each of the three levels of probate jurisdiction (archdeaconry or equivalent, consistory and prerogative court) that could receive wills. Second, wills survive for more than ten percent of male deaths; figure S1 reports the share of deaths generating a probate record by county over time. Third, an occupation is reported for more than ten percent of male probate records; we identify gender based on status indicators (eg: widow) and forenames.[30] These criteria excluded many printed probate records where the authors of printed indexes omitted occupations. Finally, we excluded observations for records reporting titles not occupations (eg: "gentleman"). We coded occupations using Wrigley's (2004) Primary Secondary Tertiary system. We allocate individuals to agriculture if their occupation is coded as farming or fishing in PST; to industry if they were in secondary sector occupations (plus mining); and to services if they followed any of PST's retailing, distribution and service occupations. This distribution matches that of Broadberry et al and Shaw-Taylor et al, but differs slightly (and unimportantly) from that used by Clark et al.[31] Like Broadberry et al and Shaw-Taylor et al, we allocate labourers to agriculture if they are located outside towns, as defined by Langton's (2000) list.[32] In our core sample, we are able to code 98.9 percent of occupational labels.

The apprentices' fathers' dataset is based on a large sample of London guild records. The majority of the dataset was originally extracted by Cliff Webb and is described in Leunig, Minns and Wallis (2011). Additional material for the Merchant Taylors has been supplied by Michael Scott. Material for several other guilds is taken from the Records of London Livery Companies Online database (www.rollco.org), which has been kindly supplied by the Centre for Metropolitan History. We include data for counties in decades when they supplied an average of more than ten apprentices each year for whom we are able to code their father's occupation as within agriculture, industry or services, as

[30] We allocate the small share (3.4 percent) without a gender identified through forename matching to males, as further checking indicates that individuals in this group almost all have rare variants on spellings of male forenames. Our results are robust if the sample is restricted to males only.

[31] Several of the occupations Clark et al identify as farming and fishing are placed in other sectors under the PST system (farrier, dredger, seedsman, hop dealer, hayman, drover, groom, veterinary surgeon). One, scavelman, is uncategorised. We have tested Clark et al's categorisation and the results are not meaningfully different.

[32] The effect of the technique we choose to allocate labourers between sectors is relatively trivial here. Labourers only appear in small numbers. Overall, labourers supply 3.2 percent of male probates: the highest share is 5.6 percent of male probates in 1610-19.

above, giving us a minimum of 100 observations per county per decade. Some counties, all those in Wales, Cornwall, and the far north, such as Durham, are usually excluded as a result. We exclude the period after 1759, as there are fewer than ten counties meeting this criteria after that point.

Probate sources:

Bedfordshire	Alan F. Cirket, *Index of Bedfordshire Probate Records 1484-1858*, ed. by Joan Stuart and Peggy Wells, The Index Library, 105 (London: British Record Society, 1994)
Berkshire	Berkshire Family History Society, *Berkshire Probate Index, 1480-1857*, 2012
Buckinghamshire	Hunt, Julian, Roger Bettridge, and Alison Toplis, eds., *Probate Records of the Archdeaconry Court of Buckingham, 1483-1660 and of the Buckinghamshire Peculiars, 1420-1660*, The Index Library, 114 (London: British Record Society, 2001)
Cambridgeshire	Thurley, Clifford A., and Dorothea Thurley, eds., *Index of the Probate Records of the Court of the Archdeacon of Ely, 1513-1857*, The Index Library, 88 (London: British Record Society, 1976) Thurley, Clifford A., and Dorothea Thurley, *Index of the Probate Records of the Consistory Court of Ely, 1449-1858*, ed. by Rosemary Rodd and E. S. Leedham-Green, The Index Library, 103, 106, 107 (London: British Record Society, 1994). Dataset formerly available at http://venn.csi.cam.ac.uk/Probates/ [accessed 7/6/2013] (no longer available)
Cheshire, Lancashire	Cheshire Archives and Local Studies, *Chester probate records 1519-1858*, http://archivedatabases.cheshire.gov.uk/RecordOfficeWillEPayments/search.aspx [accessed 25/4/2016]
Cumberland, Westmorland	Cumbria Archive Service, CASCAT, http://www.archiveweb.cumbria.gov.uk/CalmView/Record.aspx?src=CalmView.Catalog&id=PROB [accessed 25/4/2016]
County Durham, Northumberland	Durham University Library, North East Inheritance Database, http://familyrecords.dur.ac.uk/nei/data/simple.php [accessed 25/4/2016]
Essex, Hertfordshire	Essex Record Office, Essex Records Online, http://seax.essexcc.gov.uk/ [accessed 25/4/2016] London Metropolitan Archives, *Volunteer projects - Diocese of London Consistory Court Wills*, https://www.cityoflondon.gov.uk/things-to-do/london-metropolitan-archives/about/Pages/volunteer-wills-project.aspx [accessed 25/4/2016]
Hampshire	Hampshire Archives and Local Studies, *CALM*, http://calm.hants.gov.uk/ [accessed 25/4/2016]
Herefordshire	Cliff Webb, Index to Hereford Wills 1500-1700 (unpublished private notes, 2008)
Hertfordshire	Crawley, Beryl, and Cliff Webb, eds., *Wills at Hertford 1415-1858*, Index Library, 120 (London: British Record Society, 2007)
Lancashire, Westmorland	Lancashire Archives, *LANCAT*, http://www.lancashire.gov.uk/libraries-and-archives/archives-and-record-office/search-the-archives/lancat.aspx [accessed 25/4/2016]

Oxfordshire	Oxfordshire Wills Index 1516-1857, origins.net, http://www.origins.net/help/aboutNWI-oxf.aspx [accessed 28/03/2014] (now available via Findmypast)
Suffolk	Grimwade, M. E., W. R. Serjeant, and R. K. Serjeant, eds., *Index of the Probate Records of the Court of the Archdeacon of Suffolk, 1444-1700*, The Index Library, 90-91 (Keele, Staffordshire: British Record Society, 1979) Serjeant, W. R., and M. E. Grimwade, eds., *Index of the Probate Records of the Court of the Archdeacon of Sudbury, 1354-1700*, The Index Library, 95-96 (Keele, Staffordshire: British Record Society, 1984) Norfolk Record Office, *NROCAT*, http://nrocat.norfolk.gov.uk/DServe/public/searches/nroprobate.htm [accessed 25/4/2016]
Surrey	Surrey & South London Will Abstracts 1470-1858, eds. origins.net and Cliff Webb, http://www.origins.net/help/aboutNWI-surrwills.aspx [accessed 23/02/2014] (now available via Findmypast)
Wiltshire	Webb, Cliff, ed., *Wills at Salisbury 1464-1858*, The Index Library, 122, 123, 123A (London: British Record Society, 2009)
Warwickshire	Webb, Cliff, ed., *Wills in the Consistory Court of Lichfield 1650-1700*, The Index Library, 125 (London: British Record Society, 2010)
Worcestershire, Warwickshire	Fry, Edw Alex, ed., *Calendar of Wills and Administrations in the Consistory Court of the Bishop of Worcester, 1451-[1652]: Also Marriage Licenses and Sequestrations Now Deposited in the Probate Registry at Worcester*, The Index Library, 31,39 (London: British Record Society, 1904-1910)
Wales	National Library of Wales, *Wills Online*. https://www.llgc.org.uk/discover/nlw-resources/wills/ [accessed 25/4/2016]
(Province of Canterbury)	The National Archives, 'Prerogative Court of Canterbury Wills, 1384-1858' (UK Data Service, 2004) <http://discover.ukdataservice.ac.uk/catalogue/?sn=4816> [accessed 27 August 2013]
(Province of York)	*Index of Wills in the York Registry* [1389-1688], Yorkshire Archaeological Society, vols. 11,14,19,22,24,26,28,32,35, 49,60, 68, 89. (Worksop, 1888-1934)

Appendix 2: The Regression

Under the baseline specification:

$$\vartheta_{sit}=exp(\alpha+d_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})/[1+ exp(\alpha+d_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})]+u_{sit} \quad A1)$$

Where ϑ_{sit} is the sectoral share from the probate record in sector *s* (agriculture, industry and services, respectively), county *i* and time *t*, α is a constant, d_{si} is a county/sector dummy, β_{1si} and β_{2si} are the coefficients of the county/sector quadratic trends, β_{3s} is the main coefficient of interest and δ_{it} is the share of deaths covered by the probate record. The derivative with respect to each variable is equal to its coefficient times $exp(z)/[1+exp(z)]^2$, where $exp(z)/[1+exp(z)]$ is the fitted value. At the sample mean of the dependent variable, which by definition is equal to one third, $exp(z)/[1+exp(z)]^2=0.222$ for all sectors. Therefore at this value the condition that the marginal effects of time and share of deaths covered cancel themselves out across sectors simplify into:

$$\beta_{13i}=-\beta_{11i}-2\beta_{21i}t- \beta_{12i}-2\beta_{22i}t-2\beta_{23i}t \quad A2)$$

And:

$$\beta_{33}=-\beta_{31}-\beta_{32} \quad A3)$$

Substituting these conditions into A1) for *s=3* and re-arranging yields:

$$\vartheta_{sit}=exp[\alpha+d_{3i}+\beta_{11i}(-t)+\beta_{12i}(-t)+\beta_{21i}(-2t^2)+\beta_{22i}(-2t^2)-\beta_{23i}(-2t^2)+\beta_{31}(-\delta_{it})+\beta_{32}(-\delta_{it})]/\{1+exp[\alpha+d_{3i}+\beta_{11i}(-t)+\beta_{12i}(-t)+\beta_{21i}(-2t^2)+\beta_{22i}(-2t^2)-\beta_{23i}(-2t^2)+\beta_{31}(-\delta_{it})+\beta_{32}(-\delta_{it})]\}+u_{si\,t} \quad A4)$$

Table A1 shows the results. The first column shows the baseline specification; the second one allows the coefficient of the share of deaths covered (β_{3s}) to vary across decades; the third one only include data up to the 1750s. It is straightforward to compute the key coefficient for services with *A3)* and for reasons of space its values are not presented here.

Table A1: Shares of deaths covered and sectoral shares in the probate record: generalised linear regression analysis for fractional response variables

Sector	Period	(1)	(2)	(3)
Agriculture	1540-1809	0.301		
		(4.90)***		
	1540-1759			0.242
				(4.82)***
	1540-1549		-1.679	
			(-3.58)***	
	1550-1559		-0.011	
			(-0.07)	
	1560-1569		-0.238	
			(-0.91)	
	1570-1579		-0.227	
			(-1.33)	
	1580-1589		0.066	
			(0.92)	
	1590-1599		0.404	
			(7.12)***	
	1600-1609		0.143	
			(6.40)***	
	1610-1619		-0.080	
			(-6.84)***	
	1620-1629		-0.236	
			(-9.09)***	
	1630-1639		-0.278	
			(-6.97)***	
	1640-1649		-1.092	
			(-5.36)***	
	1650-1659		-0.105	
			(-1.57)	
	1660-1669		-0.965	
			(-9.07)***	
	1670-1679		-0.948	
			(-8.75)***	
	1680-1689		-1.170	
			(-8.74)***	
	1690-1699		-1.076	
			(-7.37)***	
	1700-1709		-1.211	
			(-7.35)***	
	1710-1719		-0.659	
			(-8.26)***	
	1720-1729		0.051	
			(1.16)	
	1730-1739		-0.483	
			(-16.04)***	
	1740-1749		-1.122	
			(-14.73)***	
	1750-1759		-0.148	
			(-2.44)***	
	1760-1769		1.102	

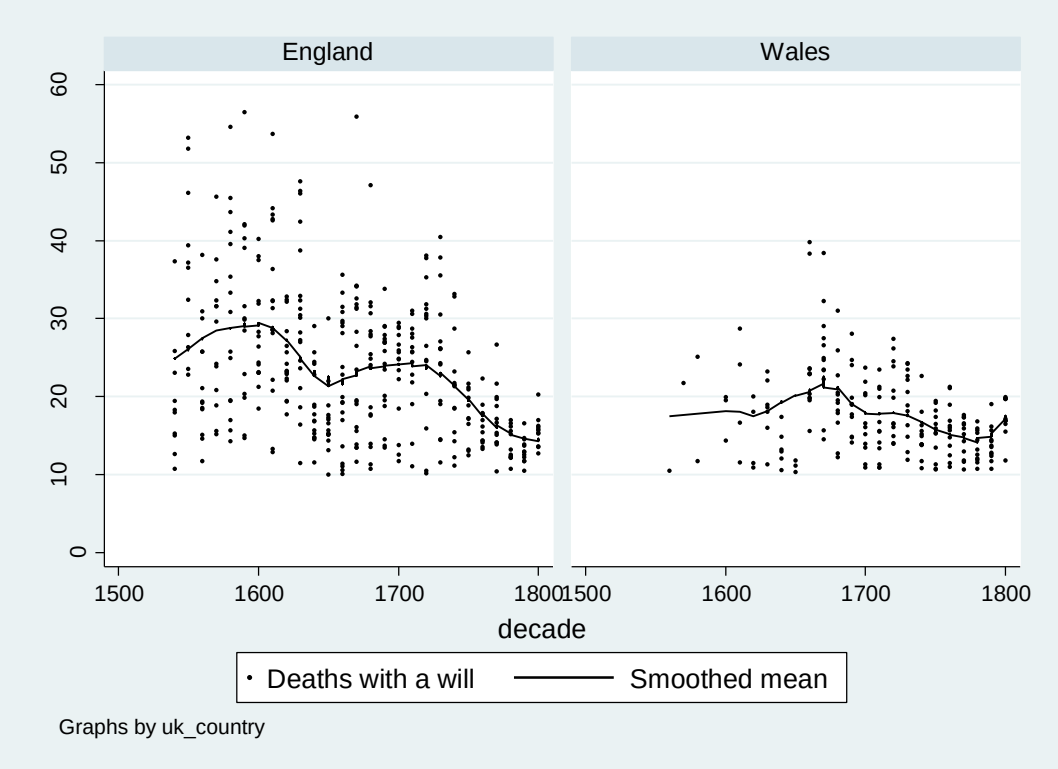
			(4.70)***	
	1770-1779		2.528	
			(6.77)***	
	1780-1789		4.459	
			(6.95)***	
	1790-1799		5.770	
			(6.87)***	
	1800-1809		5.644	
			(6.91)***	
Industry	1550-1809	0.407		
		(5.0)***		
	1550-1759			0.359
				(5.18)***
	1540-1549		-1.750	
			(-2.40)**	
	1550-1559		-1.145	
			(-4.53)***	
	1560-1569		-0.704	
			(-1.88)*	
	1570-1579		-0.211	
			(-0.90)	
	1580-1589		-0.187	
			(-1.82)*	
	1590-1599		-0.025	
			(-0.55)	
	1600-1609		0.048	
			(5.85)***	
	1610-1619		0.209	
			(26.59)***	
	1620-1629		0.221	
			(6.48)***	
	1630-1639		0.156	
			(3.32)***	
	1640-1649		0.178	
			(0.75)	
	1650-1659		-0.348	
			(-4.81)***	
	1660-1669		0.796	
			(6.82)***	
	1670-1679		0.742	
			(6.35)***	
	1680-1689		0.913	
			(6.48)***	
	1690-1699		0.645	
			(4.27)***	
	1700-1709		0.628	
			(3.75)***	
	1710-1719		0.595	
			(9.25)***	
	1720-1729		0.597	
			(7.71)***	

1730-1739	0.833		
	(162.73)***		
1740-1749	1.132		
	(26.95)***		
1750-1759	1.192		
	(9.90)***		
1760-1769	1.284		
	(3.94)***		
1770-1779	0.214		
	(0.44)		
1780-1789	0.031		
	(0.04)		
1790-1799	-0.052		
	(-0.05)		
1800-1809	-0.172		
	(-0.17)		
County/sector fixed effects	Yes	Yes	Yes
Quadratic county/sector trends	Yes	Yes	Yes
N	1800	1800	1446

Note: ***=significant at the 1 percent level, **=significant at the 5 percent level and *=significant at the 1 percent level, *N*=sample size. Clustered standard errors allow for arbitrary correlation within sectors; the *z-statistics* are in parentheses.

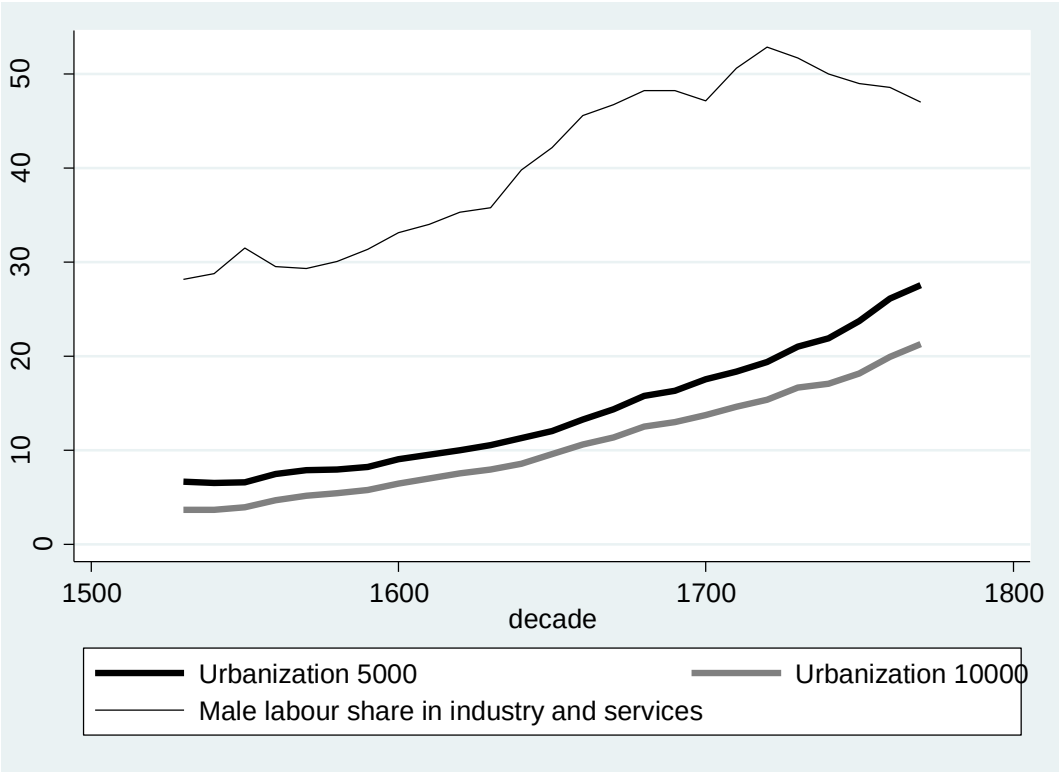
S1: Online Appendix: Supplementary Figures

Figure S1: Share of male deaths in the probate dataset.



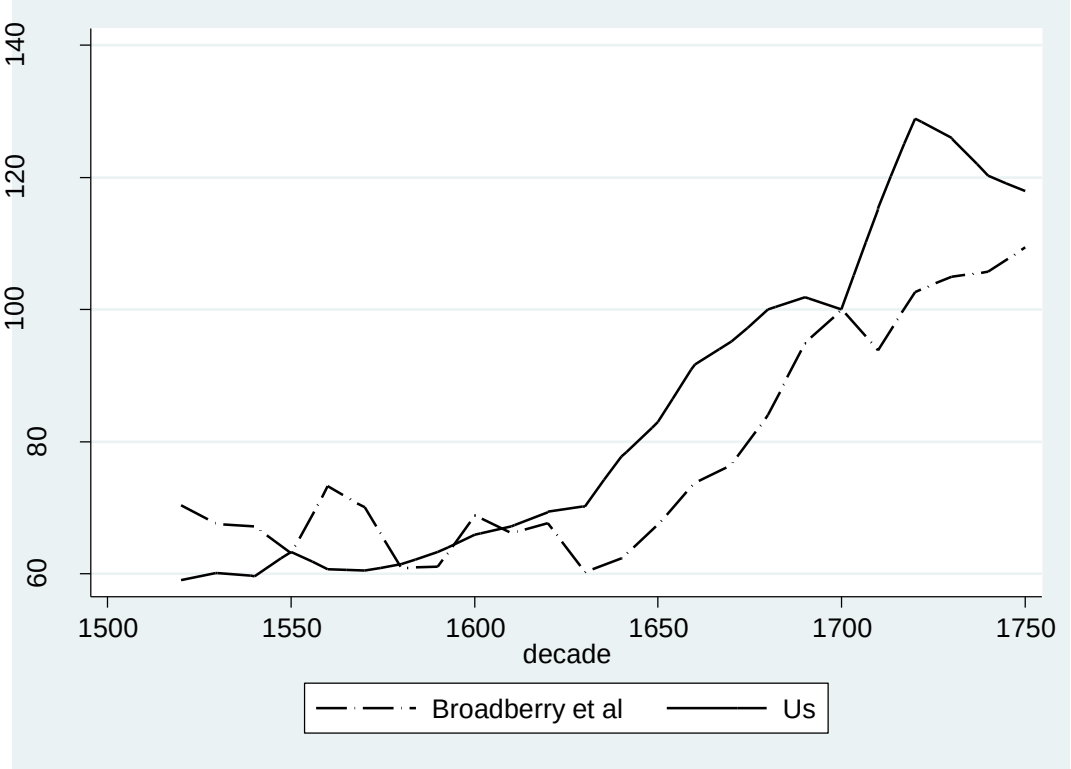
Note: The figure reports the share of male deceased with appearing in our probate sample. We used Clark's method to estimate male deaths per decade (see Clark et al 2012: 368). The smoothed mean is generated by a locally weighted regression line.

Figure S2: Urbanization and male labour share in industry and services



Notes: the urbanization rates are equal to the population living in cities divided by the total population. The population figures are linearly interpolated between benchmark years. "Urbanization 5000" uses 5000 inhabitants as the threshold to define a city; "Urbanization 10000" uses 10000 inhabitants as the threshold to define a city.
Sources: city populations: de Vries (1984); Bairoch (1988). England population: Wrigley et al (1997: 614-615); Broadberry et al's (2015) online database at: https://www.nuffield.ox.ac.uk/People/sites/stephen.broadberry/SitePages/Biography.aspx. Male labour share: see the Appendix 2 and the text.

Figure S3: Indexed real GDP per head in England, 1530s-1750s (1700=100)



Note: After 1700 Broadberry et al's (2015) estimate refers to Britain.

Figure S4: Indexed output per worker in agriculture in England relative to the mean in the rest of Europe (England in the 1530s=100)

Notes: The figures are based on table 8 in Allen (2000: 20). The 1530s point is linearly interpolated on the basis on the 1500 and 1600 point estimates. Our ratios substitute Allen's with our agricultural share estimates.
Sources: Allen (2000: 20); see the text and the Appendix 2.

Appendix S2: Technical appendix

This appendix expands on two of the potential problems of bias that we face in using probate records: variation in death rates across sectors and wealth bias.

(a) Variation in Adult Death Rates

One source of potential in the probate record stems from the fact that if the adult death rate differs across sectors, sectoral shares amongst the dead and hence in the probate record only imperfectly mirror sectoral shares in society at large. As sectors with a high (low) death rate will be over- (under-) represented, the size of the bias increases with the ratio between the sector-specific death rate and that in society at large. Formally:

$$s_S = (\frac{\omega_s}{\omega})^{-1}\vartheta_s \qquad \text{A1)}$$

Where s_s is the sectoral share in sector *s* (agriculture, industry and services, respectively), ω_s is the adult death rate in sector *s*, un-subscripted ω is the death rate in society at large, and ϑ_s is the sectoral share in sector *s* in the probate record.

How big is this bias in the context of early modern England? Here we have to consider two effects: income effects are expected to cause a positive bias in the agriculture share; the urban mortality penalty should have an opposite effect. As our agricultural share is comparatively low, we are particularly concerned about the latter effect and indeed Wrigley et al. (1997: 202-203) argue that in early modern England the urban/rural divide mattered more than income for mortality. A comparison between their estimates and those reported by Woods (2003: 36) suggests that the ratio between life expectancy in the countryside and in the city is a good guide to ratios between mortality rates: for Woods life expectancy in the early modern English country-side was about 1.5 times that in the city; for Wrigley et al. levels of mortality in the city may have been 60 per cent higher than in the country-side. Much of the difference was due to infant mortality and Woods' (2003: 36) figures also imply that life-expectancy at 15 - which is the relevant one for the work-force - in early modern London was about 90 per cent of that of England. If anything we expect the London figure to provide an upper bound of the urban penalty, given that this increased with population density. The figures thus suggest that for adults (people aged 15 or more) c. 1.10 (as 1/0.9=1.11) is a reasonable estimate of mortality rates in the city relative to England.

This is confirmed also by available data on age-specific mortality probabilities. Landers (1993: 172) reports figures for London in 1730-49, which can be compared with those reported for England at the same time by Wrigley et al (1997: 262, 290), interpolating as they do with Brass' (1971) method

for the intervals between 15 and 25. Comparison with adult life expectancy in other decades (Wrigley et al 1997: 290) suggests that there is nothing unusual about 1730-49 in terms of mortality. Within each age-interval the crude death rate is the mortality probability divided by the length of the interval. The overall adult crude death rate in London and England is the weighted average of the crude death rates of the intervals from age 15 onwards, where the weights are given by the proportion of the adult population covered by each age interval. The latter are drawn from Wrigley and Schofield's (1989: 218) estimates of the age structure of England in 1696 (assuming for simplicity that nobody is older than 75). The resulting adult crude death rates in London and England are 25.60 per thousand and 21.59, yielding a ratio of 1.18.

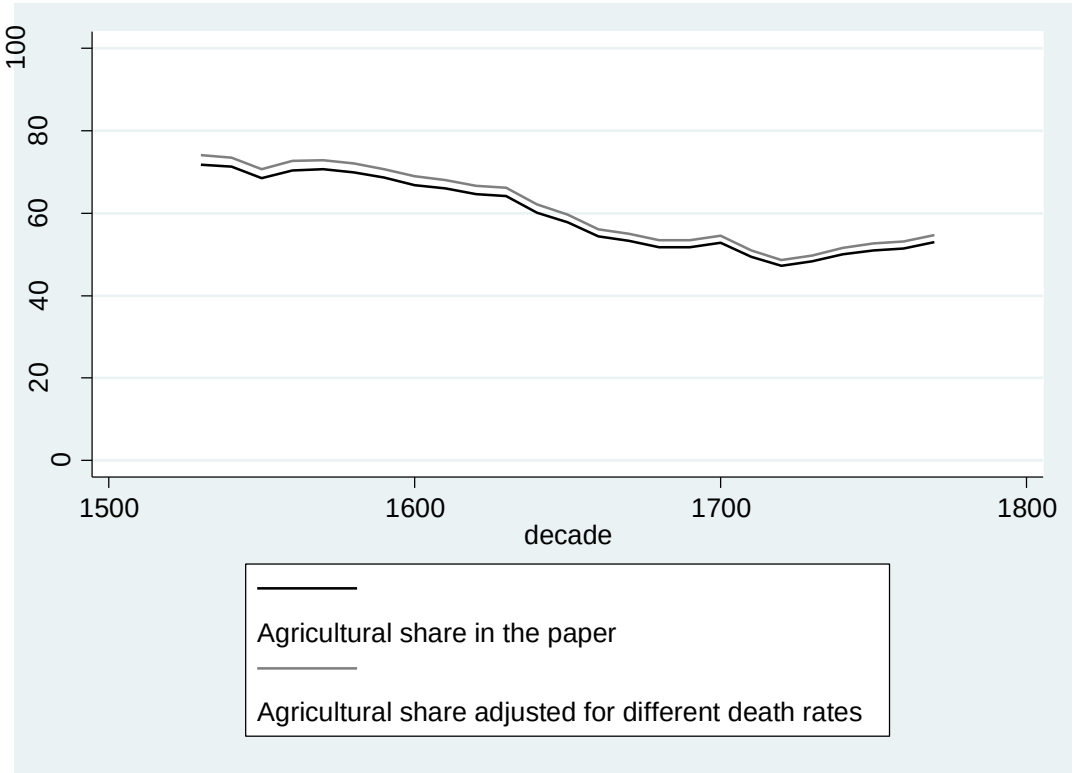
The crude death rate in England is equal to the weighted average between the death rate in the cities and that in the countryside, where the weights are defined by the urbanization rate. It follows that:

$$\omega_r = \frac{\omega - \omega_u U}{(1-U)} \qquad \text{A2)}$$

Where ω_r and ω_u are the adult death rates in the country-side and in the city respectively, U is the urbanization rate. Given that in our period on average the urbanization rate was about 14 percent, equation A1) and the estimated adult crude death rates imply an adult crude death rate in the country-side of 20.93 per thousand, which yields a rate with the national one of 97 per cent. The following graph compares our agricultural share (balanced sample) with that adjusted for different death rates in the country-side and the city using this value and equation A1):

The difference is very modest (less than 2 percentage points on average) and the two plots tell the same story. It is therefore safe to neglect the urban mortality penalty for the purpose of the analysis, particularly as this is an upper bound of the adjustment needed.

Figure S2.1: Agricultural share in the paper and adjusting for different adult death rates in the country-side and the city



Sources: see Appendix 2 and the text.

(b) *Wealth bias in the probate record*

The key source of bias in the probate record is that only people with wealth and/or capital to bequeath are likely to appear in it. The size of this bias increases with the ratio between the fraction of deaths leaving a will in each sector and that in society at large. Formally:

$$s_s - \vartheta_s = s_s \left[1 - \frac{\delta_s}{\sum_s \delta_s s_s}\right] \qquad \text{A3)}$$

Where s_s is the sectoral share in sector *s*, ϑ_s is the sectoral share in sector *s* in the probate record, and δ_s is the share of deaths leaving a will in sector *s*. Only the society-wide fraction of deaths leaving a will, $\sum_s \delta_s s_s$, is known. However, the sector-specific fractions of deaths with a probate record can be computed on the basis of how sectoral shares in the probate record vary with the share of deaths leaving a will. In fact, the relationship between the two variables can be estimated by running the following regression:

$\vartheta_{sit}=exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})/[1+ exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})]+u_{sit}$ A4)

Where ϑ_{sit} is the sectoral share from the probate record in sector *s*, county *i* and time *t*, α_{si} is a county/sector constant, β_{1si} and β_{2si} are the coefficients of the county/sector quadratic trends, β_{3s} is the main coefficient of interest and δ_{it} is the share of deaths covered by the probate record. Neglecting for simplicity the error, if δ_{it} is 100 percent then ϑ_{sit} becomes equal to s_{sit}, the actual sectoral share in county *i* and time *t*. Hence:

$$s_{sit} - \vartheta_{sit} = \frac{\exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s})}{1+\exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s})} - \frac{\exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})}{1+\exp(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s}\delta_{it})} \quad \text{A5)}$$

Combining A3) and A5) and solving for δ_{sit} yields:

$$\delta_{sit} = \delta_{it}\left[1 - \frac{\beta_{3s}}{(\alpha_{si}+\beta_{1si}t+\beta_{2si}t^2+\beta_{3s})}(1-\delta_{it})\right] \quad \text{A6)}$$

One difficulty with using regression equation A4) in this settings is that the fitted values ought to sum up to one. While multivariate extensions of Papke and Wooldridge's (1996) generalised linear model for fractional response variables are available (e.g. Buis 2010), in practice estimation becomes challenging: with our specification it was not possible for the iterative procedure to converge towards the maximum likelihood estimator with Buis' (2010) method. A viable alternative is to constraint the marginal effects to (approximately) sum up to 0. The derivative with respect to each variable is equal to its coefficient times $exp(z)/[1+exp(z)]^2$, where $exp(z)/[1+exp(z)]$ is the fitted value. At the sample mean of the dependent variable, which by definition is equal to one third, $exp(z)/[1+exp(z)]^2=0.222$ for all sectors. Therefore at this value the condition that the marginal effects of time and share of deaths covered cancel themselves out across sectors simplify into:

$\beta_{13i}=-\beta_{11i}-2\beta_{21i}t-\beta_{12i}-2\beta_{22i}t-2\beta_{23i}t$ A7)

And:

$\beta_{33}=-\beta_{31}-\beta_{32}$ A8)

Substituting these conditions into A4) for *s=3* and re-arranging yields:

$\vartheta_{3it}=exp[\alpha_{3i}+\beta_{11i}(-t)+\beta_{12i}(-t)+\beta_{21i}(-2t^2)+\beta_{22i}(-2t^2)+\beta_{23i}(-t^2)+\beta_{31}(-\delta_{it})+\beta_{32}(-\delta_{it})]/\{1+exp[\alpha_{3i}+\beta_{11i}(-t)+\beta_{12i}(-t)+\beta_{21i}(-2t^2)+\beta_{22i}(-2t^2)+\beta_{23i}(-t^2)+\beta_{31}(-\delta_{it})+\beta_{32}(-\delta_{it})]\}+u_{3it}$ A9)

The first column of Table A3 shows the baseline specification; the second one allows the coefficient of the share of deaths covered (β_{3s}) to vary across decades; the third one only include data up to the

1750s. It is straightforward to compute the key coefficient for services with equation A8) and for reasons of space its values are not presented here.

Table S2.2: Shares of deaths covered and sectoral shares in the probate record: generalised linear regression analysis for fractional response variables

Sector	Period	(1)	(2)	(3)
Agriculture	1540-1809	0.586		
		(6.01)***		
	1540-1759			0.492
				(5.96)***
	1540-1549		-0.430	
			(-1.38)	
	1550-1559		0.594	
			(7.16)***	
Table S2.2-continued				
	1560-1569		0.513	
			(3.23)***	
	1570-1579		0.556	
			(9.30)***	
	1580-1589		0.531	
			(73.51)***	
	1590-1599		0.894	
			(7.26)***	
	1600-1609		0.584	
			(7.34)***	
	1610-1619		0.392	
			(4.43)***	
	1620-1629		0.250	
			(4.08)***	
	1630-1639		0.016	
			(0.81)	
	1640-1649		-0.777	
			(-6.14)***	
	1650-1659		-0.101	
			(-3.12)***	
	1660-1669		-0.886	
			(-11.14)***	
	1670-1679		-0.877	
			(-10.78)***	
	1680-1689		-1.123	
			(-10.68)***	
	1690-1699		-1.177	
			(-7.85)***	
	1700-1709		-1.258	
			(-8.24)***	
	1710-1719		-0.592	
			(-10.66)***	
	1720-1729		0.171	

			(2.47)**	
	1730-1739		-0.254	
			(-26.28)***	
	1740-1749		-0.802	
			(-20.32)***	
	1750-1759		0.179	
			(2.07)**	
	1760-1769		1.577	
			(6.00)***	
	1770-1779		3.213	
			(7.54)***	
	1780-1789		5.255	
			(7.69)***	
	1790-1799		6.788	
			(7.63)***	
	1800-1809		6.710	
			(7.74)***	

Table S2.2-continued

Industry	1550-1809	0.320		
		(2.53)**		
	1550-1759			0.254
				(5.18)**
	1540-1549		-2.222	
			(-4.28)***	
	1550-1559		-1.324	
			(-8.69)***	
	1560-1569		-0.945	
			(-3.94)***	
	1570-1579		-0.507	
			(-5.52)***	
	1580-1589		-0.398	
			(-21.76)***	
	1590-1599		-0.252	
			(-1.91)*	
	1600-1609		-0.182	
			(-2.14)**	
	1610-1619		0.033	
			(0.34)	
	1620-1629		0.001	
			(0.01)	
	1630-1639		0.042	
			(1.71)*	
	1640-1649		0.087	
			(0.60)	
	1650-1659		-0.292	
			(-9.04)***	
	1660-1669		0.763	
			(8.87)***	
	1670-1679		0.735	
			(8.46)***	
	1680-1689		0.951	

		(8.62)***	
	1690-1699	0.579	
		(3.61)***	
	1700-1709	0.667	
		(4.22)***	
	1710-1719	0.638	
		(15.59)***	
	1720-1729	0.645	
		(6.16)***	
	1730-1739	0.860	
		(21.62)***	
	1740-1749	1.079	
		(77.08)***	
	1750-1759	1.091	
		(7.28)***	
	1760-1769	1.169	
		(3.24)***	

Table S2.2-continued

	1770-1779	0.192	
		(0.35)	
	1780-1789	-0.188	
		(-0.22)	
	1790-1799	-0.271	
		(-0.24)	
	1800-1809	-0.435	
		(-0.40)	
County/sector fixed effects	Yes	Yes	Yes
Quadratic county/sector trends	Yes	Yes	Yes
N	1809	1809	1452

Note: ***=significant at the 1 percent level, **=significant at the 5 percent level and *=significant at the 1 percent level, *N*=sample size. Clustered standard errors allow for arbitrary correlation within sectors; the *z-statistics* are in parentheses.
Sources: see Appendix 2 and the text.

References

Brass, W. "On the scale of mortality." *Biological Aspects of Demography* edited by Brass, W. London: Taylor and Francis, 1971, pp. 69-110.

Buis, L. M. 2010. “Relationship between the likelyhood functions used in fmlogit and mlogit. At http://www.maartenbuis.nl/software/likelihoodFmlogit.pdf.

Landers, J. *Death and the Metropolis. Studies in the Demographic History of London 1670-1830*. Cambridge: Cambridge University Press, 1993.

Papke, L. E., and J. M. Wooldridge. "Econometric Methods for Fractional Response Variables with an Application to 401(K) Plan Participation Rates." *Journal of Applied Econometrics* 11, no. 6 (1996): 619-632.

Woods, R. “Urban-rural mortality differentials: an unresolved debate”. *Population and Development Review* 29, no. 1 (2003): 29-46.

Wrigley, E. A., and Schofield, R. S. *The Population History of England 1541-1871. A Reconstruction*. First paperback edition. Cambridge: Cambridge University Press, 1989.

Wrigley, E. A., Davies, R. S., Oeppen, J. E., and Schofield, R. S. *English Population History from Family Reconstitution 1580-1837*. Cambridge: Cambridge University Press, 1997.

Appendix S3: Sectoral shares by county (probate), Direct & Adjusted estimates.

Table S3.1

		Direct			Adjusted		
Decade	county	Ag.	Ind.	Serv.	Ag.	Ind.	Serv.
1620	Anglesey	0.71	0.08	0.21	0.75	0.11	0.14
1640	Anglesey	0.57	0.24	0.19	0.60	0.26	0.13
1650	Anglesey	0.62	0.20	0.18	0.65	0.23	0.12
1660	Anglesey	0.54	0.18	0.28	0.58	0.21	0.21
1670	Anglesey	0.77	0.08	0.15	0.80	0.11	0.09
1680	Anglesey	0.66	0.11	0.23	0.69	0.14	0.16
1690	Anglesey	0.72	0.14	0.14	0.75	0.17	0.08
1700	Anglesey	0.76	0.11	0.13	0.78	0.14	0.08
1710	Anglesey	0.70	0.16	0.14	0.72	0.18	0.10
1720	Anglesey	0.53	0.24	0.23	0.56	0.26	0.17
1730	Anglesey	0.64	0.20	0.16	0.67	0.22	0.12
1740	Anglesey	0.70	0.21	0.09	0.72	0.23	0.05
1750	Anglesey	0.72	0.15	0.13	0.74	0.17	0.09
1760	Anglesey	0.75	0.11	0.14	0.77	0.14	0.10
1770	Anglesey	0.73	0.16	0.12	0.75	0.18	0.07
1780	Anglesey	0.74	0.11	0.15	0.76	0.13	0.11
1520	Bedfordshire	0.75	0.10	0.14	0.77	0.14	0.09
1530	Bedfordshire	0.76	0.13	0.11	0.77	0.17	0.06
1540	Bedfordshire	0.76	0.15	0.09	0.77	0.19	0.04
1550	Bedfordshire	0.71	0.19	0.10	0.73	0.23	0.04
1560	Bedfordshire	0.77	0.15	0.08	0.78	0.20	0.02
1570	Bedfordshire	0.81	0.14	0.05	0.82	0.19	0.00
1580	Bedfordshire	0.72	0.20	0.08	0.73	0.24	0.03
1590	Bedfordshire	0.68	0.23	0.08	0.69	0.27	0.03
1600	Bedfordshire	0.65	0.26	0.09	0.66	0.30	0.03
1610	Bedfordshire	0.68	0.26	0.07	0.69	0.30	0.01
1620	Bedfordshire	0.67	0.24	0.09	0.68	0.29	0.03
1630	Bedfordshire	0.75	0.19	0.06	0.76	0.24	0.00
1640	Bedfordshire	0.66	0.27	0.07	0.68	0.32	0.01
1650	Bedfordshire	0.61	0.30	0.10	0.62	0.34	0.04
1660	Bedfordshire	0.58	0.29	0.13	0.60	0.33	0.07
1670	Bedfordshire	0.59	0.30	0.11	0.61	0.35	0.04
1680	Bedfordshire	0.53	0.33	0.14	0.56	0.37	0.07
1690	Bedfordshire	0.56	0.29	0.15	0.58	0.34	0.08
1700	Bedfordshire	0.58	0.27	0.15	0.61	0.32	0.07
1710	Bedfordshire	0.51	0.30	0.19	0.55	0.35	0.10
1720	Bedfordshire	0.52	0.27	0.21	0.56	0.33	0.11
1730	Bedfordshire	0.52	0.27	0.21	0.57	0.33	0.11
1740	Bedfordshire	0.50	0.32	0.18	0.55	0.38	0.07
1750	Bedfordshire	0.51	0.29	0.20	0.57	0.35	0.08

1760	Bedfordshire	0.58	0.25	0.17	0.64	0.32	0.05
1770	Bedfordshire	0.59	0.24	0.18	0.65	0.31	0.04
1780	Bedfordshire	0.56	0.25	0.19	0.63	0.32	0.05
1520	Berkshire	0.50	0.25	0.25	0.52	0.30	0.18
1530	Berkshire	0.72	0.16	0.12	0.72	0.20	0.08
1540	Berkshire	0.70	0.19	0.12	0.70	0.24	0.06
1550	Berkshire	0.68	0.26	0.07	0.68	0.30	0.02
1560	Berkshire	0.69	0.22	0.09	0.68	0.27	0.05
1570	Berkshire	0.72	0.21	0.07	0.72	0.26	0.03
1580	Berkshire	0.72	0.21	0.07	0.71	0.26	0.03
1590	Berkshire	0.70	0.23	0.07	0.69	0.28	0.03
1600	Berkshire	0.67	0.24	0.09	0.67	0.29	0.04
1610	Berkshire	0.66	0.24	0.10	0.65	0.29	0.06
1620	Berkshire	0.65	0.25	0.10	0.65	0.31	0.04
1630	Berkshire	0.64	0.25	0.11	0.64	0.31	0.05
1640	Berkshire	0.63	0.27	0.10	0.63	0.33	0.04
1650	Berkshire	0.59	0.28	0.13	0.59	0.34	0.07
1660	Berkshire	0.56	0.31	0.12	0.57	0.37	0.06
1670	Berkshire	0.56	0.32	0.12	0.57	0.38	0.06
1680	Berkshire	0.52	0.32	0.15	0.53	0.38	0.09
1690	Berkshire	0.55	0.32	0.13	0.56	0.38	0.06
1700	Berkshire	0.53	0.31	0.16	0.54	0.38	0.08
1710	Berkshire	0.49	0.32	0.19	0.50	0.39	0.11
1720	Berkshire	0.43	0.35	0.22	0.45	0.42	0.13
1730	Berkshire	0.44	0.32	0.24	0.46	0.39	0.14
1740	Berkshire	0.47	0.32	0.21	0.49	0.40	0.10
1750	Berkshire	0.44	0.29	0.27	0.47	0.38	0.15
1760	Berkshire	0.42	0.34	0.24	0.46	0.43	0.12
1770	Berkshire	0.47	0.29	0.24	0.51	0.38	0.10
1780	Berkshire	0.43	0.31	0.26	0.47	0.41	0.12
1640	Breconshire	0.77	0.18	0.06	0.74	0.22	0.05
1650	Breconshire	0.80	0.15	0.05	0.77	0.19	0.04
1660	Breconshire	0.80	0.15	0.05	0.77	0.20	0.03
1670	Breconshire	0.79	0.16	0.05	0.76	0.21	0.03
1680	Breconshire	0.79	0.13	0.08	0.76	0.18	0.06
1690	Breconshire	0.78	0.13	0.09	0.76	0.18	0.06
1700	Breconshire	0.80	0.14	0.06	0.77	0.19	0.03
1710	Breconshire	0.75	0.16	0.09	0.73	0.21	0.06
1720	Breconshire	0.78	0.15	0.07	0.76	0.20	0.04
1730	Breconshire	0.67	0.18	0.15	0.65	0.23	0.11
1740	Breconshire	0.64	0.19	0.17	0.63	0.25	0.12
1750	Breconshire	0.75	0.13	0.12	0.73	0.19	0.08
1760	Breconshire	0.69	0.19	0.11	0.68	0.25	0.07
1770	Breconshire	0.72	0.17	0.11	0.71	0.23	0.06
1780	Breconshire	0.68	0.16	0.17	0.66	0.22	0.12
1520	Buckinghamshire	0.76	0.09	0.16	0.77	0.12	0.11

1530	Buckinghamshire	0.77	0.09	0.14	0.77	0.12	0.11
1540	Buckinghamshire	0.80	0.14	0.06	0.79	0.18	0.03
1550	Buckinghamshire	0.76	0.18	0.06	0.74	0.23	0.03
1560	Buckinghamshire	0.79	0.15	0.06	0.77	0.20	0.03
1570	Buckinghamshire	0.78	0.16	0.06	0.76	0.20	0.04
1580	Buckinghamshire	0.77	0.17	0.07	0.74	0.22	0.04
1590	Buckinghamshire	0.76	0.17	0.07	0.73	0.22	0.04
1600	Buckinghamshire	0.69	0.21	0.10	0.67	0.26	0.07
1610	Buckinghamshire	0.72	0.20	0.08	0.69	0.24	0.06
1620	Buckinghamshire	0.72	0.19	0.09	0.70	0.24	0.06
1630	Buckinghamshire	0.73	0.18	0.09	0.71	0.23	0.05
1640	Caernarvonshire	0.63	0.15	0.23	0.67	0.21	0.12
1650	Caernarvonshire	0.65	0.14	0.21	0.69	0.20	0.12
1660	Caernarvonshire	0.65	0.18	0.18	0.68	0.23	0.09
1670	Caernarvonshire	0.80	0.10	0.10	0.82	0.16	0.02
1690	Caernarvonshire	0.74	0.14	0.13	0.75	0.19	0.05
1700	Caernarvonshire	0.78	0.13	0.09	0.79	0.18	0.03
1710	Caernarvonshire	0.68	0.17	0.15	0.69	0.22	0.09
1720	Caernarvonshire	0.75	0.14	0.11	0.76	0.19	0.05
1730	Caernarvonshire	0.72	0.15	0.13	0.72	0.20	0.07
1740	Caernarvonshire	0.73	0.16	0.11	0.74	0.21	0.05
1750	Caernarvonshire	0.83	0.09	0.08	0.84	0.14	0.02
1760	Caernarvonshire	0.78	0.12	0.10	0.80	0.17	0.04
1770	Caernarvonshire	0.75	0.12	0.14	0.77	0.16	0.07
1780	Caernarvonshire	0.75	0.09	0.16	0.78	0.13	0.09
1520	Cambridgeshire	0.61	0.14	0.25	0.64	0.17	0.19
1530	Cambridgeshire	0.76	0.08	0.16	0.77	0.12	0.11
1540	Cambridgeshire	0.71	0.16	0.13	0.72	0.20	0.08
1550	Cambridgeshire	0.75	0.16	0.09	0.76	0.20	0.04
1560	Cambridgeshire	0.72	0.17	0.11	0.72	0.20	0.08
1570	Cambridgeshire	0.72	0.20	0.08	0.72	0.23	0.05
1580	Cambridgeshire	0.70	0.21	0.09	0.70	0.26	0.04
1590	Cambridgeshire	0.66	0.25	0.08	0.66	0.28	0.06
1600	Cambridgeshire	0.69	0.23	0.08	0.68	0.27	0.04
1610	Cambridgeshire	0.66	0.24	0.10	0.65	0.28	0.07
1620	Cambridgeshire	0.70	0.22	0.08	0.69	0.27	0.04
1630	Cambridgeshire	0.68	0.23	0.09	0.67	0.29	0.04
1640	Cambridgeshire	0.63	0.27	0.10	0.63	0.31	0.06
1650	Cambridgeshire	0.65	0.26	0.10	0.64	0.31	0.05
1660	Cambridgeshire	0.61	0.27	0.12	0.61	0.32	0.07
1670	Cambridgeshire	0.61	0.27	0.12	0.61	0.32	0.07
1680	Cambridgeshire	0.56	0.30	0.15	0.56	0.35	0.10
1690	Cambridgeshire	0.56	0.29	0.16	0.56	0.33	0.11
1700	Cambridgeshire	0.56	0.31	0.13	0.56	0.36	0.08
1710	Cambridgeshire	0.54	0.30	0.16	0.55	0.35	0.10
1720	Cambridgeshire	0.52	0.29	0.18	0.54	0.35	0.12

1730	Cambridgeshire	0.54	0.29	0.17	0.55	0.35	0.10
1740	Cambridgeshire	0.57	0.24	0.19	0.59	0.30	0.11
1750	Cambridgeshire	0.53	0.25	0.22	0.55	0.31	0.14
1760	Cambridgeshire	0.57	0.26	0.18	0.59	0.32	0.09
1770	Cambridgeshire	0.54	0.24	0.22	0.57	0.30	0.12
1780	Cambridgeshire	0.58	0.21	0.21	0.61	0.27	0.12
1590	Cardiganshire	0.81	0.03	0.16	0.83	0.05	0.12
1600	Cardiganshire	0.80	0.07	0.13	0.82	0.09	0.09
1610	Cardiganshire	0.87	0.08	0.05	0.89	0.10	0.01
1640	Cardiganshire	0.82	0.07	0.10	0.84	0.09	0.06
1650	Cardiganshire	0.80	0.13	0.07	0.81	0.15	0.03
1660	Cardiganshire	0.86	0.05	0.09	0.88	0.07	0.05
1670	Cardiganshire	0.77	0.07	0.16	0.79	0.10	0.11
1680	Cardiganshire	0.84	0.10	0.06	0.86	0.12	0.01
1690	Cardiganshire	0.77	0.14	0.10	0.79	0.17	0.04
1700	Cardiganshire	0.81	0.07	0.12	0.83	0.10	0.06
1710	Cardiganshire	0.69	0.12	0.19	0.72	0.15	0.13
1720	Cardiganshire	0.75	0.08	0.17	0.79	0.11	0.10
1730	Cardiganshire	0.67	0.10	0.24	0.70	0.13	0.17
1740	Cardiganshire	0.64	0.15	0.21	0.67	0.18	0.14
1750	Cardiganshire	0.58	0.12	0.30	0.62	0.15	0.22
1760	Cardiganshire	0.73	0.10	0.17	0.78	0.14	0.09
1770	Cardiganshire	0.70	0.12	0.17	0.75	0.16	0.09
1780	Cardiganshire	0.68	0.14	0.18	0.73	0.17	0.10
1580	Carmarthenshire	0.70	0.21	0.09	0.72	0.24	0.04
1590	Carmarthenshire	0.80	0.08	0.13	0.81	0.11	0.08
1600	Carmarthenshire	0.80	0.06	0.14	0.82	0.09	0.09
1610	Carmarthenshire	0.73	0.09	0.18	0.75	0.12	0.13
1620	Carmarthenshire	0.80	0.09	0.11	0.82	0.12	0.06
1640	Carmarthenshire	0.77	0.13	0.10	0.79	0.16	0.05
1650	Carmarthenshire	0.83	0.09	0.08	0.84	0.12	0.03
1660	Carmarthenshire	0.75	0.13	0.12	0.77	0.16	0.07
1670	Carmarthenshire	0.72	0.12	0.16	0.74	0.15	0.10
1680	Carmarthenshire	0.79	0.10	0.12	0.81	0.13	0.06
1690	Carmarthenshire	0.75	0.12	0.13	0.77	0.15	0.07
1700	Carmarthenshire	0.79	0.12	0.09	0.80	0.16	0.04
1710	Carmarthenshire	0.71	0.17	0.12	0.73	0.20	0.07
1720	Carmarthenshire	0.64	0.15	0.21	0.67	0.19	0.14
1730	Carmarthenshire	0.63	0.18	0.19	0.66	0.22	0.12
1740	Carmarthenshire	0.65	0.15	0.20	0.68	0.19	0.13
1750	Carmarthenshire	0.75	0.12	0.13	0.77	0.16	0.07
1760	Carmarthenshire	0.72	0.14	0.14	0.74	0.18	0.08
1770	Carmarthenshire	0.72	0.13	0.15	0.75	0.17	0.08
1780	Carmarthenshire	0.73	0.13	0.14	0.75	0.17	0.08
1570	Cheshire	0.85	0.08	0.07	0.85	0.12	0.04
1580	Cheshire	0.76	0.12	0.12	0.76	0.15	0.09

1590	Cheshire	0.79	0.13	0.08	0.79	0.15	0.06
1600	Cheshire	0.78	0.13	0.09	0.78	0.16	0.06
1610	Cheshire	0.79	0.10	0.10	0.79	0.14	0.07
1620	Cheshire	0.76	0.14	0.10	0.76	0.18	0.06
1640	Cheshire	0.69	0.18	0.12	0.70	0.22	0.08
1650	Cheshire	0.70	0.18	0.12	0.70	0.21	0.09
1660	Cheshire	0.70	0.17	0.13	0.70	0.21	0.09
1670	Cheshire	0.68	0.19	0.13	0.69	0.22	0.09
1680	Cheshire	0.64	0.20	0.16	0.65	0.24	0.11
1690	Cheshire	0.64	0.20	0.15	0.65	0.25	0.10
1700	Cheshire	0.68	0.19	0.13	0.69	0.23	0.09
1710	Cheshire	0.64	0.19	0.16	0.65	0.23	0.12
1720	Cheshire	0.57	0.22	0.21	0.58	0.27	0.14
1730	Cheshire	0.58	0.23	0.19	0.59	0.28	0.12
1740	Cheshire	0.56	0.26	0.18	0.58	0.30	0.12
1750	Cheshire	0.59	0.22	0.18	0.60	0.27	0.13
1760	Cheshire	0.57	0.24	0.20	0.58	0.29	0.13
1770	Cheshire	0.54	0.27	0.19	0.55	0.33	0.12
1780	Cheshire	0.54	0.25	0.21	0.55	0.31	0.14
1610	Cumberland	0.82	0.10	0.09	0.83	0.13	0.04
1640	Cumberland	0.77	0.14	0.09	0.78	0.17	0.05
1650	Cumberland	0.80	0.14	0.07	0.80	0.17	0.03
1660	Cumberland	0.78	0.15	0.07	0.79	0.19	0.02
1670	Cumberland	0.85	0.09	0.06	0.86	0.13	0.02
1680	Cumberland	0.76	0.11	0.13	0.78	0.15	0.07
1690	Cumberland	0.76	0.12	0.11	0.78	0.16	0.06
1700	Cumberland	0.80	0.10	0.09	0.82	0.14	0.04
1710	Cumberland	0.73	0.15	0.12	0.75	0.19	0.06
1720	Cumberland	0.66	0.19	0.15	0.70	0.23	0.08
1550	Denbighshire	0.76	0.05	0.19	0.76	0.07	0.17
1610	Denbighshire	0.65	0.22	0.13	0.65	0.24	0.11
1620	Denbighshire	0.70	0.17	0.13	0.69	0.19	0.11
1640	Denbighshire	0.55	0.27	0.18	0.55	0.29	0.17
1650	Denbighshire	0.61	0.26	0.12	0.60	0.28	0.11
1660	Denbighshire	0.66	0.19	0.15	0.65	0.22	0.13
1670	Denbighshire	0.70	0.17	0.13	0.69	0.19	0.12
1680	Denbighshire	0.73	0.17	0.09	0.72	0.20	0.08
1690	Denbighshire	0.71	0.18	0.11	0.70	0.20	0.10
1700	Denbighshire	0.72	0.19	0.09	0.71	0.21	0.08
1710	Denbighshire	0.69	0.19	0.12	0.68	0.21	0.11
1720	Denbighshire	0.64	0.24	0.13	0.63	0.26	0.11
1730	Denbighshire	0.65	0.21	0.14	0.64	0.23	0.13
1740	Denbighshire	0.70	0.20	0.10	0.68	0.22	0.09
1750	Denbighshire	0.70	0.17	0.13	0.69	0.19	0.12
1760	Denbighshire	0.74	0.13	0.12	0.73	0.16	0.11
1770	Denbighshire	0.71	0.18	0.11	0.70	0.20	0.10

1780	Denbighshire	0.65	0.19	0.16	0.64	0.21	0.15
1640	Derbyshire	0.64	0.27	0.09	0.64	0.32	0.04
1650	Derbyshire	0.65	0.25	0.10	0.65	0.30	0.05
1560	Durham	0.67	0.15	0.17	0.69	0.19	0.12
1590	Durham	0.68	0.18	0.15	0.69	0.22	0.09
1610	Durham	0.73	0.17	0.09	0.74	0.22	0.04
1640	Durham	0.58	0.28	0.14	0.60	0.33	0.07
1650	Durham	0.57	0.31	0.12	0.59	0.35	0.06
1660	Durham	0.62	0.28	0.10	0.63	0.33	0.04
1670	Durham	0.41	0.31	0.27	0.44	0.36	0.20
1680	Durham	0.39	0.28	0.32	0.43	0.33	0.24
1690	Durham	0.56	0.24	0.21	0.58	0.29	0.13
1700	Durham	0.56	0.28	0.16	0.58	0.33	0.08
1710	Durham	0.49	0.28	0.23	0.52	0.33	0.15
1720	Durham	0.35	0.31	0.34	0.39	0.36	0.24
1730	Durham	0.43	0.32	0.25	0.47	0.37	0.16
1740	Durham	0.45	0.30	0.24	0.49	0.36	0.16
1750	Durham	0.45	0.30	0.25	0.49	0.35	0.16
1760	Durham	0.38	0.29	0.33	0.42	0.35	0.23
1770	Durham	0.36	0.31	0.34	0.40	0.37	0.23
1780	Durham	0.37	0.30	0.34	0.41	0.35	0.24
1520	Essex	0.58	0.25	0.16	0.60	0.28	0.12
1530	Essex	0.66	0.22	0.12	0.67	0.24	0.09
1540	Essex	0.68	0.21	0.12	0.69	0.23	0.08
1550	Essex	0.65	0.21	0.14	0.66	0.24	0.10
1560	Essex	0.66	0.22	0.11	0.67	0.25	0.09
1570	Essex	0.64	0.24	0.11	0.65	0.26	0.08
1580	Essex	0.66	0.22	0.11	0.67	0.25	0.08
1590	Essex	0.68	0.22	0.09	0.69	0.24	0.06
1600	Essex	0.66	0.24	0.10	0.66	0.27	0.07
1610	Essex	0.67	0.24	0.09	0.68	0.26	0.06
1620	Essex	0.65	0.25	0.11	0.66	0.28	0.07
1630	Essex	0.62	0.25	0.13	0.63	0.28	0.09
1640	Essex	0.58	0.32	0.10	0.60	0.34	0.06
1650	Essex	0.57	0.28	0.15	0.59	0.31	0.11
1660	Essex	0.51	0.32	0.17	0.53	0.35	0.12
1670	Essex	0.50	0.29	0.22	0.52	0.32	0.16
1680	Essex	0.51	0.29	0.19	0.54	0.32	0.14
1690	Essex	0.51	0.30	0.19	0.53	0.33	0.14
1700	Essex	0.54	0.28	0.18	0.57	0.31	0.13
1710	Essex	0.51	0.28	0.21	0.53	0.31	0.16
1720	Essex	0.48	0.30	0.22	0.51	0.33	0.16
1730	Essex	0.50	0.27	0.24	0.53	0.30	0.18
1740	Essex	0.53	0.27	0.21	0.56	0.30	0.15
1750	Essex	0.55	0.22	0.23	0.58	0.25	0.17
1760	Essex	0.51	0.26	0.23	0.54	0.30	0.17

1770	Essex	0.54	0.24	0.22	0.57	0.27	0.16
1780	Essex	0.55	0.25	0.20	0.58	0.28	0.14
1560	Flintshire	0.78	0.07	0.15	0.79	0.12	0.10
1590	Flintshire	0.83	0.15	0.02	0.84	0.19	-0.04
1600	Flintshire	0.81	0.16	0.02	0.83	0.21	-0.04
1610	Flintshire	0.81	0.07	0.12	0.82	0.12	0.06
1620	Flintshire	0.68	0.13	0.20	0.69	0.18	0.13
1640	Flintshire	0.72	0.11	0.17	0.73	0.16	0.11
1650	Flintshire	0.72	0.14	0.14	0.73	0.20	0.08
1660	Flintshire	0.69	0.14	0.17	0.70	0.20	0.10
1670	Flintshire	0.74	0.14	0.13	0.74	0.20	0.06
1680	Flintshire	0.71	0.12	0.18	0.71	0.18	0.10
1690	Flintshire	0.84	0.09	0.07	0.84	0.16	0.01
1700	Flintshire	0.71	0.18	0.11	0.71	0.24	0.04
1710	Flintshire	0.71	0.21	0.09	0.71	0.27	0.02
1720	Flintshire	0.64	0.25	0.11	0.65	0.32	0.04
1730	Flintshire	0.60	0.28	0.12	0.61	0.35	0.04
1740	Flintshire	0.61	0.28	0.11	0.62	0.35	0.03
1750	Flintshire	0.68	0.20	0.12	0.68	0.27	0.05
1760	Flintshire	0.65	0.22	0.13	0.65	0.30	0.06
1770	Flintshire	0.65	0.23	0.12	0.64	0.31	0.05
1780	Flintshire	0.61	0.25	0.14	0.60	0.33	0.07
1610	Glamorganshire	0.65	0.17	0.18	0.67	0.21	0.12
1620	Glamorganshire	0.70	0.12	0.18	0.72	0.16	0.11
1630	Glamorganshire	0.77	0.08	0.15	0.79	0.13	0.08
1640	Glamorganshire	0.74	0.13	0.13	0.75	0.18	0.07
1650	Glamorganshire	0.67	0.12	0.21	0.69	0.16	0.15
1660	Glamorganshire	0.65	0.18	0.17	0.67	0.22	0.10
1670	Glamorganshire	0.69	0.13	0.18	0.70	0.17	0.12
1680	Glamorganshire	0.70	0.13	0.18	0.72	0.17	0.12
1690	Glamorganshire	0.66	0.14	0.20	0.68	0.19	0.13
1700	Glamorganshire	0.69	0.15	0.16	0.71	0.19	0.10
1710	Glamorganshire	0.60	0.21	0.18	0.63	0.26	0.11
1720	Glamorganshire	0.58	0.12	0.30	0.60	0.17	0.23
1730	Glamorganshire	0.61	0.20	0.19	0.63	0.25	0.12
1740	Glamorganshire	0.63	0.16	0.21	0.66	0.21	0.14
1750	Glamorganshire	0.65	0.15	0.21	0.67	0.20	0.13
1760	Glamorganshire	0.66	0.15	0.19	0.69	0.20	0.12
1770	Glamorganshire	0.63	0.15	0.22	0.65	0.20	0.14
1780	Glamorganshire	0.64	0.18	0.17	0.66	0.24	0.11
1530	Gloucestershire	0.62	0.18	0.20	0.64	0.20	0.15
1540	Gloucestershire	0.69	0.18	0.13	0.71	0.21	0.09
1550	Gloucestershire	0.65	0.23	0.12	0.66	0.25	0.09
1560	Gloucestershire	0.67	0.22	0.11	0.68	0.24	0.08
1570	Gloucestershire	0.71	0.20	0.09	0.72	0.22	0.06
1580	Gloucestershire	0.71	0.21	0.08	0.72	0.24	0.05

1590	Gloucestershire	0.68	0.23	0.09	0.69	0.25	0.06
1600	Gloucestershire	0.69	0.21	0.10	0.70	0.24	0.06
1610	Gloucestershire	0.66	0.22	0.13	0.66	0.24	0.09
1620	Gloucestershire	0.59	0.27	0.14	0.60	0.30	0.10
1630	Gloucestershire	0.61	0.25	0.15	0.62	0.28	0.10
1640	Gloucestershire	0.58	0.28	0.14	0.60	0.30	0.10
1650	Gloucestershire	0.53	0.32	0.14	0.55	0.35	0.10
1660	Gloucestershire	0.51	0.33	0.16	0.52	0.36	0.12
1670	Gloucestershire	0.48	0.34	0.18	0.50	0.37	0.14
1680	Gloucestershire	0.43	0.38	0.19	0.45	0.40	0.15
1690	Gloucestershire	0.47	0.37	0.16	0.49	0.39	0.12
1700	Gloucestershire	0.48	0.38	0.14	0.50	0.40	0.09
1710	Gloucestershire	0.40	0.40	0.20	0.43	0.43	0.14
1720	Gloucestershire	0.36	0.40	0.24	0.39	0.44	0.17
1730	Gloucestershire	0.34	0.40	0.25	0.38	0.44	0.18
1740	Gloucestershire	0.39	0.39	0.22	0.43	0.43	0.14
1750	Gloucestershire	0.20	0.34	0.47	0.24	0.38	0.38
1760	Gloucestershire	0.21	0.34	0.45	0.25	0.40	0.35
1770	Gloucestershire	0.17	0.31	0.51	0.21	0.37	0.42
1540	Hampshire	0.66	0.19	0.15	0.66	0.23	0.11
1550	Hampshire	0.71	0.19	0.10	0.70	0.23	0.07
1560	Hampshire	0.74	0.18	0.09	0.73	0.22	0.05
1570	Hampshire	0.73	0.19	0.08	0.73	0.23	0.04
1580	Hampshire	0.75	0.17	0.08	0.74	0.21	0.05
1590	Hampshire	0.77	0.16	0.07	0.76	0.20	0.03
1600	Hampshire	0.73	0.19	0.08	0.73	0.24	0.04
1610	Hampshire	0.74	0.19	0.07	0.74	0.23	0.03
1620	Hampshire	0.71	0.21	0.08	0.71	0.25	0.03
1630	Hampshire	0.66	0.20	0.15	0.66	0.24	0.09
1640	Hampshire	0.66	0.22	0.13	0.66	0.26	0.07
1650	Hampshire	0.59	0.26	0.14	0.60	0.31	0.09
1660	Hampshire	0.61	0.26	0.12	0.62	0.31	0.07
1670	Hampshire	0.54	0.29	0.17	0.55	0.34	0.11
1680	Hampshire	0.49	0.28	0.22	0.51	0.33	0.16
1690	Hampshire	0.49	0.28	0.23	0.51	0.32	0.17
1700	Hampshire	0.46	0.31	0.23	0.47	0.35	0.17
1710	Hampshire	0.46	0.30	0.24	0.48	0.35	0.17
1720	Hampshire	0.33	0.35	0.32	0.35	0.39	0.25
1730	Hampshire	0.40	0.36	0.23	0.43	0.41	0.16
1740	Hampshire	0.42	0.37	0.22	0.44	0.42	0.14
1750	Hampshire	0.42	0.35	0.23	0.44	0.41	0.15
1760	Hampshire	0.38	0.36	0.26	0.41	0.43	0.16
1770	Hampshire	0.38	0.36	0.27	0.41	0.42	0.17
1520	Herefordshire	0.75	0.05	0.20	0.81	0.07	0.12
1530	Herefordshire	0.76	0.07	0.17	0.79	0.09	0.11
1540	Herefordshire	0.80	0.07	0.13	0.82	0.10	0.08

1550	Herefordshire	0.81	0.08	0.11	0.82	0.10	0.07
1560	Herefordshire	0.83	0.11	0.06	0.83	0.14	0.03
1570	Herefordshire	0.81	0.15	0.04	0.81	0.17	0.01
1580	Herefordshire	0.79	0.15	0.06	0.79	0.18	0.03
1590	Herefordshire	0.80	0.15	0.04	0.79	0.19	0.02
1600	Herefordshire	0.81	0.13	0.06	0.80	0.17	0.03
1610	Herefordshire	0.77	0.16	0.07	0.76	0.20	0.04
1620	Herefordshire	0.76	0.16	0.09	0.75	0.20	0.05
1630	Herefordshire	0.77	0.15	0.08	0.76	0.20	0.04
1640	Herefordshire	0.73	0.20	0.07	0.72	0.24	0.04
1650	Herefordshire	0.72	0.20	0.07	0.72	0.23	0.05
1660	Herefordshire	0.73	0.20	0.06	0.73	0.24	0.04
1670	Herefordshire	0.74	0.18	0.08	0.74	0.22	0.04
1520	Hertfordshire	0.65	0.16	0.20	0.67	0.19	0.14
1530	Hertfordshire	0.77	0.14	0.09	0.78	0.17	0.05
1540	Hertfordshire	0.62	0.24	0.14	0.64	0.27	0.09
1550	Hertfordshire	0.51	0.34	0.14	0.54	0.37	0.10
1560	Hertfordshire	0.65	0.26	0.09	0.67	0.29	0.05
1570	Hertfordshire	0.66	0.25	0.08	0.68	0.28	0.04
1580	Hertfordshire	0.66	0.27	0.08	0.67	0.29	0.04
1590	Hertfordshire	0.63	0.28	0.09	0.64	0.30	0.06
1600	Hertfordshire	0.60	0.28	0.12	0.61	0.31	0.08
1610	Hertfordshire	0.62	0.26	0.12	0.64	0.28	0.08
1620	Hertfordshire	0.62	0.24	0.14	0.64	0.28	0.08
1630	Hertfordshire	0.64	0.25	0.11	0.66	0.28	0.06
1640	Hertfordshire	0.58	0.31	0.11	0.60	0.33	0.06
1650	Hertfordshire	0.51	0.33	0.15	0.54	0.36	0.10
1660	Hertfordshire	0.49	0.33	0.17	0.52	0.36	0.11
1670	Hertfordshire	0.49	0.35	0.16	0.52	0.38	0.10
1680	Hertfordshire	0.49	0.29	0.22	0.52	0.33	0.15
1690	Hertfordshire	0.46	0.34	0.20	0.50	0.37	0.14
1700	Hertfordshire	0.47	0.33	0.20	0.51	0.36	0.13
1710	Hertfordshire	0.40	0.35	0.25	0.44	0.38	0.18
1720	Hertfordshire	0.35	0.39	0.26	0.40	0.42	0.18
1730	Hertfordshire	0.38	0.33	0.29	0.43	0.37	0.21
1740	Hertfordshire	0.37	0.35	0.28	0.42	0.39	0.19
1750	Hertfordshire	0.41	0.33	0.26	0.46	0.37	0.17
1760	Hertfordshire	0.42	0.30	0.28	0.47	0.34	0.19
1770	Hertfordshire	0.42	0.29	0.29	0.47	0.34	0.19
1780	Hertfordshire	0.42	0.30	0.28	0.47	0.35	0.18
1640	Lancashire	0.82	0.14	0.04	0.81	0.17	0.02
1650	Lancashire	0.78	0.16	0.07	0.77	0.19	0.05
1700	Lancashire	0.76	0.15	0.09	0.76	0.19	0.05
1710	Lancashire	0.61	0.21	0.18	0.63	0.25	0.12
1610	Merionethshire	0.65	0.20	0.15	0.66	0.24	0.11
1640	Merionethshire	0.79	0.09	0.12	0.79	0.12	0.09

1650	Merionethshire	0.84	0.13	0.03	0.83	0.16	0.01
1660	Merionethshire	0.85	0.07	0.08	0.84	0.10	0.06
1670	Merionethshire	0.84	0.13	0.03	0.83	0.16	0.01
1680	Merionethshire	0.79	0.13	0.07	0.78	0.16	0.05
1690	Merionethshire	0.86	0.08	0.06	0.85	0.11	0.04
1700	Merionethshire	0.87	0.09	0.03	0.86	0.13	0.01
1710	Merionethshire	0.86	0.08	0.07	0.84	0.11	0.05
1720	Merionethshire	0.77	0.14	0.09	0.77	0.17	0.07
1730	Merionethshire	0.77	0.15	0.08	0.76	0.18	0.06
1740	Merionethshire	0.82	0.11	0.07	0.81	0.14	0.05
1750	Merionethshire	0.80	0.12	0.08	0.79	0.15	0.06
1760	Merionethshire	0.83	0.08	0.09	0.82	0.11	0.06
1770	Merionethshire	0.81	0.10	0.10	0.80	0.13	0.07
1780	Merionethshire	0.72	0.15	0.13	0.72	0.18	0.10
1560	Montgomeryshire	0.80	0.20	0.00	0.78	0.24	-0.02
1610	Montgomeryshire	0.72	0.19	0.09	0.71	0.23	0.06
1620	Montgomeryshire	0.63	0.21	0.16	0.63	0.25	0.12
1630	Montgomeryshire	0.75	0.18	0.07	0.74	0.23	0.03
1640	Montgomeryshire	0.69	0.20	0.11	0.69	0.24	0.07
1650	Montgomeryshire	0.71	0.19	0.09	0.71	0.23	0.06
1660	Montgomeryshire	0.72	0.22	0.07	0.72	0.25	0.03
1670	Montgomeryshire	0.75	0.17	0.08	0.74	0.21	0.04
1680	Montgomeryshire	0.81	0.12	0.07	0.81	0.17	0.03
1690	Montgomeryshire	0.78	0.13	0.09	0.78	0.17	0.05
1700	Montgomeryshire	0.75	0.19	0.07	0.75	0.23	0.03
1710	Montgomeryshire	0.74	0.17	0.10	0.74	0.21	0.05
1720	Montgomeryshire	0.67	0.23	0.10	0.68	0.27	0.05
1730	Montgomeryshire	0.74	0.17	0.09	0.75	0.21	0.04
1740	Montgomeryshire	0.67	0.19	0.13	0.68	0.24	0.08
1750	Montgomeryshire	0.71	0.17	0.12	0.72	0.22	0.07
1760	Montgomeryshire	0.79	0.13	0.08	0.79	0.18	0.03
1770	Montgomeryshire	0.68	0.18	0.15	0.69	0.22	0.09
1780	Montgomeryshire	0.69	0.17	0.15	0.70	0.21	0.09
1560	Northumberland	0.39	0.30	0.30	0.44	0.35	0.21
1590	Northumberland	0.48	0.29	0.23	0.52	0.34	0.14
1610	Northumberland	0.44	0.29	0.27	0.48	0.34	0.18
1640	Northumberland	0.42	0.30	0.28	0.46	0.35	0.19
1650	Northumberland	0.40	0.31	0.29	0.45	0.36	0.20
1660	Northumberland	0.46	0.33	0.22	0.50	0.38	0.12
1670	Northumberland	0.36	0.29	0.35	0.41	0.34	0.25
1680	Northumberland	0.33	0.29	0.38	0.38	0.34	0.28
1780	Northumberland	0.40	0.24	0.36	0.46	0.28	0.26
1520	Oxfordshire	0.53	0.10	0.37	0.58	0.15	0.28
1530	Oxfordshire	0.62	0.11	0.27	0.64	0.14	0.21
1540	Oxfordshire	0.68	0.16	0.16	0.71	0.20	0.08
1550	Oxfordshire	0.65	0.17	0.17	0.67	0.22	0.11

1560	Oxfordshire	0.72	0.19	0.09	0.73	0.23	0.05
1570	Oxfordshire	0.73	0.18	0.09	0.73	0.23	0.04
1580	Oxfordshire	0.72	0.20	0.08	0.72	0.25	0.03
1590	Oxfordshire	0.69	0.22	0.09	0.68	0.27	0.05
1600	Oxfordshire	0.66	0.25	0.09	0.66	0.30	0.04
1610	Oxfordshire	0.65	0.25	0.10	0.64	0.29	0.06
1620	Oxfordshire	0.61	0.26	0.13	0.60	0.32	0.08
1630	Oxfordshire	0.68	0.20	0.13	0.67	0.27	0.07
1640	Oxfordshire	0.60	0.27	0.13	0.59	0.33	0.08
1650	Oxfordshire	0.57	0.29	0.13	0.56	0.35	0.09
1660	Oxfordshire	0.55	0.31	0.14	0.54	0.37	0.09
1670	Oxfordshire	0.52	0.34	0.14	0.51	0.40	0.09
1680	Oxfordshire	0.54	0.32	0.14	0.53	0.38	0.09
1690	Oxfordshire	0.50	0.36	0.15	0.49	0.41	0.09
1700	Oxfordshire	0.50	0.34	0.16	0.50	0.40	0.10
1710	Oxfordshire	0.44	0.37	0.19	0.44	0.43	0.12
1720	Oxfordshire	0.41	0.41	0.18	0.42	0.47	0.11
1730	Oxfordshire	0.42	0.37	0.21	0.43	0.43	0.14
1740	Oxfordshire	0.43	0.36	0.20	0.44	0.43	0.12
1750	Oxfordshire	0.46	0.32	0.22	0.47	0.40	0.13
1760	Oxfordshire	0.48	0.28	0.24	0.49	0.36	0.15
1770	Oxfordshire	0.45	0.31	0.24	0.47	0.39	0.14
1780	Oxfordshire	0.48	0.30	0.22	0.50	0.39	0.11
1580	Pembrokeshire	0.81	0.08	0.12	0.81	0.10	0.09
1590	Pembrokeshire	0.66	0.17	0.17	0.67	0.19	0.14
1600	Pembrokeshire	0.80	0.09	0.11	0.82	0.12	0.07
1640	Pembrokeshire	0.65	0.17	0.19	0.68	0.18	0.14
1650	Pembrokeshire	0.60	0.19	0.21	0.63	0.20	0.17
1660	Pembrokeshire	0.63	0.19	0.17	0.67	0.21	0.12
1670	Pembrokeshire	0.62	0.15	0.22	0.66	0.17	0.17
1680	Pembrokeshire	0.60	0.15	0.25	0.64	0.17	0.18
1690	Pembrokeshire	0.54	0.11	0.35	0.58	0.14	0.28
1700	Pembrokeshire	0.57	0.14	0.29	0.62	0.16	0.22
1710	Pembrokeshire	0.55	0.10	0.34	0.60	0.13	0.27
1720	Pembrokeshire	0.33	0.10	0.57	0.39	0.13	0.49
1730	Pembrokeshire	0.42	0.12	0.46	0.48	0.15	0.38
1740	Pembrokeshire	0.37	0.17	0.46	0.42	0.19	0.38
1750	Pembrokeshire	0.51	0.25	0.25	0.56	0.27	0.18
1770	Pembrokeshire	0.58	0.17	0.25	0.62	0.19	0.19
1780	Pembrokeshire	0.61	0.18	0.21	0.64	0.20	0.16
1630	Radnorshire	0.83	0.09	0.08	0.84	0.12	0.04
1640	Radnorshire	0.86	0.12	0.02	0.86	0.14	0.00
1650	Radnorshire	0.82	0.12	0.06	0.83	0.13	0.04
1660	Radnorshire	0.77	0.16	0.07	0.77	0.18	0.05
1670	Radnorshire	0.83	0.12	0.05	0.83	0.14	0.03
1680	Radnorshire	0.87	0.09	0.03	0.88	0.12	0.01

1690	Radnorshire	0.82	0.12	0.06	0.82	0.14	0.03
1700	Radnorshire	0.87	0.09	0.04	0.88	0.11	0.01
1710	Radnorshire	0.85	0.09	0.07	0.85	0.11	0.04
1720	Radnorshire	0.85	0.11	0.04	0.85	0.13	0.02
1730	Radnorshire	0.81	0.13	0.06	0.82	0.15	0.03
1740	Radnorshire	0.82	0.14	0.05	0.83	0.16	0.02
1750	Radnorshire	0.85	0.08	0.07	0.85	0.11	0.04
1760	Radnorshire	0.75	0.19	0.05	0.77	0.21	0.02
1770	Radnorshire	0.88	0.09	0.03	0.89	0.11	0.00
1780	Radnorshire	0.83	0.07	0.10	0.84	0.10	0.06
1640	Shropshire	0.57	0.28	0.14	0.59	0.33	0.08
1650	Shropshire	0.62	0.25	0.14	0.63	0.30	0.07
1660	Shropshire	0.53	0.32	0.15	0.55	0.37	0.08
1520	Suffolk	0.53	0.29	0.18	0.57	0.33	0.10
1530	Suffolk	0.57	0.24	0.19	0.59	0.27	0.13
1540	Suffolk	0.57	0.26	0.17	0.60	0.30	0.10
1550	Suffolk	0.60	0.25	0.16	0.62	0.28	0.10
1560	Suffolk	0.60	0.25	0.14	0.62	0.28	0.09
1570	Suffolk	0.64	0.26	0.11	0.66	0.29	0.06
1580	Suffolk	0.64	0.25	0.12	0.66	0.28	0.06
1590	Suffolk	0.64	0.25	0.11	0.65	0.28	0.07
1600	Suffolk	0.64	0.25	0.11	0.66	0.28	0.06
1610	Suffolk	0.62	0.26	0.12	0.64	0.28	0.08
1620	Suffolk	0.60	0.26	0.14	0.62	0.30	0.08
1630	Suffolk	0.60	0.25	0.15	0.63	0.29	0.09
1640	Suffolk	0.58	0.29	0.13	0.60	0.32	0.08
1650	Suffolk	0.53	0.31	0.16	0.56	0.34	0.10
1660	Suffolk	0.51	0.32	0.17	0.54	0.35	0.10
1670	Suffolk	0.48	0.32	0.21	0.51	0.35	0.13
1540	Surrey	0.50	0.35	0.15	0.52	0.38	0.09
1550	Surrey	0.57	0.28	0.14	0.60	0.32	0.08
1560	Surrey	0.53	0.33	0.14	0.56	0.37	0.07
1570	Surrey	0.56	0.29	0.14	0.60	0.33	0.07
1580	Surrey	0.57	0.28	0.15	0.61	0.32	0.07
1590	Surrey	0.57	0.26	0.16	0.61	0.31	0.08
1600	Surrey	0.49	0.32	0.19	0.54	0.36	0.10
1610	Surrey	0.59	0.26	0.15	0.64	0.31	0.05
1620	Surrey	0.53	0.26	0.21	0.59	0.31	0.10
1630	Surrey	0.47	0.31	0.21	0.54	0.36	0.10
1640	Surrey	0.40	0.34	0.27	0.47	0.38	0.15
1650	Surrey	0.37	0.32	0.31	0.44	0.37	0.19
1660	Surrey	0.39	0.30	0.31	0.46	0.36	0.18
1670	Surrey	0.27	0.28	0.45	0.34	0.33	0.33
1680	Surrey	0.27	0.28	0.45	0.35	0.33	0.32
1690	Surrey	0.29	0.32	0.39	0.37	0.38	0.26
1700	Surrey	0.26	0.34	0.40	0.34	0.39	0.27

1710	Surrey	0.26	0.36	0.37	0.34	0.42	0.24
1720	Surrey	0.21	0.36	0.43	0.29	0.42	0.29
1730	Surrey	0.24	0.40	0.37	0.31	0.46	0.23
1740	Surrey	0.26	0.38	0.37	0.33	0.45	0.22
1750	Surrey	0.26	0.38	0.36	0.33	0.44	0.22
1760	Surrey	0.26	0.36	0.38	0.34	0.43	0.23
1770	Surrey	0.23	0.39	0.38	0.31	0.46	0.23
1780	Surrey	0.24	0.38	0.38	0.31	0.45	0.23
1630	Warwickshire	0.70	0.22	0.08	0.70	0.26	0.04
1600	Westmorland	0.75	0.17	0.07	0.76	0.21	0.03
1610	Westmorland	0.71	0.22	0.07	0.72	0.25	0.04
1620	Westmorland	0.65	0.25	0.10	0.65	0.29	0.06
1640	Westmorland	0.80	0.18	0.02	0.79	0.21	0.00
1650	Westmorland	0.80	0.15	0.05	0.80	0.18	0.02
1660	Westmorland	0.78	0.17	0.05	0.77	0.21	0.02
1670	Westmorland	0.81	0.15	0.04	0.81	0.18	0.01
1680	Westmorland	0.73	0.22	0.05	0.73	0.25	0.01
1690	Westmorland	0.77	0.15	0.08	0.77	0.19	0.04
1700	Westmorland	0.78	0.17	0.05	0.78	0.20	0.02
1710	Westmorland	0.72	0.19	0.09	0.73	0.22	0.05
1720	Westmorland	0.72	0.18	0.09	0.74	0.21	0.05
1580	Wiltshire	0.72	0.22	0.06	0.72	0.26	0.03
1590	Wiltshire	0.69	0.25	0.06	0.69	0.29	0.02
1600	Wiltshire	0.68	0.25	0.07	0.68	0.30	0.03
1610	Wiltshire	0.67	0.26	0.07	0.66	0.30	0.03
1620	Wiltshire	0.63	0.27	0.10	0.64	0.32	0.05
1630	Wiltshire	0.66	0.23	0.11	0.66	0.29	0.05
1640	Wiltshire	0.64	0.26	0.10	0.64	0.32	0.04
1650	Wiltshire	0.60	0.28	0.12	0.61	0.33	0.06
1660	Wiltshire	0.58	0.31	0.11	0.59	0.36	0.05
1670	Wiltshire	0.54	0.35	0.10	0.56	0.40	0.04
1680	Wiltshire	0.51	0.37	0.12	0.54	0.42	0.04
1690	Wiltshire	0.51	0.37	0.12	0.53	0.42	0.05
1700	Wiltshire	0.48	0.38	0.14	0.51	0.43	0.06
1710	Wiltshire	0.46	0.39	0.15	0.49	0.44	0.06
1720	Wiltshire	0.42	0.38	0.20	0.46	0.44	0.10
1730	Wiltshire	0.41	0.39	0.20	0.46	0.45	0.09
1740	Wiltshire	0.42	0.37	0.21	0.47	0.44	0.09
1750	Wiltshire	0.43	0.37	0.20	0.48	0.44	0.08
1760	Wiltshire	0.43	0.35	0.22	0.49	0.42	0.09
1770	Wiltshire	0.43	0.35	0.21	0.49	0.43	0.08
1780	Wiltshire	0.47	0.31	0.22	0.53	0.39	0.09
1520	Worcestershire	0.54	0.13	0.33	0.58	0.16	0.25
1530	Worcestershire	0.63	0.14	0.23	0.64	0.17	0.19
1540	Worcestershire	0.64	0.19	0.16	0.66	0.23	0.11
1550	Worcestershire	0.68	0.18	0.14	0.68	0.21	0.11

1560	Worcestershire	0.69	0.20	0.11	0.69	0.22	0.09
1570	Worcestershire	0.76	0.20	0.04	0.75	0.23	0.01
1580	Worcestershire	0.73	0.20	0.07	0.72	0.24	0.04
1590	Worcestershire	0.70	0.23	0.07	0.69	0.27	0.05
1600	Worcestershire	0.70	0.22	0.08	0.69	0.26	0.05
1610	Worcestershire	0.68	0.24	0.08	0.66	0.28	0.05
1620	Worcestershire	0.63	0.24	0.13	0.62	0.29	0.09
1630	Worcestershire	0.67	0.23	0.09	0.67	0.28	0.05