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The Commercialization of Labour Markets: evidence from wage inequality in the Middle Ages

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Abstract

This paper moves beyond the focus on 'average' wage trends in pre-industrial economies by examining the broad diversity of pay rates and forms of remuneration across occupations and regions in medieval England. We find that, while some workers enjoyed substantial growth in wage rates after the Black Death, there was a large group who experienced no real increases. We argue that wage inequality in post-Black Death England reflects the uneven penetration of market forces across occupations and regions, with deep-rooted customary structures continuing to shape remuneration. Its findings suggest that a more nuanced approach is essential for understanding the complexities and continuities of pre-industrial labour dynamics.

JEL classification codes: J33, J42, N33, N53

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1 Introduction

Much of our understanding concerning the development and dynamics of historical economies are underpinned by long-run wage series. Wage evidence has become the fulcrum upon which several grand theories like the Little and Great Divergences and the 'Malthusian' nature of pre-modern economies, now pivot. Many studies have endeavoured to find long-run wage trends that are broadly representative and reflect an 'average' wage for a 'typical' labourer. Given the importance of wage evidence, it is unsurprising that much scholarship concerning the earnings of pre-industrial workers has focused around representativeness.[1] This is especially important when nominal wages are considered alongside living costs in order to compute real wages and provide measurements of equality and welfare. The utility of a single wage series is undeniable, especially for more macroeconomic questions.[2] However, such series and their underlying methodology mask an array of variation which is vital for our understanding levels of remuneration and the disposable income this provided in a specific place and time. Such granularity is essential for addressing more substantive economic questions: wage distribution(s) and inequality are key to understanding the functioning of historical labour markets (Carvalhal, Lucassen, Stephenson, & De Zwart, 2025)

This paper furthers a more comprehensive perspective on wage inequality and focuses predominantly on the long fourteenth century: a period for which our knowledge on both the levels and drivers of wage inequality is especially limited. This is a glaring gap, because the period is typically considered to have been transformative for pre-industrial labour markets. Indeed, the Black Death - and its negative effects

[1] For a critical overview of the methods and data used to reconstruct historical wages, see the contributions in Hatcher and Stephenson (2018) and a recent overview by de Zwart (2025). In pre-industrial societies, for much of the population, wages were distinct from earnings, which could include other sources of income such as the sale of crops grown on smallholdings or secondary goods produced in the home. Household production could also provide subsistence goods, lowering dependence on the market.

[2] Case-in-point is the recent appraisal of long-run productivity growth in England by Bouscasse, Nakamura, and Steinsson (2024), which hinges on the day wage time series by Clark (2010). In a robustness check, the authors consider the use of various other day and annual wage series (Allen, 2007; Humphries & Weisdorf, 2019). Chilosi and Ciccarelli (2025) assess the representativeness of real wage evidence in interpreting long-run growth by deriving GDP with a general equilibrium model and comparing these results with those derived from wage observations.

on medieval labour supply - is sometimes said to have ushered in a 'golden age' for labourers and even modern economic growth (Voigtländer & Voth, 2013). Most of these claims have focused solely on the average earnings of a relatively homogeneous group of workers who worked by the day and earned cash in agriculture and construction (Allen, 2001; Clark, 2005, 2007). However, recent work on labourers employed on a longer-term basis and remunerated with in-kind wages has reframed thinking about both the scale and the timing of a post-plague increase in labour remuneration (Humphries & Weisdorf, 2019; Claridge, Delabastita, & Gibbs, 2024). This raises a question concerning the degree to which the most frequently-cited wage series might hide substantial variation in the labour market experiences of fourteenth-century workers.[3]

This paper has two objectives. First, it aims to present a more holistic perspective on the evolution of work and pay in the Middle Ages. It does so by focusing primarily on differences between workers and the wages they earned. Where previous studies have endeavoured to control for heterogeneity, here we embrace it. We explore new data concerning both the wages earned and work performed by English agricultural labourers. These labourers, called *famuli*, contributed the largest share of agricultural labour on the seigniorial demesne farms of medieval lords (Farmer, 1988, 760), and, as a group, have been used fruitfully to explore not only wages, but the dynamics of labour markets (Farmer, 1996; Claridge & Langdon, 2015; Humphries & Weisdorf, 2015, 2019; Claridge et al., 2024).

We adopt a novel empirical approach by analysing *famuli* earnings in the form of a weekly rate. This allows us to compare remuneration across the entire range of *famuli* workers, not only in terms of occupation and earnings, but also tenure. This approach differs fundamentally from earlier work on medieval wages, where the emphasis has often been on the measurement of a representative series for a subgroup of workers. We focus instead on a range of occupational groups within the *famuli* labour force, including both part-time and full-time workers, to ask how their working and earning differed and changed over time. These themes contribute

[3] Such concerns are demonstrated particularly clearly by fierce discussions about whether female workers benefited as much as men from the windfall wages that are argued to have followed the Black Death (Bardsley, 1999; Hatcher, 2001; Humphries & Weisdorf, 2015; de Pleijt & Van Zanden, 2021; Bailey, 2024).

to the broader literature on historical living standards by challenging the notion that any single type of worker can be truly 'representative,' given the varied impact of labour market shocks like the Black Death on occupational structure, employment tenure, and regional differences.

Second, the analysis of a broad array of workers helps shed new light on long-running debates concerning the degree to which the late medieval English economy was commercialized, and how it did (or did not) affect certain segments of the labour market. In the wake of the trailblazing work by Richard Britnell, who demonstrated the proliferation of markets in medieval England, a consensus has emerged in the literature: over the thirteenth and early fourteenth centuries, an increasing volume of economic exchange occurred within market settings. This, in turn, lead to increasing market orientation in both the seigniorial and peasant sectors; both groups produced a significant share of their output for sale rather than consumption (Britnell, 1993, 228-31; Campbell, 2009; Bailey, 2021, 39-40). These developments helped support Smithian growth in a period of dramatic population increase. Expansion is argued to have occurred in both product and factor markets, and this has been demonstrated through the growth of chartered markets (Britnell, 1981), high levels of integration in grain prices (Clark, 2015; Federico, Schulze, & Volckart, 2021), the responsiveness of agriculturalists to commercial opportunities (Stone, 2001; Dodds, 2007, 132-61), the depth of credit markets (Briggs, 2009, 65-99) and the extent of land transactions at all social levels (Whittle, 1998; Bekar & Reed, 2013).

How do labour markets fit into the wider commercialization narrative? In medieval England, as for most pre-industrial economies, waged labour accounted for only a share of all agricultural labour inputs.[4] That said, before the Black Death, perhaps one-third of all labour was still 'traded' in the market.[5] Therefore an understanding of the extent to which the labour market was commercialized is vital to understanding the wider medieval economy. However, to date the evidence avail-

[4] The majority of agricultural labour was expended by tenants on their own holdings (Hatcher, 2024).

[5] Bailey (2021, 35) has estimated that in 1340 waged labour accounted for 30 per cent, labour services 10 per cent, and family holdings 60 per cent of total productive labour expended in medieval England.

able to assess labour market commercialization has been largely indirect. Labour markets are generally assumed to have shared in the trend of greater commercialization. Several interpretations have highlighted the precarity of those who held little or no land before the Black Death, whose survival must have been made possible - at least in part - by the availability of waged work on both the estates of lords and larger-scale peasant farms (Campbell, 2009). Similarly, growing recognition of the relatively limited role of labour services - work owed by servile tenants as part of their rent - in demesne agriculture highlights the extent to which lords depended on the market to supply labour (Campbell, 2000, 2-3). Even when lords had the right to demand labour services from their tenants, they frequently commuted this for cash payments which could be used to hire more flexible waged labour (Stone, 1997; Campbell, 2005).

Recently, Bailey (2023) has demonstrated that narratives of heavily-regulated labour markets in early fourteenth century England do not stand up to systematic scrutiny. In reality, legal frameworks did very little to prevent the development of an open market for labour before the Black Death. While attempts were made to more tightly control workers and suppress wages followed the Black Death, the very necessity of such interventions demonstrates the extent and depth of the labour market at that time. Moreover, the limited success of this legislation, revealed by the dramatic increase of wages beyond the levels 'set' by the Ordinance and Statute of Labourers, shows that markets were already far too developed for the medieval English state to effectively control how workers were hired, the terms of their employment, or their rates of pay (Claridge et al., 2024; Bailey, 2025).

On the other hand, there is also evidence for the limited reach of commercial forces and attitudes in wage-setting in medieval (and indeed post-medieval) labour markets. Strong social norms, referred to as 'customs', both at the national level and at the level of estates or even individual manors, played a role in a wide range of

transactions in the pre-industrial world.[6] These were based around long-established local practices which had a binding effect on the behaviour of economic agents. For instance, in medieval England, levels of rents were frequently determined by custom, with many tenants paying rents set at sub-market rates, through appeals to fixed obligations which had been agreed since 'time out of mind' (Hatcher, 1981). Customary practices could interact with market forces in ways that heightened inequality, for example, when tenants with customarily fixed head rents profited by subletting their land to others who were then compelled to pay higher market rates (Campbell, 2005). With regard to wages, de Pleijt and Van Zanden (2021) argue that custom played varying roles in shaping pre-industrial women's wages across Europe. In England, the persistence of in-kind wages for many workers throughout much of the fourteenth century, despite fluctuations in their value due to changing grain prices, perhaps reflects a customary entitlement to a defined level of consumption, effectively serving as an insurance mechanism for medieval workers (Claridge et al., 2024).[7] Munro (2003) has argued that increased real day wages in England and the Low Countries from 1375 was the result of sticky customary nominal wages which did not adjust in a period of price deflation. Therefore, despite the sustained scholarly attention paid to levels of commercialization in England, the significance of 'labour market commercialization' in determining the remuneration received by workers, and its interrelation with deep-rooted customary practices, has not yet been fully explored.

Our data and method allow us to examine the extent to which the medieval English labour market was commercialized. First, we examine *occupational* variation in wage rates to show how the nature of labour markets changed over the course of the fourteenth century. We find that the market for *famuli* labour was segmented and these segments developed at different speeds. Wage rates and employ-

[6] 'Customs' are a slippery concept. This term is often used generally by economic historians, particularly when examining wage dynamics, to explain patterns and variations inexplicable using the logic of neo-classical economic theory (Woodward, 1994). For medievalists, 'customs' refer to something more specific, typically contemporary references in legal records to long-standing, localized practices that were regularly and explicitly invoked in courts and set down in custumals to resolve disputes and routinise obligations (Birrell, 2014; Bonfield, 1989). Throughout this paper we will consider both usages and how these were interrelated.

[7] It has been argued that these in-kind wages reflect a contemporary understanding of a respectable standard of living. See: Humphries (2025).

ment patterns for most annually-employed 'core' *famuli* changed very little: they remained the central workforce in manorial agriculture, but were largely excluded from any wage windfalls which followed the Black Death. At the same time, some tasks, which were largely peripheral and poorly paid before the Black Death, became semi-permanent and better paid while other peripheral jobs did not experience wage growth and largely disappeared. We understand this as a 'professionalization' of the *famuli* labour force.

Second, we consider the *regional* dimension of medieval wage inequality, in which we find that population density had a significant role in 1300 in suppressing wages in commercialised regions, but this effect had largely disappeared by 1400. This is confirmed by a third stream of evidence, in which we quantitatively assess the extent to which occupational and regional dimensions, by themselves, are able to explain medieval wage inequality. We find that, for c.1300, much variation remains unidentified. This highlights low levels of labour market integration and the importance of local customs in determining wages. However, our econometric findings also reveal that, throughout the fourteenth century, market forces and commercialization became increasingly determinant factors for wage inequality. In conclusion, this paper appreciates both stability, in terms of stable occupational wage premia and the role of customs, and change, in the form of skyrocketing wages for a select group of workers, and the market forces that defined these.

The remainder of this paper is structured as follows: Section 2 introduces the historical sources and our data architecture. In Section 3, we describe the changing distribution and dimensions of *famuli* wages. Section 4 explores inequalities in wages between occupations. Section 5 explores growing 'professionalisation of the *famuli* workforce as measured through occupation structure and lengths of tenure. Section 6 examines regional trends in wage inequality. Section 7 quantitatively explores the factors that determined wages in the medieval labour market. In Section 8, we place our findings in a broader perspective. Finally, Section 9 concludes.

2 Data: The *famuli* as a case study

Our analysis is based upon the exceptional evidence found in medieval English manorial accounts, which we use to reconstruct and examine the weekly wage rates of *famuli* labourers. The *famuli* themselves represented around perhaps a third to a half of all labour deployed on the demesnes of medieval lords (Claridge & Langdon, 2015). We estimate that there were around 128,000 *famuli* working in England in 1300, a number which fell to 56,000 in 1400.[8] While work as a *famulus* or *famula* was certainly not the typical way to make a living in late medieval England, which was dominated by peasant tenants, the *famuli* represented a substantial share of workers on the agricultural labour market. They accounted for perhaps 9-12 per cent of the non-landholding rural population and 2-3 per cent of the total population. Therefore, while they cannot be argued to be 'representative' for the medieval English labour force at large, understanding the extent and causes of variation in the wages of the *famuli* can provide insights into the degree to which a well-documented segment of the labour market was commercialized.

The *famuli* have long been subject to scholarly research due to the richness of the information available about their work and pay in surviving manorial accounts. Postan (1954) paid the *famuli* their first scholarly attention as a unique group of labourers in 1954, focusing on the twelfth and thirteenth centuries. Farmer (1996) followed this up nearly forty years later, examining the *famuli* but in the fourteenth and fifteenth centuries. His approach was more data-heavy with wages quarried from a sample of accounts of some 150 manors. Claridge and Langdon (2015) deployed a larger data sample of more than 300 manors from around 1300 to examine the in-kind earnings of *famuli* labourers, finding structural inequalities across workers. While Farmer (1996, 229) had deemed it "impossible to construct any index of the remuneration received by the *famuli* as a whole", Claridge et al. (2024) used *famuli* wages to do exactly this in order to explore the changing dynamics of labour markets in medieval England. In this paper, we explore the same group of labourers with a focus on the *variation* of *famuli* wages.

[8] For the methodology used to derive these estimates, and those that follow in this paragraph, see Appendix C.3.

This paper reconstructs weekly wage rates, which is a novel approach that deviates from established methods used to analyse pre-industrial earnings. When measuring differences between labourers and across regions, weekly rates bring several advantages. First, weekly rates are most consistent with how both employers and *famuli* employees would have understood rates of pay. In fact, the medieval scribes who created manorial accounts regularly reported wage rates in weekly terms. In addition, these accounts record the number of weeks a worker was employed (Claridge & Langdon, 2015).[9] Therefore, the calculation of weekly rates is not an anachronistic concept. Further, an attempt to convert the weekly rates expressed in the accounts into either day or annual equivalents would require assumptions about either the number of days worked in a week or the number of weeks worked in a year (in the latter case, pro-rating the wages of those *famuli* who worked for less than a year would be required). Such assumptions introduce noise and uncertainty into the calculations which are avoided by simply preserving the weekly rates.

Cash wages were recorded differently. Money payments were typically recorded as a total sum received by a worker for a specific period of time, which could vary from a defined period of weeks to a whole accounting year. Dairymaids, for example, were often paid cash wages for the summer, when grass was plentiful and cows were producing the most milk. Carters, on the other hand, were typically employed year-round. Therefore, calculating the average weekly rate paid to a given worker in a given year involves combining information about the various in-kind and cash payments made to workers as well as the length of their employment. These pieces of information can all be retrieved from the historical sources.

This paper uses cross-sectional data, drawing from hundreds of manorial accounts. Our cross sections are centred around two key moments in medieval history. The first, from c. 1300, allows us to explore the dynamics of *famuli* work and wages at the height of the 'high farming' period of seigniorial agriculture which was also the height of the medieval English population. We drew this cross section from 433 manorial accounts.[10] Our second cross section from c. 1400 captures *famuli* labour

[9] We refer to Appendix A for more information on the calculation of medieval wage rates and the underlying assumptions.

[10] We are able to identify the composition of grain liveries and value the total composite wage paid to *famuli* for 254 of these 433 accounts.

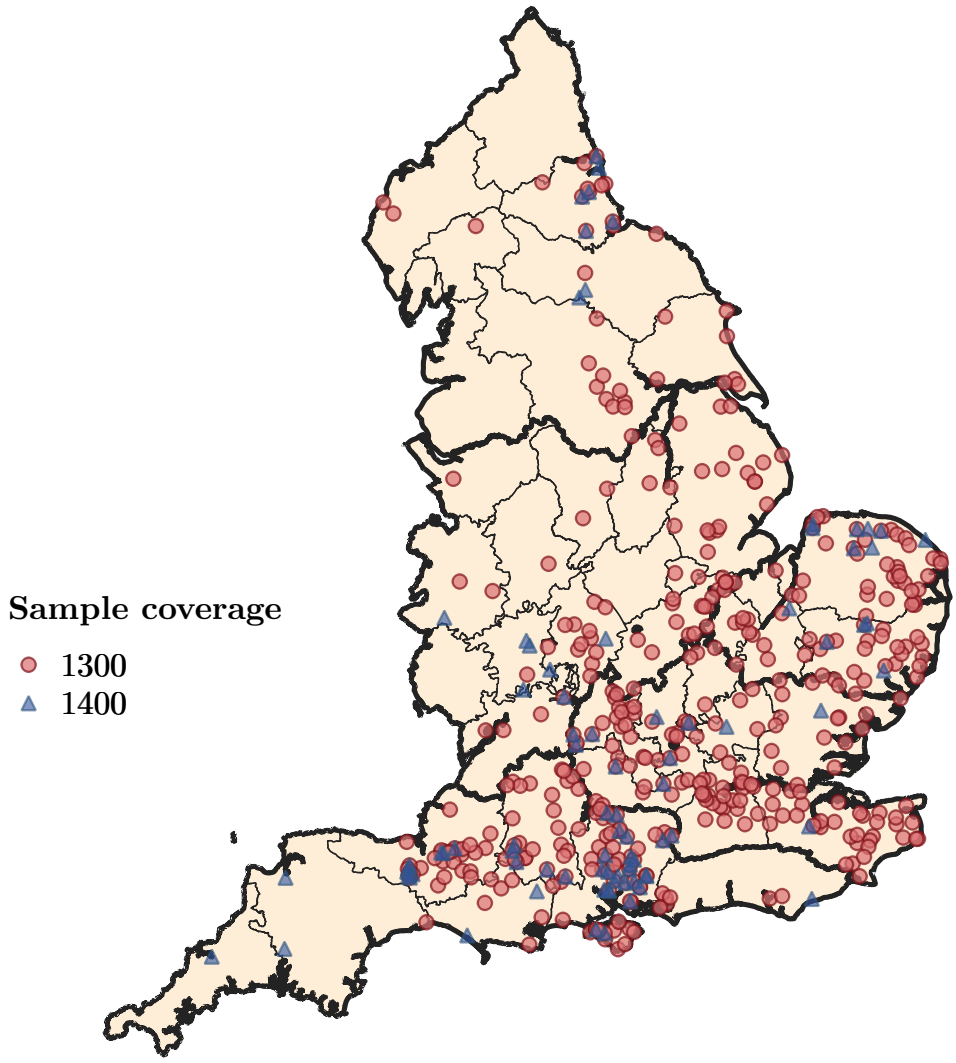
in the aftermath of the economic and social changes created by the Black Death and subsequent outbreaks of plague. This is drawn from 85 accounts. Due to the nature of surviving evidence, the sample for 1400 is smaller than that for 1300. To ensure that changes in the sample composition do not drive our results, we tested the core analysis using a balanced panel of accounts containing the 54 manors which we observe in both 1300 and 1400. These confirm that our findings remain qualitatively unchanged (see Appendix C.2). Together, our samples allow us to look for patterns of continuity and change in wage inequality in the wake of the structural changes of the fourteenth century. The spatial distribution of the manors from the cross sections is seen in Figure 1.[11] While the samples are biased towards the South and East of England, this is broadly reflective of population density and economic activity, and all regions are represented by at least some manors in 1300 and 1400 (Campbell, 2008). We refer to Appendix A for a more in-depth discussion of the sources and the data collection process.

3 The dimensions of *famuli* remuneration

Famuli workers were heterogeneous in terms of occupation, length of contract, and earnings, and the variation in these variables is recorded in manorial accounts. This allows us to gauge the individual-level drivers of wage inequality. Figure 2(a) provides a first appreciation of the variation in nominal rates of pay the different categories of *famuli* received by showing the distribution of total wage rates in 1300 and 1400. This total rate encapsulates all elements of what constituted a 'total wage' for a *famulus* which we introduce in this section. It is apparent that any appraisal based on an averaging technique such as the 'raw' averages displayed by the vertical lines in the figure, obscures the wide variation of total wage rates paid to even the limited category of *famuli* workers. We already find a relatively wide dispersion in 1300, which became even more pronounced in 1400.

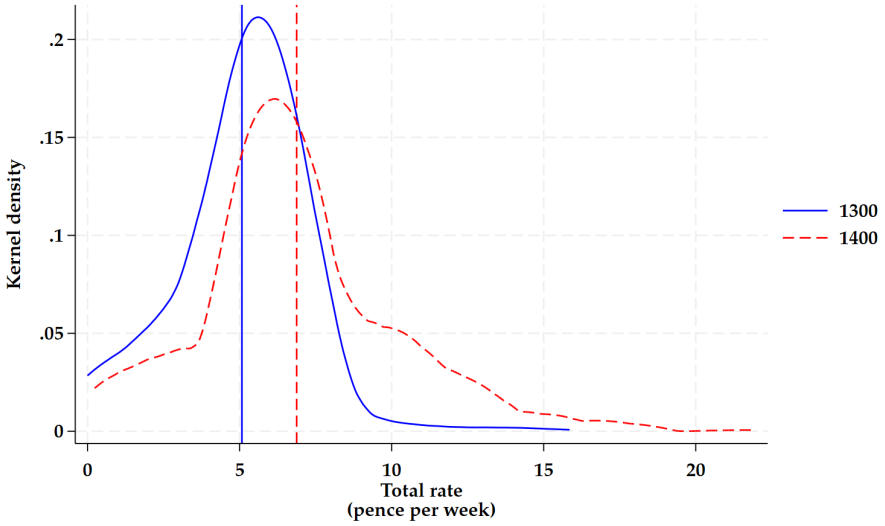
[11] Because of sample size concerns, our spatial analysis refers to the regional rather than the county level. For a discussion of the composition of our regional macro-regions, see Appendix B.

Figure 1: **Map of the manorial coverage of the two cross-sectional samples**

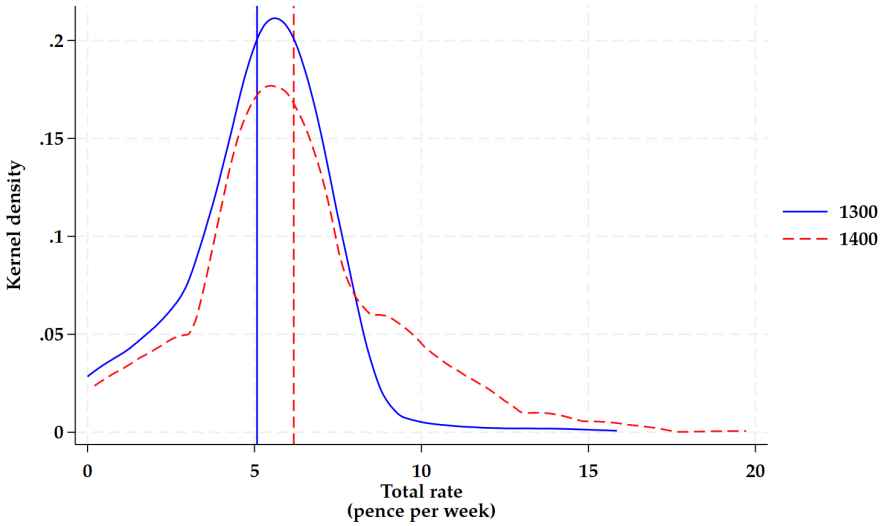


Notes: The bold borders represent the macro regions as discussed in the text. The non-bold borders represent historical county borders.

Figure 2: **Wage distribution of *famuli* (total rates), ca 1300 and 1400 England**



(a) **Nominal rates**



(b) **Real rates**

Notes: The vertical lines represent the average total wage rate. The wage distributions are approximated through kernel density estimation using a Epanechnikov function with a smoothing parameter of 1. For panel (b), we deflated the 1400 wage distribution using the ratio of the average value of the Allen consumption basket for the period 1390-1410 over the average value for the period 1290-1310.

Source: Consumption baskets: Allen (n.d.). Wage rates: Authors' database.

To illustrate the wide range of wage rates in medieval England, let us take examples from both ends of the distributions in 1300 and 1400. Harvest workers were often among the higher earners. In 1301, a harvest worker stacking grain on the manor of Ditton Valence (Cambridgeshire) earned 5d. of cash and 1 bushel of a barley and rye mixture, together worth 11d. per week.[12] In 1409-10, harvest workers mowing at Sedgeford (Norfolk) earned 17d. per week in cash, considerably more than their forebears in 1300.[13] At the other end of the scale, a page (boy) guarding cows and geese working at Bewley (Durham) in 1302-3 earned only one quarter of a bushel of wheat per week, equating to around 2d. (Britnell, 2014, 178). His equivalent in 1396-7, a page helping the shepherd at Carthorpe (Yorkshire), earned one third of a bushel of maslin (a mixture of rye and wheat) per week, again with no cash, worth about 1.5d.[14] In this case, the boy in c. 1400 actually earned 25 percent less than his predecessor was paid nearly a century earlier.

Comparing the nominal pay rate distributions of 1300 and 1400, labour markets seem to have developed at two different speeds. While we find a marked level of upper-tail wage growth, there was limited wage growth at the lower end of the wage distribution. This is a reflection that any structural transformations during the fourteenth century appear to have left at least some workers relatively unaffected. This becomes even clearer when we move to panel (b) of Figure 2, in which we perform the same exercise but in real rather than nominal terms: by 1400, a large group of *famuli* earned exactly the same as their predecessors had around 1300. This is a striking finding, suggesting that earlier observations of increased total annual wage earnings might be explained, at least to some extent, by changing lengths of employment within the group of 'annual' workers (Humphries & Weisdorf, 2019; Claridge et al., 2024).[15] In what follows, we focus on increases in nominal rather than real rates, and identify that some groups of workers only received very minor increases in their rate of pay. However, it is important to keep in mind that even these small wage increases were in part offset by increases in the cost of living over the two respective cross-section periods.

[12] The National Archives (TNA), SC6 766/15.
[13] Norfolk Record Office (NRO), DCN 60/33/13.
[14] North Yorkshire Archives, ZJX 3/2/35.
[15] We return to the issue of length of employment in Section 5.

To understand how and why the wages paid to the *famuli* varied we need to first appreciate that they were paid a composite wage formed of cash and in-kind components. Then we must consider how the rates of remuneration paid to labourers varied across three dimensions. The first and most straightforward is the amount of cash labourers received. In-kind remuneration, however, is more complicated as it could be adjusted in two separate ways. First, in-kind *quantity*, our second dimension, is simply the amount of grain given to labourers. In contemporary practice, this was expressed in the number of weeks it took a worker to earn a quarter of grain. The third dimension is in-kind *quality* which was determined by the types of grain paid to workers. This ranged from less desirable and lower-value grains like oats and even beans and legumes, to the most desirable grain, wheat.[16] While the composition of grain liveries varied considerably between manors and over time, most *famuli* received 'middling' mixtures, which, in terms of quality, sat somewhere between the poles of oats and wheat. For the remainder of this paper, we quantify the quality of a grain livery by calculating its weighted market price using local prices quarried from the same accounts as the wages we record, as well annual prices calculated by Farmer (1988, 1991).[17]

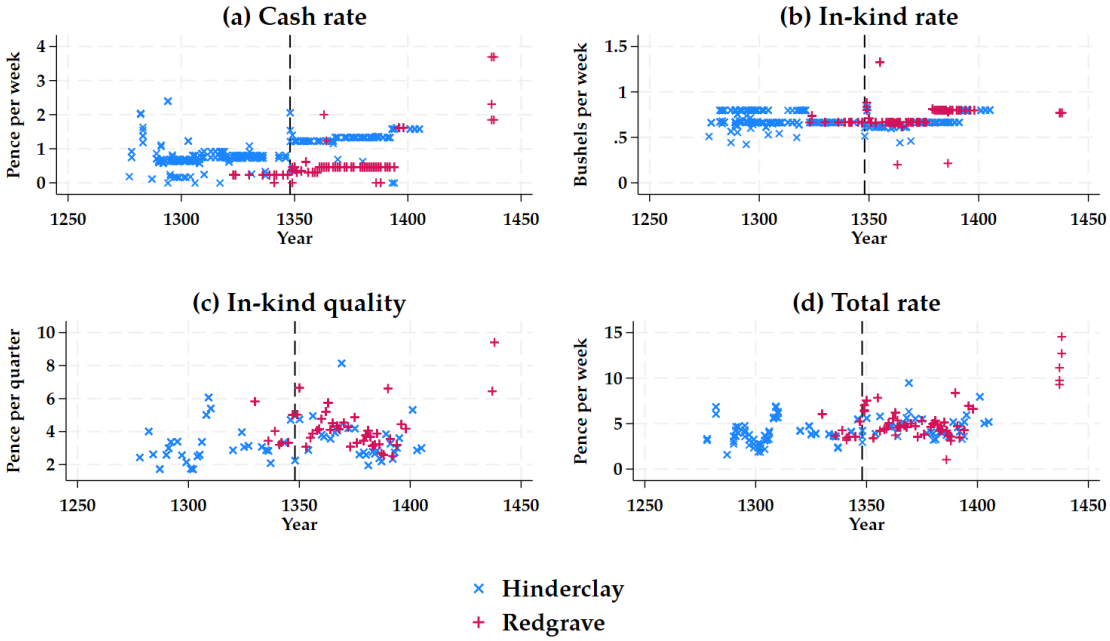
To illustrate these three dimensions, and how they impacted on total earnings, we can focus on the example of the remuneration of ploughmen, at two Suffolk manors held by the monastery of Bury St Edmunds, Hinderclay and Redgrave, across the fourteenth century (Figure 3). Panel (a) shows the amount of cash received by ploughmen, expressed in pence (d.) per week. These rates were often quite sticky over time, but were adjusted at both manors, for instance rising from 0.8d. to 1.5d. at Hinderclay. Panel (b) illustrates the amount of grain received by ploughmen, expressed in bushels per week. Again, this quantity was very sticky, at Hinderclay remaining at 0.67 bushels per week (or 12 weeks per quarter) for almost the entire fourteenth century, before jumping to 0.8 bushels per week (or 10 weeks per quarter) from the 1390s. Panel (c) shows the quality of in-kind payments, expressed in the value of a quarter of the grain mix. The actual mixtures of grains received were also

[16] Wheat was at the heart of elite diets, exemplified by the exclusive preference for wheat bread at aristocratic and monastic tables (Dyer, 2023).

[17] For more information on the calculation of the total wage rates, including the pricing of the liveries, we refer to Appendix A.

relatively sticky but varied between the two demesnes. On both, workers were paid a mix of barley, beans and peas, rye and wheat, but received different proportions of these. This explains some of the variation in livery quality between the two manors in the *same* year. However, the significant variation *between* years is explained by the changing prices of grains. Panel (d) combines the information across all three dimensions to provide the total pay rate of a ploughman at each manor expressed in pence per week.

Figure 3: **Changes in the remuneration of *famuli* ploughmen in three dimensions: Hinderclay and Redgrave**



Notes: The dotted vertical line is plotted at 1348, when the Black Death arrived in England.

Source: Authors' database

Looking at these four panels together illustrates two important aspects of the remuneration of *famuli* workers. First, cash typically provided only a small proportion of total earnings at these Suffolk manors. This reflects national trends: although its share grew over the course of the fourteenth century, cash accounted for less than half of total *famuli* remuneration. In the 1300s, on average, 18 percent of annually employed male *famuli* wages were paid in cash. By the 1400s this had risen to 37 percent (Claridge et al., 2024).

Secondly, we can see that differences in cash remuneration could be evened out between workers due to differences in the quality and quantity of in-kind payments. While between 1350 and 1400 ploughmen at Hinderclay were paid around 1d. in cash per week more than those at Redgrave, the total rates of pay at both manors were very similar. This was because workers at Redgrave received higher-quality grains, and later, also greater quantities than *famuli* at Hinderclay. That lords adjusted the nature and balance of remuneration across all dimensions is also seen at other estates. When grain prices rose in the first decade of the fourteenth century, some of the bishop of Winchester's manors reduced the rate of grain payment from one quarter every eight weeks to one quarter every ten, while increasing cash payments from 3s. to 4s. With grain liveries paid in barley, this meant that workers lost about 5s. worth of grain while gaining only 1s. in cash (Farmer, 1988, 762). After the Black Death, on Ramsey Abbey manors, many *famuli* also received more cash, but any rise in total remuneration was cancelled out by a reduction in the quality of grain they received, with wheat increasingly replaced by peas (Farmer, 1991, 481-2). Therefore, it is only by combining information on all three dimensions of remuneration, that we can understand the full 'pay packet' earned by *famuli* workers, and how this varied across space and time.

Examining *famuli* wages in the aggregate reveals significant variation in pay among workers, which was informed by three different dimensions of their remuneration: the amount of cash, the quantity of grain, and the quality of the crop mix which they received. What led some workers to experience significant increases in pay after the Black Death while other workers experienced only minor gains, and how this was related to the degree to which the fourteenth century English labour market was commercialized, forms the focus of the rest of this article.

4 Occupational wage inequality

We now break down the distribution of total wage rates to observe the different drivers of wage inequality, and whether these drivers changed over the course of the fourteenth century. An intuitive point to start is the occupational composition of the *famuli* labour force. We distinguish between twelve major occupational groups

among the *famuli*. We refer to Appendix A.1 for a Latin list of occupational titles. In Appendix C.1, we present a more detailed discussion of the employment structure of the *famuli* in 1300 and 1400. Here, we focus on the key trends in employment and wage rates.

The 'core' *famuli* occupations were well-defined roles which are found consistently in accounts from across England, especially at the highpoint of demesne agriculture in c.1300. These consisted of ploughmen,[18] carters (*carectarii*) cowherds (*vaccarii*), dairymaids (*dayae*/*daiae*/*deye*), shepherds (*bercarii*) and swineherds (*porcarii*). These roles were essential to the basic exploitation of agricultural land and livestock on a medieval estate. The main tasks of individuals in these groups are reflected in their occupational titles, but their work often stretched to other jobs, especially in slack periods, which for arable roles, was between sowing and harvesting and for dairymaids, the winter, when cows produced less milk (Searle, 1974, 305; Penn & Dyer, 1990, 362; Britnell, 2001, 6-7).[19] A further 'core' group consists of what we call 'titular *famuli*'. What differentiates these labourers from other 'core' workers is that they were described in the accounts not by occupational designators, but more generic terms such as *famuli* of the court (*famulus curiae*), 'servant' (*serviens*) and simply '*famulus*'. These individuals often performed one of the occupations outlined previously, but were not explicitly tied to the occupation in the accounts. The reason for this, as discussed below, may lie in the greater use of names to identify individual workers in accounts from the last quarter of the fourteenth century, which meant occupational titles were no longer recorded as consistently (Claridge et al., 2024). A focus on the most important agricultural work, combined with a degree of flexibility ensured that 'core' *famuli* were essential throughout the agricultural year and, accordingly, most were employed on an annual basis.[20]

The other five categories of workers were more peripheral. Harrowers (*herciatores*) and harvest workers (performing tasks such as stacking, forking and reaping) were important for arable production, but only at specific times in the year. Hiring

[18] This group consists of workers designated as 'ploughmen' (*carucarii*, as well as the more specific designators of 'driver of the plough' (*fugatores*) and 'holder of the plough' (*tentores*).

[19] For more on the specific tasks of these workers, see Appendix C.1.

[20] As shown in Table 1, in 1300 the average 'core' *famulus* or *famula* worked 316 days per year and 79 percent were full time. These trends were heightened by 1400, when they worked on average for 352 days per year and 95 percent were full time.

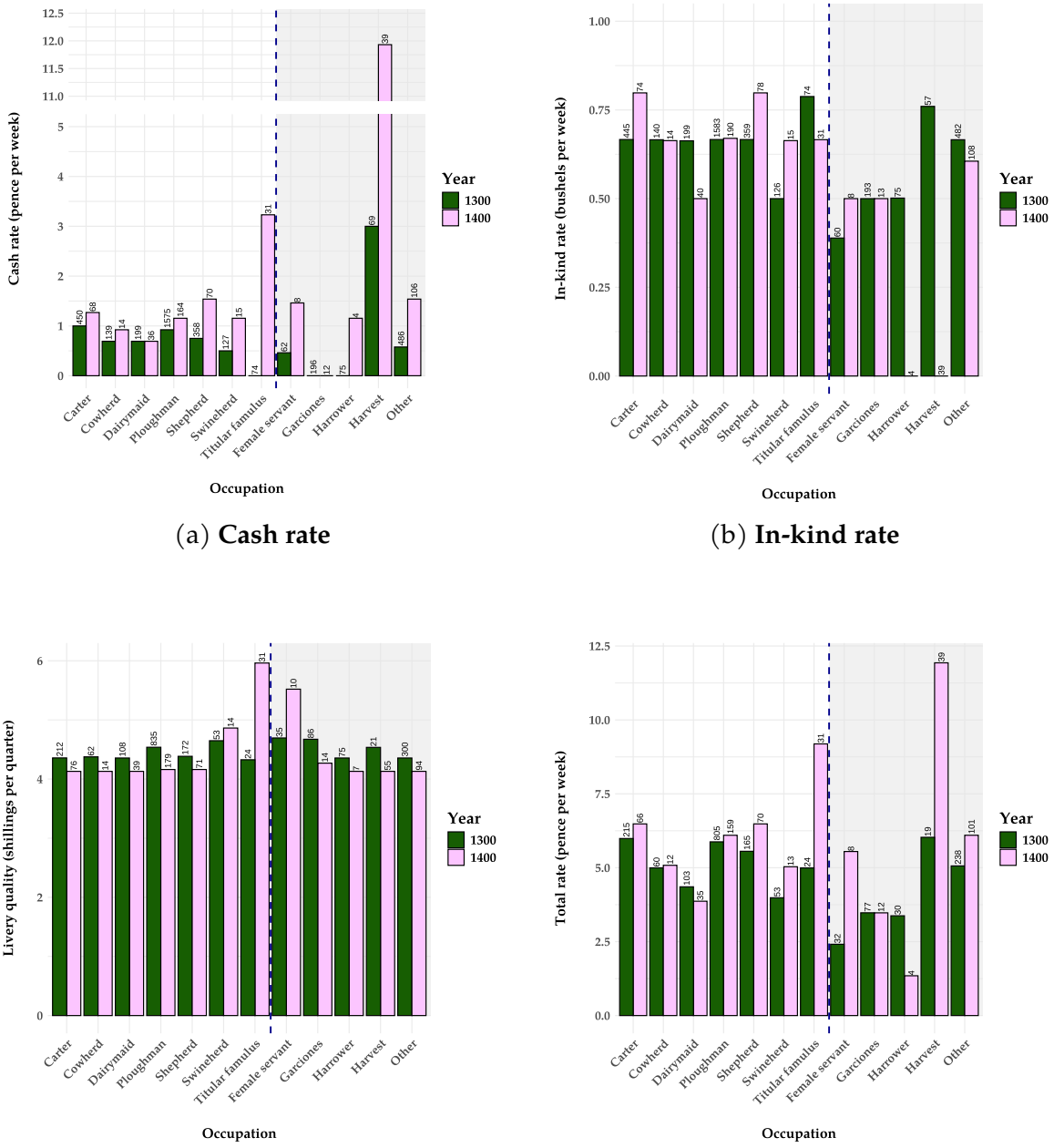
famuli to perform these tasks was only one option available to demesne managers, who could also hire day labour, use labour services owed by tenants (where available) or redeploy 'core' *famuli*. *Garciones*,[21] who were typically younger workers, and often children, performed a wide variety of more marginal tasks. Their work was often centred around animal herding, from tending horses, helping shepherds and swineherds to managing geese and scaring birds, but they were also often employed in harrowing (Claridge & Langdon, 2015). Female servants, a role similarly defined by the type of person rather than task, performed roles such as managing the *curia*, making pottage (fed to *famuli* workers for breakfast) and making malt.[22] Finally, the remaining category of 'other' *famuli* represents a variety of lesser-seen occupations doing more specialist or supplementary work and includes parkers, warreners, grooms, and general workers without occupational titles. We entirely exclude managers, such as reeves, bailiffs and serjeants from this analysis, as their remuneration is complex to reconstruct.[23]

[21] Our *garciones* category also includes 'pages' (*pagettii*), another title typically used to denote young male workers.

[22] We include the Latin terms *mulieres*, *ancillae* and *puellae* in our 'female servants' category.

[23] For instance, many of these workers were so-called 'service' *famuli* who received rent-remission as part of their remuneration, while others received an annual payment in clothes, typically consisting of a robe and hood. Their pay-packet therefore varied significantly from the other *famuli* in our sample and we leave the calculation of the value of their total wage for future research.

Figure 4: **Median wage rates in *famuli* occupations, c. 1300 and 1400 England**



(a) **Cash rate**

(b) **In-kind rate**

(c) **Quality of livery**

(d) **Total rate** (cash and in-kind income)

Notes: The occupations left of the dashed line and without the shaded background are the 'core' famuli occupations. The number of observations per wage rate are displayed on top of the respective bars.

Source: Authors' database

Figure 4 shows median rates of pay for these twelve different occupational categories.[24] A first observation is the clear hierarchy of occupations in c.1300. We see that the 'core' and male-dominated occupations of carters, ploughmen and shepherds earned the highest *total* wage rates of between 5.5d. to 6d. per week (see panel 4d). Cowherds, dairymaids, swineherds and titular *famuli* form a second grouping, earning between 4d. and 5d. per week. Meanwhile, more peripheral groups had a diversity of experience. Harvest workers were paid relatively well in 1300, earning around 6d. per week, placing them on the same level as the best paid 'core' workers (if only for a few weeks of the year). 'Other' workers earned around 5d. a week, placing them within the second grouping of 'core' workers. On the other hand, *garciones*, harrowers and female servants earned much less, at 2d. to 3.5d. per week.

Unique to our empirical approach is that we can break divergence in *total* remuneration down into their constituent components: *cash* payments (panel 4a), in-kind *quantities* (panel 4b) and in-kind *quality* (panel 4c). Differences in total wage rates were not typically due to disparities in the quality of grain paid in-kind, which was remarkably stable between workers, but rather by differences in the quantities of grain and the amount of cash they received.[25] In-kind rates (see panel 4b), which made up the majority of total remuneration, were divided broadly, into two tiers, mirroring the earlier findings of Claridge and Langdon (2015). This follows a different pattern than what we observe in total remuneration. First-tier workers, consisting of carters, ploughmen, shepherds, cowherds, dairymaids, harvest workers, titular *famuli* and 'others' earned on average 0.67 bushels or more per week.[26] The second tier of consisted of *garciones*, harrowers and swineherds, who earned 0.5 bushels or less per week.[27] Variation in total wages beyond these relatively sticky lev-

[24] This analysis of differences in median wage rates *between* occupations does not account for *within*-occupation inequality. In Sections 4 and 6, we respectively consider between-occupation and between-region inequality. In Section 7, we return to the issue of inequality *within* those units of analysis.

[25] Some workers did receive a typically higher 'individual' grain payment rather than receiving part of the collective livery given to all workers. This is not captured by our median payments but is accounted for in our observation of total rates. A similar analysis as in Figure 4c but based on average rates, reveals only slightly more variation, showing that these individual livery cases had a modest impact on the overall picture of wage inequality.

[26] In the calculus of the sources working for 8-12 weeks per quarter of grain.

[27] In the calculus of the sources, working for 16-21 weeks per quarter of grain.

els of in-kind remuneration (which, in many cases may have been fixed by custom) came from differences in cash stipends (see panel 4a) which ranged significantly more than grain liveries. Harvest workers received the largest cash stipends at 3d., carters and ploughmen were given around 1d. per week. Shepherds, cowherds, dairymaids and other workers were typically paid less cash, at 0.7-0.75d. per week. Trailing them were swineherds and female servants who earned around 0.5d. per week, and, more dramatically, *garciones*, harrowers, and titular *famuli* who, in most cases, received no cash at all. Therefore, it is clear that while broad occupational variation in pay was set through liveries, more discrimination was maintained through cash payments, which were more easily changed between workers than liveries.

The second key finding is that the Black Death did not impact workers' earnings in all occupations equally. For some workers wage growth was modest, while for others it completely transformed their earnings (see panel 4d). Harvest workers, who were already well paid in 1300, saw an astronomical increase in earnings, following a pattern similar to those who worked by the day or on other short-term arrangements (Penn & Dyer, 1990; Clark, 2007). Harvesters also received all their wages in cash in 1400, allowing them greater flexibility than in the early fourteenth century. The windfall for harvesters is likely explained by the chronic shortages of labour during the harvest season, exacerbated on some demesnes by the disappearance of labour services, which gave other workers an especially strong bargaining position (Mullan & Britnell, 2010a, 58-64, Bailey, 2021, 87-88). The titular *famuli* also experienced dramatic wage growth driven by growing cash stipends and an increase in the quality of grain they received as in-kind payment. We cannot be certain exactly what these workers were doing but many were likely performing many of the same 'core' jobs of ploughing and carting. Titular *famuli* were often named in the accounts which suggests that they could bargain the terms of their employment (Claridge et al., 2024) and this may explain why they were able to secure higher wages unlike other 'core' workers. The small number of female servants in the sample also saw a substantial increase in weekly rates, allowing them to catch up with 'core' occupations like swineherds and cowherds.

Beyond these examples, most *famuli* wages did not change substantially in the

aftermath of the Black Death. For most 'core' workers, and many peripheral workers, wage growth over the fourteenth century was far more muted and did little to disrupt the occupational wage hierarchies which had existed since 1300. Carters, ploughmen and shepherds - male-dominated roles - saw increased wages, and swineherds gained in relative terms, while dairying, a role dominated by women, saw a small fall in income, largely because they did not receive the increase in cash stipends enjoyed by their colleagues. 'Other' workers in the aggregate saw a modest growth in their total wages, but this was largely in-line with the first grouping of 'core' workers. *Garciones* and harrowers remained the worst-paid workers. While the former continued to earn 3.5d. per week, harrowers saw a decline in wages to 1d. per week, although the fact that only nine workers exist in our dataset shows how marginal this group of workers had become (see Table 1).

These changes were driven by cash payments (see panel 4a). The transformation for harvest workers particularly stands out. While work during the harvest season had always received generous cash compensation, by 1400 payments had quadrupled to 12d. per week. This was four times higher than the 3d. paid to the titular *famuli*, who themselves also received a notable pay bump. Female servants and 'other' workers also enjoyed substantial rises in stipends.[28] Inequalities in in-kind wages remained relatively static, with small adjustments in *quantity* (see panel 4b) and *quality* (see panel 4c) of livery rates. The most substantial change was that workers who laboured at specific times of the year, namely harvesters and harrowers, became solely remunerated in cash, further underlining the shift towards an increasingly commercialized and cash-based labour market.

The evidence of occupational wage hierarchies reveals the cross-currents of custom and market in determining remuneration in fourteenth-century England. Rigidity in in-kind payments, which had a strong insurance value for workers, meant that much of workers' pay was determined by fixed values. These followed pre-established hierarchies, with certain 'core' workers paid at first-tier rates and oth-

[28] The cash stipends of female servants tripled across the fourteenth century (although the wider significance of this finding is difficult to gauge as only eight female servants are found in the 1400 sample). 'Other' workers saw a doubling in cash stipends to 1.6d. per week. Within this group, some specific occupational groups drove this growth. For instance, parkers saw a twelve-fold increase in their cash rate (from 1d. per week to 13d. per week), warreners a ten-fold increase (from 0.6d. per week to 6.5d. per week) and woodwards a five-fold increase (from 0.7d. per week to 4d. per week).

ers paid at second-tier rates. The Black Death did lead to some equalisation, or convergence, in in-kind rates for some labourers, but, for others, rates remained unchanged. The flexibility of cash remuneration allowed workers who were particularly in demand, or whose pay was more determined by their individual skill, such as titular *famuli*, harvest labourers and certain 'other' workers, to particularly benefit from labour shortages. Ultimately, it seems the type of workers who were best placed to overcome the customary limitations implied by in-kind payment were most able to take advantage of changed conditions after the Black Death.

5 Towards a full-time *famuli* labour force

An important follow-up question is whether our analysis of inequalities of wage rates obscures changes in employment or time worked (or in other words, the possibility to earn wage rates discussed above).[29] In this section, we argue that wage differentials between types of worker were accompanied by an increasing professionalisation of the *famuli* labour force. This is revealed by the continuity of employment within 'core' occupations alongside decline in some more peripheral occupations and a shift from part-time to annual employment.

Table 1 (panel 'employment') demonstrates that 'core' workers like ploughmen, carters, and shepherds remained a significant presence within the *famuli* across the fourteenth century, even if the composition of 'core' workers shifted towards pastoral roles. We find that 'core' workers, on average, worked more days per year in c. 1400 than in c. 1300. How might this be explained? In 1300, a number of 'core' workers worked for slightly less than a full year. By 1400, most core workers were working for a full year (or closer to 52 weeks).[30]

The persistent presence of 'core' roles can be contrasted with the decline of some more marginal roles within the workforce. Numbers of ploughmen, harrowers and other soil-preparation workers shrank dramatically by 1400, as did the *garciones*. The

[29] This issue is also raised by Hatcher (2011), who questions whether day labourers were in fact able to secure consistent employment at the elevated wage rates observed after the Black Death.

[30] This also reveals how seemingly contrasting findings of stable real pay rates for many *famuli* can be married with earlier findings of real wage increases for annual workers over the fourteenth century (Humphries & Weisdorf, 2019; Claridge et al., 2024). This divergence can be partly explained by changes in length of employment.

exception was harvest workers who grew from 2 percent to 8 percent.[31] This trend was shaped by the policies of a few manors to hire harvest workers for longer periods, perhaps in places where they faced exceptional competition for day-waged labour to perform these roles.[32]

[31] For a more detailed discussion of employment patterns of *famuli* in our sample, please see Appendix C.1.

[32] These workers were hired in large numbers on the Norfolk Cathedral Priory manors of Gnatingdon, Plumstead and Sedgeford. Hiring harvest workers for specific terms may have been a response to Norfolk's tight labour market in the early fifteenth century. See NRO, LEST/IC 30, DCN 60/29/40, LEST/IB 52.

Table 1: **Occupational Structure and Length of Employment of *Famuli*, c. 1300 and 1400**

Occupation	Year	Employment		Tenure	
		Freq.	% Freq.	% part-time	Mean days
Carter	1300	461	0.11	0.23	306
	1400	79	0.12	0.06	345
Cowherd	1300	152	0.04	0.24	310
	1400	16	0.02	0.00	359
Dairymaid	1300	210	0.05	0.24	304
	1400	43	0.06	0.02	357
Ploughman	1300	1658	0.39	0.18	323
	1400	199	0.29	0.05	354
Shepherd	1300	379	0.09	0.23	308
	1400	80	0.12	0.06	350
Swineherd	1300	146	0.03	0.17	320
	1400	16	0.02	0.12	344
Titular famulus	1300	74	0.02	0.36	301
	1400	31	0.05	0.06	354
All core workers	1300	3080	0.72	0.20	316
	1400	464	0.68	0.05	352
Female servant	1300	88	0.02	0.23	291
	1400	12	0.02	0.17	316
Garciones	1300	254	0.06	0.67	124
	1400	15	0.02	0.67	149
Harrower	1300	144	0.03	0.50	93
	1400	9	0.01	0.11	289
Harvest	1300	80	0.02	0.86	49
	1400	55	0.08	0.71	48
Other	1300	608	0.14	0.34	253
	1400	126	0.19	0.32	260
All non-core workers	1300	1174	0.28	0.46	198
	1400	217	0.32	0.42	207
All workers	1300	4254		0.27	288
	1400	681		0.17	311

Notes: The column 'year' refers to the cross sectional sample from which observations are drawn. The column '% part-time' refers to share of part-time (worked less than 300 days) workers in the occupational group. The column 'mean days' refers to the average number of work days per year for workers in the occupational group.

Source: Authors' database

This shift towards dominance by a 'core' group of 'professional' *famuli* workers is also seen when examining the tenure of workers. Table 1 (panel 'tenure') demonstrates that, while part-time workers (here defined as under 300 days a year) were always the minority, within the *famuli* their numbers fell significantly between 1300 and 1400. This led to a significant increase in the average number of days worked by the *famuli* as a whole, from 288 to 311 days. Aside from harvest workers, the only role in which part-time workers still made up the majority, namely, *garciones*, was precisely the one that was vanishing during this period.[33]

What explains the decline of more peripheral roles and part-time work in the aggregate? This process was driven by the demographic collapse of the Black Death which impacted both on the demand for, and supply of, *famuli* labourers. From the demand side, the agricultural operations of demesnes changed radically in the wake of the Black Death. In 1300, acute Malthusian pressures led to significant demand for grain and persistently high prices. This, in turn, led to a medieval peak in total sown acreage as both lords and tenants sought to expand production for their own consumption and sale on the market. From the 1370s, however, grain prices fell dramatically due to a saturated market with lower levels of demand. In response, many demesne managers pivoted towards pastoral pursuits, which were less labour intensive and leveraged the increasing consumer appetite for animal products which accompanied increases in spending power (Campbell, 2000, 183-7, 430-6; Broadberry, Campbell, Klein, Overton, & Van Leeuwen, 2015, 57-61).

From the supply side, conditions after the Black Death changed workers' preferences. More marginal and poorly-paid positions, which had once abounded, became less attractive. Demesnes were forced to provide annual employment to attract workers. In 1300, many child labourers were likely drawn from the families of *famuli* workers (Claridge & Langdon, 2015). By 1400, wages for at least some of these *famuli* had increased to levels which alleviated the need for their children to work (Horrell, Humphries, & Weisdorf, 2022).[34] Similarly, as the availability of land increased and average landholding sizes grew (Mullan & Britnell, 2010b, 136-151; Dyer, 2022, 64-

[33] The trend of falling proportions of part-time *famuli* workers can also be seen in our long-run samples for individual manors. See Appendix C.4.

[34] Women and children often act as a 'reserve' labour force, used to augment male labour, and our evidence supports such arguments (Bardsley, 1999; Langdon, 2011; Lancy, 2015).

66), and tenants less frequently sought part-time roles for themselves or their family because larger holdings could absorb more household labour. Rising day wages also likely tempted some workers to take up more flexible opportunities on both the estates of lords and larger tenant holdings, travelling between employers in search of better pay at the harvest or perhaps prioritising leisure over finding additional work at other points in the agricultural year.(Penn & Dyer, 1990; Hatcher, 1998; Claridge et al., 2024). For those who did remain as waged labourers and smallholders, growing opportunities for industrial employment may have also proved more attractive than work as a part-time *famulus* or *famula* (Poos, 1991, 58-72; Broadberry et al., 2015, 347).

This changing situation is apparent in our data. Full-time 'core' workers, an increasing proportion of which worked in pastoral agriculture, became even more dominant in 1400. At the same time, numbers of part-time workers, and especially those in more marginal arable tasks, fell precipitously. This reflects both the absolute decline in the arable focus of demesne agriculture and a decrease in the intensity of crop cultivation with a shift towards more extensive agricultural techniques (Campbell, 2000, 232-8; Broadberry et al., 2015, 80-97; Dyer, 2022, 166, 180-87). Harrowers, marlers and furrow spreaders, often on part-time contracts at specific points of the year, were a crucial part of raising cereal yields in response to demographic pressures and commercial stimuli around 1300 (Stone, 2001; Stone, 2005, 231-76). By 1400, soil-preparation tasks were increasingly performed by more targeted use of day-labour or by the remaining 'core' *famuli* at times of the year when they were not performing their main roles (Stone, 2005, 109-113, 146-8, 231-76). Similarly, when faced with the persistently low wages on offer for *garciones* in 1400, it is hardly surprising that it became difficult to recruit these workers in a world flush with new opportunities.

In combination, these trends helped further 'professionalize' the *famuli*. The proportion of 'core' workers employed on an annual basis remained relatively stable over time, except for a broader shift toward pastoralism driven by changes in how lords sought to exploit their estates. Conversely, the share of more marginal labourers fell across this period. Additionally, the emergence of the titular *famuli* signalled

a new way of defining labour roles, reflecting workers' increasing bargaining power. Increasingly, a set of standardised 'core' workers, whose wages grew little after the Black Death, were vital for the cost-effective management of the manors which remained in the hands of lords.

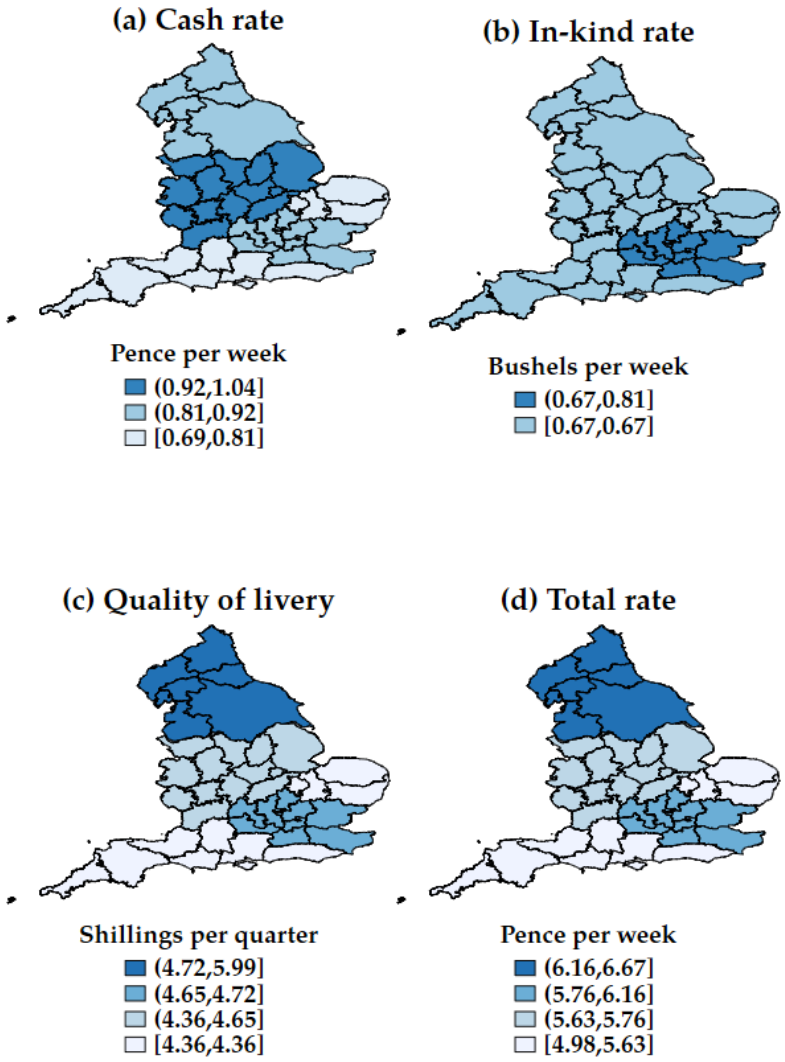
6 Regional wage inequality

We now examine another possible factor behind the variation in wage rates among the *famuli* workforce: regional differences. Regional variation in wage rates has not received sustained attention in the scholarship, although the lack of a national labour market has been highlighted (Campbell, 2009). That wages differed by region was recognised by the writers of the labour legislation made in the wake of the Black Death and subsequent plague outbreaks. The 1349 Ordinance of Labourers ordered that workers should be given the wages 'which were usually paid in the part of the country where they are working' in 1346, while the 1390 iteration of the labour legislation detailed how magistrates in individual counties should set wage rates according to prevailing food prices (Horrox, 1994, 287; Statutes of the Realm: 1101-1713, 1810-1820, vol.II, 63).

To explore this, we focus on ploughmen, the largest occupational group in our sample.[35] Figure 5 maps regional differences in the median rates of all wage components for ploughmen in our c.1300 cross section. The point of this exercise is not to argue that the ploughman's experience was representative of the *famuli* as a whole, but rather to illustrate the diverse regional wage rates paid to a (relatively) homogeneous group of medieval workers in our most representative sample. The map is divided into five regions: East Anglia, the Midlands, the North, the South and South-west, and the Thames Basin.

[35] We explore wage differences for ploughmen specifically due to their ubiquity, as ploughmen represent c.40 percent of all workers in our 1300 sample, as well as the relatively consistent nature of their role - we can be reasonably sure that ploughmen were doing similar work in 1300 and 1400.

Figure 5: **Maps of median-level nominal wage rates for ploughmen at regional level, c. 1300 England**



Notes: Wage rate categories correspond to quintiles of the respective regional wage distributions

Source: Authors' database

Considerable regional differences are evident in both the composition and the remuneration of ploughmen. In terms of total nominal wage rates, the North emerges as the highest-paying region, followed by the Thames Basin. By contrast, ploughmen in the Midlands and the South and South-west received markedly lower wages,

with those in East Anglia earning the lowest pay.[36] Breaking remuneration into its three dimensions shows that, unlike worker-level differences, regional wage disparities were not created by variations in in-kind payments. Ploughmen were paid at nearly identical rates across most of the country; only in the Thames Basin did ploughman average more than 0.67 bushels per week (or 12 weeks per quarter). It was instead the quality of grains paid and rates of cash that instead determined wage levels. Northern manors paid both exceptionally high-quality liveries, often comprised entirely of wheat, and also relatively generous cash stipends.[37] Similarly, the Thames Basin supplied liveries of moderate quality and broadly similar cash rates. While the ploughmen in the Midlands were paid the most cash, this was balanced by a lower quality of in-kind payment, leading to lower total pay rates than their brethren in other regions.[38] Lower-quality liveries and smaller stipends in the South and South-west, and especially East Anglia, led to ploughmen in these regions earning lower wages than elsewhere in England.[39]

These patterns suggest that in 1300 high levels of commercialization were not visibly correlated with high wage rates, whether in cash or in total remuneration. The Thames Basin was characterised by high levels of market-oriented agriculture due largely to its proximity to London (Campbell, Galloway, Keene, & Murphy, 1993, 175-8; Campbell, 2000, 209-10), whereas parts of the northern Midlands, and especially the North, were less commercially oriented, yet both were characterised by high wages. Using taxpayers per acre as an indicator, the North and northern Midlands had low numbers of relatively poor taxpayers as well as lower levels of market density (Campbell & Bartley, 2006, 302, 347-8). Conversely, East Anglia is often seen as the commercial region par excellence, supporting high numbers of taxpayers per acre making use of the most productive agricultural techniques, yet wage

[36] For example, ploughmen at the northern manor of Bolton (Cumberland) in 1296-7 earned a total rate of 7.5d.-8d. per week; ploughmen at the Midlands manor of Tinwell (Rutland) in 1300-01 earned at total rate of 6d. per week; and ploughmen at the East Anglian manor of Ditchingham (Norfolk) in 1299-1300 earned a total rate of 4.5d. per week. See respectively: TNA, SC6 824/2; NRO, F(M) Charter/2388; TNA, SC6 934/8.

[37] For example, the ploughmen at Bolton were paid entirely in wheat flour and given an annual stipend of 3s. per year.

[38] For example, the ploughmen at Tinwell were given an annual stipend of 4s., but their liveries were comprised of wheat mixed with the cheaper grains of barley and rye.

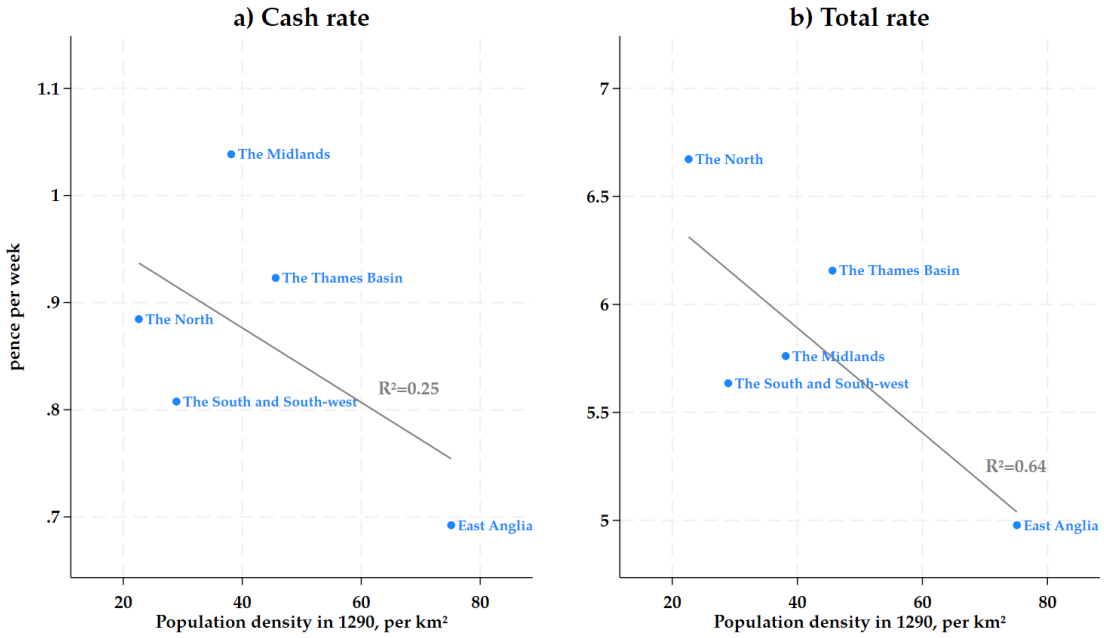
[39] For example, the ploughmen at Ditchingham were given an annual stipend of 3s. per year, but their livery was paid in a less valuable mixture of '*curallum*' (low-quality wheat), rye, barley and peas.

rates were the lowest of any region (Campbell & Bartley, 2006, 302, 342-7; Campbell & Overton, 1993).

What explains these differences in wage levels, and why did the most productive and most commercialized parts of the country pay lower wages to ploughmen than less developed regions did? We suggest that this is a story of labour supply and limited outside options for *famuli* workers, driven by an essentially Malthusian dynamic. As shown in Figure 6, there was a strong inverse correlation between the wages of ploughmen and population density.[40] In 1300, East Anglia, and Norfolk in particular, was characterized by a densely settled and intensively cultivated landscape, which placed considerable pressure on living standards, leaving much of the population living on the edge of subsistence (Campbell, 2005). Although the dynamic land market in the East of England offered peasants opportunities to alienate and subdivide their holdings, it also created rural 'congestion', and therefore an oversupply of labour. In other parts of the country, such as the Midlands and northern England, lords were more successful in preserving holdings and avoiding subdivision (Whittle, 1998). Where labour was relatively plentiful and land scarce, lords may have been able to compel *famuli* to accept low(er) wages, because they had fewer viable outside options, especially ones which provided the benefits of consistent work and regular payment. Under such conditions, many individuals would have prioritized stability and certainty of employment over higher incomes. In the North, and to a lesser extent in the Midlands, lords may have faced greater competition for a limited labour supply, potentially driving wages higher in these parts of the country.

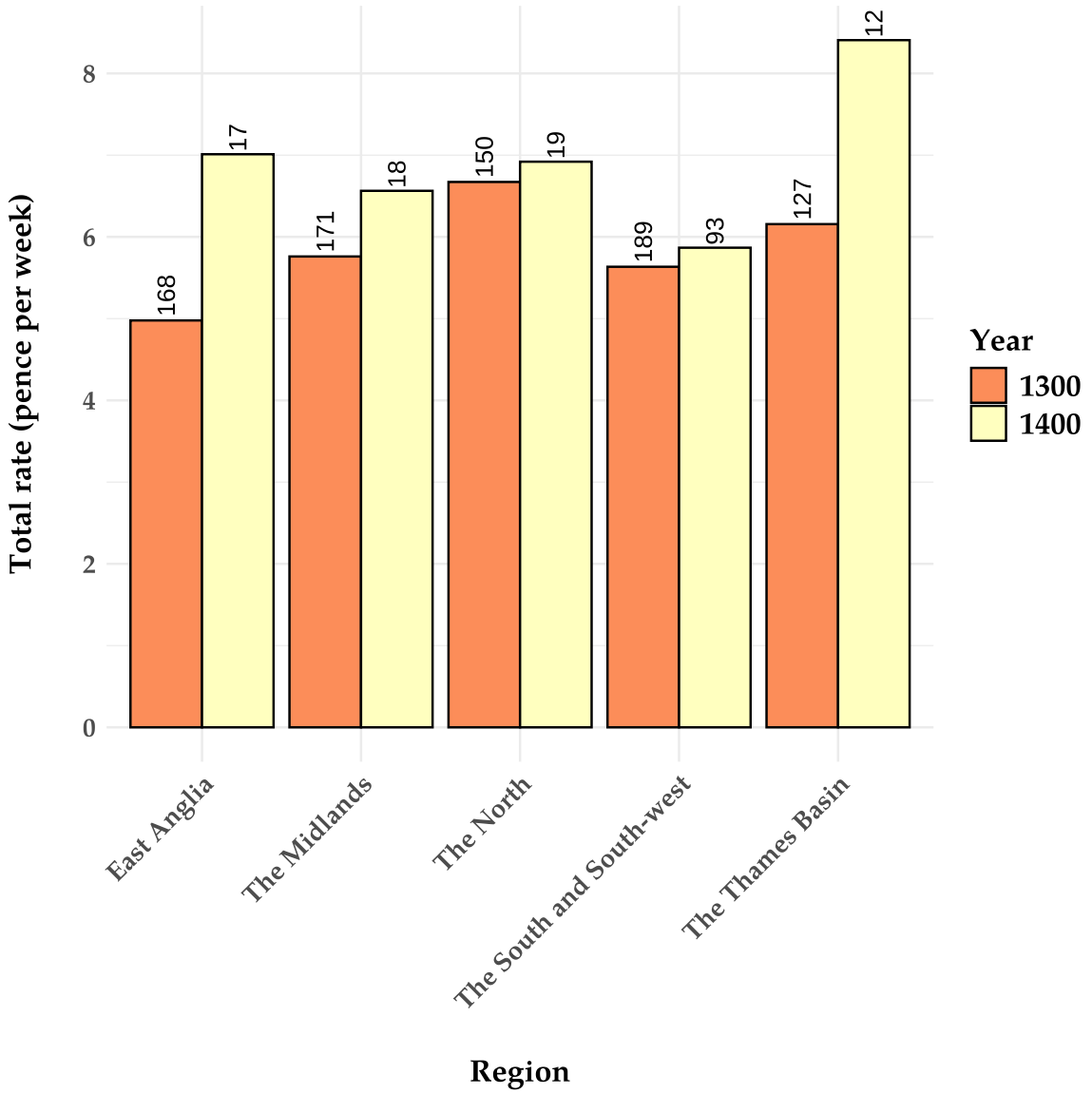
[40] We show this correlation for both cash (panel (a)) and total (panel (b)) rates. The correlation seems to be even stronger for total rates, providing further suggestive evidence for the importance of incorporating both cash and in-kind components of medieval remuneration in the inference of meaningful economic relationships.

Figure 6: **Regional population densities and median wage rates for ploughmen**



Source: Population density: calculated at the regional level from Campbell (2008); Wage rates: Authors' database.

Figure 7: **Median total wage rates of ploughmen across regions, c. 1300 and 1400 England**



Notes: The number of observations per wage rate are displayed on top of the respective bars.

Source: Authors' database

Turning to changes over time, Figure 7 demonstrates differences in the median wages of ploughmen between 1300 and 1400.[41] The differences in increases in wage rates across the board are striking. The Thames Basin saw the greatest increase, with

[41] We note that the sample for 1400 is more limited than our 1300 sample, particularly for regions beyond the South and South-west, with fewer than twenty individual ploughmen captured per region. Moreover, undoubtedly some of the titular *famuli*, a designation which was more common in c.1400, were in fact ploughmen, meaning some of the increases we see in ploughmen's wages may actually be understated.

wages in 1400 far in excess of any other region. Similarly, East Anglia saw a dramatic increase over the fourteenth century, bringing ploughmen's wages in line with that of the North. The Midlands saw a modest increase, while ploughmen in the North and South and South-west only enjoyed only a minor bump. The different scales of wage growth between regions can be linked to changes in population density. In a period where labour demand was not matched by supply, the dramatic decline in the land:labour ratio opened up opportunities for skilled agriculturalists to acquire their own holdings as leaseholders or tenant-occupiers and for rural dwellers to obtain work in retail or industrial pursuits. These opportunities were especially pronounced in East Anglia, so that the general condition of labour shortage was greatly exacerbated in this region by increased competition for other forms of employment, as a result of which ploughmen's wages rapidly converged with those of other regions (Schofield, 2001; Bailey, 2007, 242-53).

7 Decomposing wage inequality

We can also explore the degree to which the occupation or location of a *famulus* or *famula*, determined his or her remuneration, and how this changed across the fourteenth century. This is a common tool used to assess changes in wage inequality.[42] We do this by decomposing wage inequality among *famuli* in 1300 and 1400. We break down the variation in cash, in-kind and total wage rates into a region component (which captures variation across regions), an occupation component (which captures variation across occupations) and an individual component (which captures the covariance between the two):

$$Var(y_i) = \underbrace{Var(y_{i,r})}_{\text{Region component}} + \underbrace{Var(y_{i,o})}_{\text{Occupation component}} + \underbrace{2 \cdot Cov(y_{i,r}, y_{i,o})}_{\text{Individual component}}$$
$$\forall i : r \in R, o \in O \tag{1}$$

[42] Behind this variance decomposition, lies an Ordinary Least Squares (OLS) regression, in which one regresses wage rates on occupational and regional dummies and assesses the explanatory power of these dummy variables. Such variance decompositions are a key tool in the analysis of wage inequalities, for instance in the study of the role of firm-level earnings dispersion (for example, see Barth, Bryson, Davis, & Freeman, 2016). For another historical application, see Buyst and Delabastita (2023).

In essence, we hypothesize that, in a commercialized economy, *what* any individual worker did (occupation, indicated by o), and *where* they did it (location, indicated by r), should play a sizeable role in the determination of their wage. If this hypothesis is correct, the region and occupation components should play a significant part in explaining variation in wage rates.

Table 2: **Variance decomposition for *famuli* labourers, c. 1300 and 1400**

(a) **All workers**

Rate	Year	Gini	Individual	Occupation	Region	N	R^2
Cash	1300	0.532	0.914 %	0.076 %	0.009 %	3810	0.083
	1400	0.575	0.451 %	0.444 %	0.024 %	567	0.536
Livery	1300	0.182	0.870 %	0.089 %	0.047 %	3793	0.127
	1400	0.304	0.696 %	0.337 %	0.011 %	614	0.286
Total	1300	0.215	0.817 %	0.127 %	0.053 %	1821	0.176
	1400	0.250	0.615 %	0.221 %	0.088 %	550	0.368

(b) **Core workers only**

Rate	Year	Gini	Individual	Occupation	Region	N	R^2
Cash	1300	0.451	0.951 %	0.024 %	0.020 %	2922	0.046
	1400	0.403	0.840 %	0.072 %	0.063 %	398	0.138
Livery	1300	0.149	0.905 %	0.044 %	0.058 %	2926	0.092
	1400	0.178	0.877 %	0.040 %	0.085 %	442	0.103
Total	1300	0.188	0.848 %	0.061 %	0.080 %	1425	0.146
	1400	0.184	0.628 %	0.122 %	0.210 %	386	0.355

Notes: Column 'R^2' reports the adjusted R^2 of regressing wage rates on occupational and regional dummies.

Table 2 presents the results obtained from testing this hypothesis. We do so for our sample of all workers (Table 2(a)), as well as a sample with only the 'core' famuli included (Table 2(b)). For our full sample in panel (a), we find that, indeed, for both cash and total wage rates, the region and occupation in which a *famulus* or *famula* was active, became much more important over the course of the fourteenth century. For instance, in 1300, occupational and regional variables explain roughly 18 percent of the variation in total wages of all workers. By 1400, their explanatory power roughly doubled, as both variation across regions and occupations became more important. An even more striking pattern emerges when we look at the evo-

lution of cash wage rates. Table 2(a) demonstrates that, in 1300, occupation and location barely mattered for determining cash wage rates, as individual and occupation dummies explain less than 10 percent of the variation. This suggests that while goods markets may have been relatively well integrated in England, labour markets may not have enjoyed similar levels of commercialization at that time. In other words, late thirteenth- and early fourteenth-century labour markets were characterised by much variation beyond the occupational and regional dimensions we have discussed so far, leaving room for local customs to play a role in determining wage rates. While the labour market was not formally regulated at either the national and local level before 1349 (Bailey, 2023), this did not mean that wages were determined purely by market forces but instead were highly contingent on more informal institutional influences. More broadly, this finding also provides quantitative evidence for observations concerning the localised nature and uneven development of factor markets on the eve of the Black Death (Campbell, 2009, 97). By the end of the fourteenth century, a worker's occupation, and to a lesser extent their location, had become a more important determinant of cash earnings. This highlights a shift in labour market development toward greater reliance on money wages and the rise of a small number of exceptionally well-paid occupations, as discussed in Section 4.

Panel (b) presents findings for 'core' *famuli* only. The results reveal a similar, though less pronounced, trend toward the growing significance of occupational and regional determinants of wages. That occupational and regional variables are less important in our restricted sample of 'core' *famuli* is an consequence of a more homogeneous sample. The most striking difference is that, if we assess all workers, we find increasing levels of wage inequality among *famuli* as evidenced by changing Gini coefficients for cash, livery and total wage rates. Wage inequality remained more stable for the more traditional 'core' roles of the *famuli* workforce. This both corroborates our earlier observations of continuity in relative occupational and regional pay rates for many *famuli* and illustrates the range of experiences for labourers after the Black Death.

8 Beyond the *famuli*

What does our exploration of *famuli* workers suggest about the wider labour market in medieval England? The extent to which we can even speak of a general 'labour market' in pre-modern economies has been a significant debate in the historical wage literature. Some approaches, particularly those that seek to generalize results from a specific pool of workers, have assumed markets with no frictions, in which wage differences between sectors or labour market segments would be arbitraged away by the reallocation of workers. If any frictions existed, such as cases where worker preference for the security of annual employment over the uncertainty of earning by the day prevented some workers from moving between labour market segments, these frictions are assumed to have been constant over time (Clark & Van Der Werf, 1998).[43]

Hatcher (2011) has argued persuasively that such assumptions are unrealistic for medieval labour markets. Indeed, the idea that day and annual labour markets were perfect substitutes, or that any frictions between these two labour market segments were stable, is questionable. A friction between annual and day-labour markets that is both demonstrable and potentially significant was labourers' preference for the in-kind payment that almost universally accompanied annual employment contracts. This ensured that workers were willing to trade off higher daily wage rates for the increased food security of annual employment (Claridge et al., 2024). It is also improbable that this friction remained static throughout the fourteenth century - especially in light of the aforementioned commercialization of grain markets - and hence that (imp)perfect arbitrage remained stable over time.

An overarching question in this paper is how to explain the persistent levels of wage inequality within the *famuli* as a group. The Black Death had a differential impact on 'core' *famuli* - who were largely excluded from the sharp wage increases following the Black Death - and more peripheral *famuli*, some of whom did benefit from these gains. One explanation, which would arise even under assumptions of

[43] Humphries and Weisdorf (2019) also start from this hypothesis, but present an interesting elaboration to their analysis where they assume full segmentation between the markets for day and annual labour. By quantifying the relative sizes of both labour markets, they gauge how the earnings of an "average worker" evolved (2019, 2881).

perfect competition and arbitrage, is that there were significant and persistent productivity differentials between certain labour market segments due to differences in levels of human capital. This might have applied within the *famuli* if 'core' roles were more highly skilled than peripheral roles. Questions concerning the return to human capital have been explored through estimations of the long-run evolution of skill premia, which are generally seen to have declined over the later Middle Ages (Beveridge, 1936; Postan, 1950; Phelps Brown & Hopkins, 1955; Clark, 2005; van Zanden, 2009). These findings have also been translated into broader claims about the equalizing nature of the Black Death (Alfani, 2022, 3-10).

We find growing wage inequality within the *famuli* but argue that this may have actually had equalizing effects for medieval English society as a whole. Before the Black Death, 'core' workers benefited from higher wages and levels of job security than other *famuli*, forming an 'aristocracy of labour' (Campbell, 2009, 85). Following the Black Death, however, their wages stagnated. At the same time, a number of harvest-related jobs which were likely to have been more accessible to all layers of medieval society, experienced higher levels of wage growth. From this perspective the Black Death *did* have an equalizing effect, as the closed cadre of 'core' *famuli* lost their comparative wage advantage by 1400.

Relatedly, the sheer variation of wages within the *famuli* illustrates the need for careful examination of any claims concerning who might have been 'left behind' in the wake of the Black Death. Even within the more peripheral group of workers, who, with some imagination, might be seen as the 'unskilled' among the *famuli*, we have found a wide diversity of experiences in terms of wage growth: wage rises were largely restricted to harvest workers (and the increasingly-rare female servants). Furthermore, our variance decomposition in Section 7 quantitatively illustrates how difficult it is to narrow down wage variation to occupational or regional dimensions, especially in 1300 before the increased commercialization of labour markets which followed the Black Death. Clearly, we must be careful in creating large-scale narra-

tives based on the wages of a handful of occupational groups.[44]

Our results further demonstrate the pervasive role of custom in determining the degree to which workers were able to benefit from changed conditions after the Black Death. The changes in wages between different occupations and worker types appear to have been, at least in part, driven by their exposure to the market before the Black Death. Workers who enjoyed the most flexibility, such as harvest workers, and those with the greatest bargaining power, such as the titular *famuli*, were the workers who saw the most rapid growth in their wages. This was driven by significant increases in the cash component of their wages. Meanwhile, the 'core' *famuli*, many of whom who had enjoyed customary wage protections before the Black Death, found that their remuneration, which was largely in-kind, and customarily sticky, grew more modestly.[45] In the wider labour market, day workers were an even more extreme version of the 'flexible worker' case, which helps explain why their wages grew so much faster than those of annually-employed *famuli* (Claridge et al., 2024). That many individuals continued to seek work as 'core' *famuli*, despite these roles only experiencing small wage increases, serves as a reminder that the experiences of labourers in the so-called 'golden age' was perhaps more mixed than previous interpretations have allowed. The fact that 'core' *famuli* roles continued to be filled shows that some individuals continued to prefer the security of annual contracts and in-kind payment.[46]

To what degree was this mediating role of custom reflected in the wider labour market? For instance, a wide range of research has suggested that gender and age

[44] For instance, how representative were the 'unskilled' construction workers whose wages skyrocketed after the Black Death? As such, this paper provides further quantitative support of earlier criticisms by Hatcher (2011). Our interpretation also strongly concurs with the recent 'apology' for wages offered by Geens and Blondé (2025), which demonstrates that building workers moved up and down the wealth hierarchy according to changes in remuneration.

[45] Some 'core' *famuli* may have ultimately enjoyed higher total annual earnings. For instance, some individuals were employed for more days of the year in 1400 relative to 1300, effectively giving them more weeks of pay, even if the prevailing weekly rate remained broadly similar.

[46] Why would such risk-averse preferences persist after the Black Death? While access to land improved, only a minority of tenants were able to create larger engrossed holdings (Mullan & Britnell, 2010a, 178-95; Poos, 1991, 18-20). Further, inflexible systems of production could prevent smallholders from adapting to new market opportunities (Sapoznik, 2013). Declines in the area under cultivation may have made work difficult to find at certain points of the year (Bailey, 2021, 251-4; Hatcher, 2011). Under such conditions, many 'core' *famuli* may still have prioritised the stability of annual employment over the more lucrative, but potentially riskier, opportunities afforded in landholding and flexible employment.

impacted all aspects of economic agency in medieval England, including wage inequality (Briggs, 2004; Bennett, 2010; Bardsley, 2014). There is significant debate over whether the transformative events of the fourteenth century improved (Barron, 1989; Goldberg, 1992, 324-61; Hatcher, 2001) or deteriorated (Bennett, 1996, 145-57; Bardsley, 1999) the opportunities for women on medieval labour markets. Humphries and Weisdorf (2015) convincingly show that, for women, the growth of 'annual' wages stagnated while the trend for those employed on 'casual' (short-term) contracts was more similar to that of men.

Our results bring a more nuanced view to the 'pessimistic' appraisal of the prospects for annually-employed women. Dairymaids, a common role for female *famuli*, experienced little wage growth compared to other male pastoral workers. Yet, female servants, who occupied a significantly more marginal role before the Black Death and were paid some of the lowest wages of any *famuli*, saw a dramatic improvement (although they were a far smaller proportion of this labour force). While surviving sources limit direct observation, some women probably benefited from the surge in wage rates paid for harvest labour (Penn, 1987). On average, the day wages of women climbed alongside those of men, but a gender gap continued to exist because women worked in more poorly-remunerated tasks.[47]

Similarly, age status acted as a customary brake on wage increases for the worst-remunerated workers. The already low wages of *garciones* saw no appreciable rise after the Black Death. This in part reflected their lower levels of strength and human capital as well as their consistent deployment in less productive jobs. However, contemporary norms surrounding notions of adulthood surely also played a role. The fact that *garciones* was itself a slippery category which could include adolescent and even adult men who did not hold property shows the power of 'juvenility' as a customary status (Bennett, 2019). However, the decline in the number of *garciones* reveals that these customary forces would have had a limited impact on the welfare of workers. Faced with persistently low wages, *garciones* simply ceased to be an occupational group on many manors as children and young men found more attractive

[47] We are grateful to Grace Owen and Jane Whittle for sharing an early version of their work on the gender wage gap in medieval English agriculture. For a recent discussion of the impact of the Black Death on different segments of the female labour market, see: Bailey (2024).

ways to make a living.

Overall, this paper acknowledges both the unique position of *famuli* within the wider labour force, as well as their ability to cast light on developments in the labour market of medieval England. The evidence presented in this paper reveals a combination of market and customary forces at play in the determination of wage inequality: a finding which has strong ramifications for our understanding of the medieval English economy as a whole.

9 The emergence of formal *famuli* labour markets: from custom to markets?

This paper has presented a new perspective on wage inequality and labour market transformation in medieval England through a high-resolution analysis of the remuneration of *famuli* labourers across the fourteenth century. The results demonstrate that the Black Death did not uniformly elevate the earnings of all labourers and actually increased levels of wage inequality among the *famuli*. Some peripheral or flexible categories saw substantial increases in wages, driven largely by increases in cash payments. Conversely, barring some regional convergence, core occupational groups experienced only modest gains in their wage rates. These increases look even smaller in real terms.

Our findings raise two wider points. Firstly, taking any sector of the medieval workforce as representative of incomes for the whole population of workers is fraught with difficulty. With so much variation among even a relatively well-defined group such as the *famuli*, it is impossible to make secure claims about earnings, let alone living standards, from a single group of workers. It is only by trying to reconstruct the wages of various types of workers in concert, that we will be able to fully appreciate the experience of wage earners in pre-industrial economies. Secondly, we shed new light on the nature of medieval labour markets. We suggest that customary wage structures persisted for many, even amidst major demographic and economic upheaval. At the same time, the growing significance of cash wages, the disappearance of certain peripheral roles, the increased prevalence of full-time employment, and

the increased explanatory power of occupational and regional determinants point toward a commercializing and professionalizing labour market. Both customs and market dynamics played a key role in shaping the experience of labour in late medieval England.

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Appendices

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A Data appendix

A.1 Data collection

To explore the variation in wages paid to workers in late medieval England, we draw on details of the remuneration paid to *famuli* labourers recorded in manorial accounts. The *famuli* were the main labour force on most demesne farms of medieval lords. Their labour was sometimes supplemented at certain times of the year by both labourers who worked either by the day (e.g. harvest workers) or for piece rates (e.g. in the construction or repair of manorial buildings) as well as labour rendered by certain (and typically unfree) tenants as part of their rent. Many *famuli* were hired for the entire year, while others worked for only a few weeks, but all *famuli* were clearly distinguished from the day labourers who were paid by the day and exclusively in cash. Significantly, the *famuli* were almost always clearly designated in the documents by their occupations like 'ploughman' or 'carter' or by the specific agricultural tasks they were responsible for such as guarding sheep, milking cows and/or ewes or more miscellaneous 'casual' work such as breaking up clods of soil, a process called 'spreading furrows' (*spargens sulcos*) or stacking crops at harvest. We focus exclusively on the so-called 'stipendiary *famuli*' who were paid a grain livery and cash stipend as their primary remuneration. Other workers, the so-called 'service *famuli*', or *famuli*-in-serjeanty' were instead given a rent remission for their labour. As this is difficult to quantity and represents a very different form of relationship between seigniorial employer and worker, we have ignored these workers in our analysis. By 1300, the 'service *famuli*' represented around only a tenth of the total *famuli* workforce, so we capture the largest share of this group of labourers.

Our main dataset is cross-sectional. We have extracted a range of information about each worker we observed. This included their occupational title or work tasks, the number of weeks they worked in the year, and their grain and cash wage. As a further step we transformed grain wages into their cash equivalents by recording the varieties of grains in which these wages were paid and 'pricing' these with contemporary grain prices. This provides information on the weekly nominal cash payment, nominal grain payment, and total cash equivalent payment for the work-

ers in our dataset. For more information about this methodology, we also refer to appendices B and D of Claridge et al., 2024).

Our first dataset uses the 1300 cross section of Claridge and Langdon (2015) as a starting point. We augmented this dataset by adding information about the types of grain paid to workers which was not originally collected for 254 of these 433 manors. We also collected additional occupational information from the original manuscripts. This sample contains observations drawn from the decade before and the decade after the turn of the fourteenth century (see Figure 1). Any given manor was only sampled once during this time period to avoid double-counting and giving undue weight to specific workers or individual demesnes. The cross section is skewed towards the south and east of the country, with fewer observations from the north and very few from the far south west. However, this distribution is broadly correlated with population density and economic activity at the turn of the fourteenth century.

Our second cross section is entirely new and is centred on 1400. The structure mirrors our 1300 database, containing observations drawn from the decade before and the decade after the turn of the fifteenth century, samples individual demesnes only once in that range, and includes information on the quantity of cash and in-kind wages, and the grains in which the latter were paid. Due to the fact that many lords switched to leasing rather than directly managing their demesnes in the changed economic conditions of the late fourteenth century, leading to the creation of far fewer manorial accounts in this period, there are fewer surviving examples to sample. As a result, our 1400 sample contains a total of 85 manors (see Figure 1). As with the 1300 sample, the sample is biased towards the south and east although with reasonable coverage of the West Midlands, north east and south west.

We also utilise a selection of the manors found in the longitudinal sample from Claridge et al. (2024) for some illustrative discussions. This draws on observations from 25 manors held by five estates (Battle Abbey, the Bishopric of Winchester, Glastonbury Abbey, the Abbey of Bury St. Edmunds and Durham Cathedral Priory) across England with the observations spanning the period 1270 to 1440. In total it contains 483 accounts. A key difference between this long-run sample and our two

cross sections is that single demesnes, by necessity, *were* sampled for multiple years. The sample covers the four regions of the North, the Thames Basin, East Anglia and the South and Southwest. For further discussion of the long-run panel data, we refer to Claridge et al. (2024).

Table A1 presents the key summary statistics of our samples. While we have endeavoured to create representative data, there are inevitable biases in our samples given the nature of the sources. Our samples are biased towards institutional ecclesiastical estates. All manors in longitudinal were part of large ecclesiastical estates, while 68 percent of the 1300 cross-sectional manors and 88 percent of the 1400 cross-sectional manors come from these types of institutions. Ecclesiastics and religious houses were some of the largest landlords in medieval England and therefore employed significant labour forces. They also kept detailed records which have survived far better than those kept by lay institutions and smaller clerical lords. We have, however, sought to include non-ecclesiastical accounts where possible, in order to better balance our sample.

To explore the impact of occupation on remuneration we have identified the following groups in our dataset, identified by their Latin names:

1. Carters (*carectarii*)
2. Cowherds (*vaccarii*)
3. Dairymaids (*dayae*/*daiae*)
4. Female Servants (*mulieres, ancillae, puellae*)
5. *Garciones* (*garciones, pagii*)
6. Harrowers (*herciatores*)
7. Harvesters (a variety of harvest occupations including *tassatores, furcatores, famulus messuerunt*)
8. Other (a broad array of other occupations outside of the eleven main categories)
9. Ploughmen (*carucarii, tentores, fugatores*)
10. Shepherds (*bercarii*)
11. Swineherds (*porcarii*)
12. Titular *Famuli* (*famulus, famulus curiae, serviens*, but only in cases where these were paid a substantial wage akin to carters, ploughmen and shepherds).

A.2 Summary statistics

Table A1: **Summary statistics of the different datasets used in this paper**

		1300		1400		Panel	
Variable		**Freq.**	**Share**	**Freq.**	**Share**	**Freq.**	**Share**
Region	East Anglia	718	0.17	150	0.22	2020	0.41
	The Midlands	824	0.19	52	0.08	0	0.00
	The North	340	0.08	78	0.11	1610	0.33
	The South and South-west	968	0.23	305	0.45	843	0.17
	The Thames Basin	1404	0.33	96	0.14	448	0.09
Occupation	Carter	461	0.11	79	0.12	605	0.12
	Cowherd	152	0.04	16	0.02	80	0.02
	Dairymaid	210	0.05	43	0.06	185	0.04
	Ploughman	1658	0.39	199	0.29	1760	0.36
	Shepherd	379	0.09	80	0.12	486	0.10
	Swineherd	146	0.03	16	0.02	139	0.03
	Titular famulus	74	0.02	31	0.05	369	0.07
	Female servant	88	0.02	12	0.02	117	0.02
	Garciones	254	0.06	15	0.02	232	0.05
	Harrower	144	0.03	9	0.01	80	0.02
	Harvest	80	0.02	55	0.08	73	0.01
	Other	608	0.14	126	0.19	795	0.16
Gender	I(Female)	294	0.07	55	0.08	303	0.06
All workers		4254		681		4921	
Number of manors		433		85		25	
Number of estates		43		24		5	

Notes: The columns denoted by '1300' and '1400' refer to the 1300 and 1400 cross-sectional samples respectively. The final two columns, denoted by 'panel', refer to the full sample of Claridge et al. (2024). Our 'female' gender dummy is largely based on occupational category as we assume all dairymaids and female servants were women unless we have positive evidence to the contrary.

Source: Authors' database

A.3 Assumptions about length of employment

To calculate wage rates, an accurate measure of the length of employment for each individual labourer is required. The cash and grain wages paid to workers are typically recorded in different parts of manorial accounts. Cash wages are usually found in the 'expenses' section, which itemised all outlays on the manor and expressed in monetary terms. Most grain wages were recorded in the 'grange account', found near the end of the manuscript, which details all grain produced, consumed and sold on the manor. This means that many workers are described in the manuscripts as having two terms of employment, one for their cash stipend, and another for their grain livery. In the vast majority of cases, if the same worker was given both types of remuneration, the two terms are identical, but for a small number of workers, one term was longer than the other. In these cases, we term associated with the in-kind grain payment as the default term of employment. If the worker was paid only a cash stipend, we necessarily take the term of their stipend as their term of employment.

Manorial accounts almost invariably supply employment terms in periods of weeks and/or days. In some cases, workers are described as having worked for a specific season or other 'qualitative' periods of time. In order to capture such observations into our dataset, we make two additional assumptions. First, a common 'qualitative' term of employment was workers described as employed in 'harvest' (*in autumpno*). For these cases we have assumed that this meant seven weeks, as the harvest season typically varied between six and eight weeks. Similarly, we assume those who are described as having worked 'at lambing' worked for five weeks. This is informed by contemporary (as well as current-day) observations of the lambing season. For instance, at Hambledon (Hampshire) in 1409-10, an attendant helping the shepherd of ewes at lambing, is explicitly noted to have worked for 5 weeks (Page, 1999, 289).

A.4 Pricing and wage assumptions

In this section, we describe our use of decadal average grain prices in the calculation of in-kind wages for our cross-sectional samples. This paper follows Claridge et al. (2024) in quantifying the economic value of in-kind wages as following:

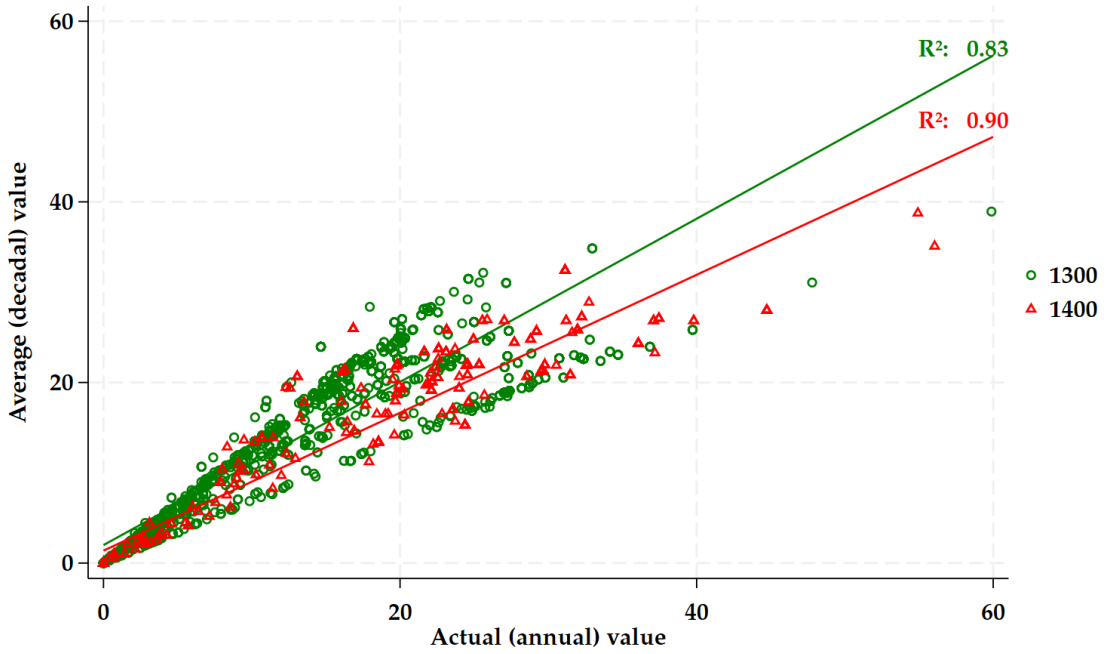
$$\tilde{Y}_{\ell,t}^{\text{in-kind}} = \sum_{g \in G} P_{g,t}.Q_{\ell,g,t} \tag{2}$$

In practice, this means that we have to retrieve the total grain payment, or "liveries", paid to workers, $Q_{\ell,g,t}$, as well as the market value of grain (g) in the year (t) it was paid, $P_{g,t}$. We do so over the universe of different grains paid to workers G. To achieve this, our cross sectional samples for '1300' and '1400' are drawn from the decades preceding and following the turn of the century. That is, our 1300 sample is drawn from accounts ranging from 1289-90 to 1310-11 and our 1400 sample draws on accounts from 1389-90 and 1410-11. A consequence of this sampling strategy is that we might compare, for example, the earnings of a ploughman at manor i at year $t = 1398$ to those of a ploughman at manor j at year $t = 1403$. To ensure that price differences between the years 1398 and 1403 do not skew the wage comparison of both workers, we value $\tilde{Y}_{\ell,t}^{\text{in-kind}}$ based on the average grain prices of all $g \in G$ for the period 1390-1410. For worker comparisons across the 1300 cross-section, we use prices over the period 1290-1310. Formally, we thus calculate decadal average prices such that:

$$\tilde{P}_{g,t} = \begin{cases} \frac{\sum_t^{1290 \leqslant t \leqslant 1310} P_{g,t}}{20}, & \text{if } 1290 \leqslant t \leqslant 1310 \\ \frac{\sum_t^{1390 \leqslant t \leqslant 1410} P_{g,t}}{20}, & \text{if } 1390 \leqslant t \leqslant 1410 \end{cases} \tag{3}$$

Figure A1 compares the values of the in-kind wages in our two respective cross-sectional samples as calculated by this 'decadal-averaging' method (on the vertical axis), compared to the value they actually earned in current (annual) prices (on the horizontal axis). Two observations stand out. First, the spread of in-kind values is significantly lower, showcasing the 'averaging out' of the volatile prices in medieval grain markets, which was the main goal of this exercise. Second, the values of in-

Figure A1: **Comparing the values of in-kind wages based on annual valuations and decadal averages, c. 1300 and 1400 England**



Notes: .

Source: Authors' database

kind earnings using decadal average prices and current annual prices respectively are (unsurprisingly) highly correlated, reassuring us that we do not impose any bias towards certain manors or occupational groups.

B Macro Regions

We have defined the macro-regions in our analysis as follows:

- **East Anglia**: Cambridgeshire, Huntingdonshire, Norfolk, Suffolk;
- **The Thames Basin**: Bedfordshire, Berkshire, Buckinghamshire, Essex, Hertfordshire, Kent, Middlesex, Oxfordshire and Surrey;
- **The South and South-west**: Cornwall, Devon, Dorset, Hampshire, Somerset, Sussex, Wiltshire;
- **The Midlands**: Cheshire, Derbyshire, Gloucestershire, Herefordshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, Rutland, Shropshire, Staffordshire, Warwickshire and Worcestershire;
- **The North**: Cumberland, Durham, Lancashire, Northumberland, Westmorland and Yorkshire.

C Additional results

C.1 Employment structure and occupations of the *famuli*

This appendix describes in more detail the occupational structure of the *famuli* in our cross sectional datasets and how this changed over the fourteenth century. It also provides some more detail on the tasks performed by key occupational categories. Figure A2 shows the occupational structure of *famuli* labourers in 1300 and 1400 according to the ten categories we establish in our paper. Our 1400 sample is significantly smaller than that of 1300 (partly due to the fact that many demesnes were leased rather than directly managed by this date), but we are reassured that it corresponds with wider economic changes over the fourteenth century, demonstrating its representativeness.[48] Growth in the share of occupations in animal husbandry, such as dairymaids and ploughmen, reflect the wider shift to pastoralism in the wake of the Black Death (Campbell, 2000, 183-7, 430-6; Broadberry et al., 2015, 57-61).

Ploughmen were the most common *famuli* workers on demesnes in the late Middle Ages, accounting for more than 41 percent of all *famuli* labourers in 1300 and 31 percent in 1400. Ploughing was probably a year-round task on most manors. Active fields were typically ploughed twice in a year, while lands left fallow were often ploughed more frequently in an effort to replenish the soil. It was only possible for an ox-driven plough team to plough about half an acre per day, although all-horse or mixed plough teams would have presumably been faster (Langdon, 1986, 255-267). Therefore, a demesne of 100 acres would have taken 200 days to plough with a single plough team, and this could not be done while crops were growing or being harvested. Even more time would be required for multiple ploughings. Most ploughmen were also kept busy with other tasks over the course of the year. Indeed, caring for the draught animals and maintaining the ploughs and harrows dominates much of the discussion that the anonymous author of the thirteenth-century *Seneschaucy* treatise devoted to describing the work of the ploughman (Oschinsky,

[48] See Appendix A for further discussion of the sample.

1971, 283).[49]. The *Seneschaucy* actually leaves the impression that ploughmen were perhaps more akin to general agriculturalists, who, in addition to ploughing and managing and maintaining the draught animals and equipment, were widely engaged in the full cycle of crop growing from sowing seed to threshing harvested grains. This probably explains why ploughmen were such a large presence among the *famuli*. After ploughmen, carters and shepherds were the next most common types of *famuli* labourers, each accounting for ∼10 percent of the total workforce. Carters were required throughout the year to transport a range of cargoes. Manure and marl had to be moved to fields for applications of fertilizer. Produce and provisions had to be moved within and between manors, back and forth to markets and to seigniorial households, connecting the activities of individual manors to the larger estate. Like ploughmen, they might perform other roles at different parts of the year, including ploughing and harrowing in Winter (Farmer, 1996).[50] Shepherds also had a virtually full-time job, reflected in the fact that unlike other *famuli*, they were not 'seconded' to the harvest and given food at the lord's table in the Autumn. The *Seneschaucy* describes their tasks as including protecting flocks from dogs and from wandering into unsafe pastures as well as making barriers with hurdles. The treatise also advised that shepherds should go as far as to sleep with their flocks at night to ensure their safety. The full-time nature of the role is clearly brought out in instructions that they could only go to the market or tavern if they had left a suitable person in their place (Farmer, 1996).

While most manors would employ several ploughmen and at least one carter and shepherd, only a subset kept permanent dairymaids. This was a job typically done by women, but occasionally men found their way into this role as well.[51] They also performed a wide variety of roles which kept them busy throughout the year (Atkins, 2024). These comprised the more obvious role of milking and making

[49] Indeed, one Bartholomew Goche, a *famuli* ploughman at the manor of Walsham le Willows, in Suffolk, was amerced for 6d. in 1346 because "he guarded the stotts [plough horses] badly, and as a result one died, by his negligence."(Lock, 1998, 295)

[50] In the accounts, we see explicit discussions of carters performing such secondary tasks at Great Berkhamstead (1296-7) and Ditton Valence (1301) among others. See respectively, (Midgley, 1945, 20, 24), SC6 766/15.

[51] For example, a 1306-6 account for King's Langley (Hertfordshire) explicitly describes a 'man' who was dairying and making pottage for the other *famuli*. See: TNA SC6 866/16; a 1291-2 account for Popenhoe (Norfolk) records wages for a 'Nicholas Dairymaid'; see: TNA SC6 942/13.

cheese, but also other tasks including winnowing grain, making malt, looking after buildings, tending poultry, keeping fires in hearths going and making the pottage for the other *famuli* (Farmer, 1996).[52] After dairymaids, the next most common occupationally-specific *famuli* were harrowers and swineherds. These were accompanied by other workers described in the documents more vaguely as *garciones* and female servants. Each of these groups accounted for c.5 percent or less of the workforce.

It is hardly surprising that 'core' workers, such as ploughmen, carters and shepherds, were a consistent presence in both 1300 and 1400 - they were specialized roles (even if they were flexible enough to vary their tasks according to the rhythm of the agricultural year) without which neither demesnes, nor the wider estates of which these were part, could easily function. Table A2 brings this out even more clearly. The first column in each panel (empl.) shows what proportion of total workers on the average manor came from each occupational group in 1300 and 1400. The second column (manors at least one), shows the proportion of manors which had a single worker from each occupational group in each cross section. As can be seen, the 'core' roles generally made up a similar proportion of workers across time. Carters and shepherds each accounted for around 10 percent of workers on the average manor, while dairymaids accounted for 5 percent. This again shows how significant these workers were to the running of the manor.

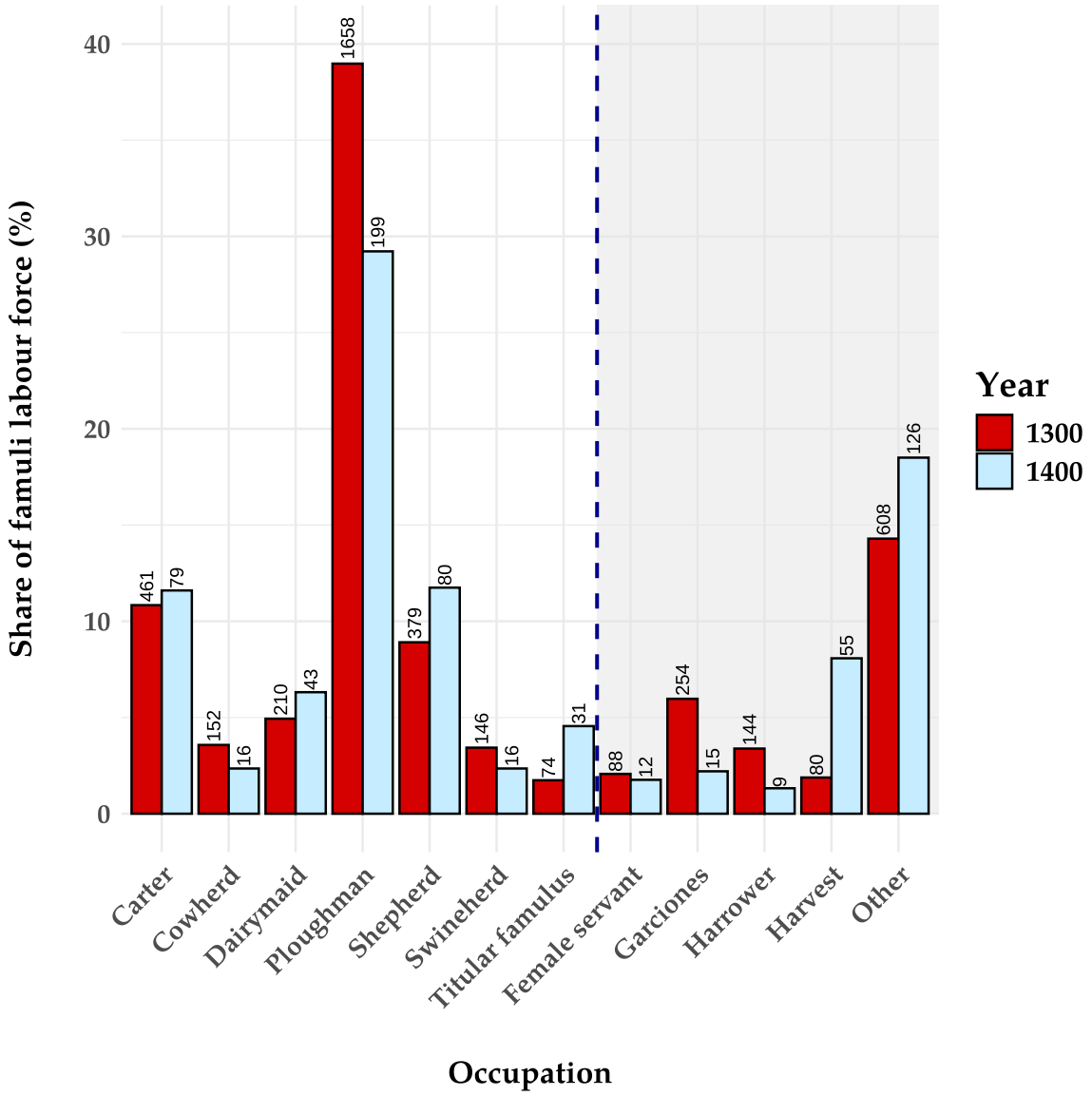
However, there were some changes within the balance of occupations within this 'core' group. Most obviously, the share of ploughmen, as the central arable worker, declined between 1300 and 1400, although they remained the dominant occupation among *famuli*. The proportion of dairymaids and shepherds increased, as seen in Figure A2. Similarly, ploughmen declined as a proportion of workers on the average manor, falling from accounting for 39 percent to 30 percent of the workforce on an average manor (see Table A2). These shifts in occupational structure away from ploughman reflect a broader reconfiguration in English agriculture over the fourteenth century. As grain prices fell, pastoral agriculture became attractive

[52] In our dataset, we see explicit discussions of dairymaids performing such secondary tasks in the accounts of Queen Carmel (1301-2, Somerset), Cleeve (1394-5, Worcestershire), Gnatingdon (1401-2, Norfolk), among others. See respectively: TNA, SC6 1090/6; Worcestershire Archives and Archaeology Service, 001:9 162/92114 BA 2636; NRO, LEST/IC 30.

for demesne managers due to rising demand for animal products and the relatively cheaper labour costs of pastoralism. Consequently, the amount of arable land under cultivation on many demesnes shrank, meaning that fewer ploughmen were required by the average demesne (Campbell, 2000, 183-7, 430-6). Finally, we see an increase in the number of titular *famuli* with this more than doubling between cross sections. As discussed in our paper (Section 4), these workers often seem to have been increasingly defined as individuals rather than by their occupation. More generally, looking at the minimum frequency reveals certain categories of worker disappearing from many demesnes. This likely reflects a process of specialisation in the post-Black Death manorial economy, as demesnes which were kept in hand, tended to focus on the production of particular products for specific markets or for consumption by seigniorial households.

The story of stasis found for 'core' roles can be contrasted with the decline in the proportion of more marginal roles. Several of these were involved in labour-intensive soil preparation work. Harrowers more than halved as a proportion of workers between 1300 and 1400. They fell from constituting 4 percent of workers on the average demesne to just 1 percent, and from being found on 30 percent of manors to just 9 percent. Furrow spreaders and marlers who were found on a handful of manors in 1300, but completely disappeared in 1400. Similarly, *garciones* also disappeared as an occupation from among the *famuli*. These workers performed a wide variety of more marginal tasks, such as scaring birds, tending geese and horses, helping shepherds and swineherds and harrowing (Claridge & Langdon, 2015). While in 1300, *garciones* were present on 34 percent of manors, by 1400 they were present on just 11 percent of manors. Harvesters represent an exceptional case - while they increased as a proportion of all *famuli* in the 1400 sample, the number of manors on which they fell decreased from $\sim$11 to $\sim$7 percent.

Figure A2: **Employment structure of *famuli*, c. 1300 and 1400 England**



Notes: The occupations left of the dashed line and without the shaded background are the 'core' famuli occupations. The number of observations per relative frequency are displayed on top of the respective bars.

Source: Authors' database

Table A2: **Prevalence of *famuli* across manors, c. 1300 and 1400 England**

Occupation	1300		1400	
	% Empl.	**% Manors** at least one	**% Empl.**	**% Manors** at least one
Carter	11.38 %	71.82 %	11.92 %	61.18 %
Cowherd	3.47 %	34.41 %	2.33 %	17.65 %
Dairymaid	5.66 %	46.88 %	6.03 %	48.24 %
Ploughman	39.48 %	91.92 %	30.32 %	71.76 %
Shepherd	8.88 %	60.51 %	10.87 %	56.47 %
Swineherd	2.87 %	32.33 %	2.00 %	17.65 %
Titular famulus	1.93 %	3.70 %	4.66 %	9.41 %
Female servant	1.99 %	17.78 %	1.44 %	10.59 %
Garciones	5.30 %	34.18 %	2.05 %	10.59 %
Harrower	3.98 %	29.79 %	1.23 %	9.41 %
Harvest	1.22 %	10.62 %	2.47 %	7.06 %
Other	13.85 %	65.59 %	24.68 %	63.53 %

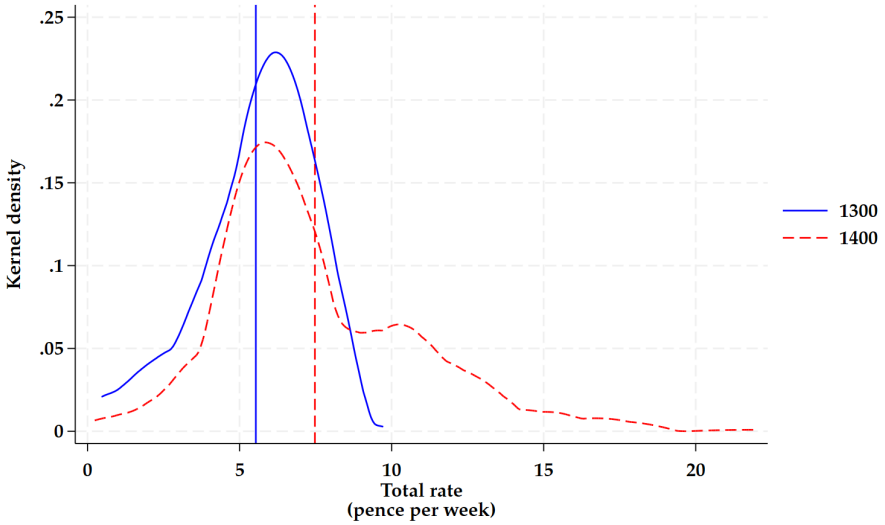
Notes: The column denoted by '% Empl.' indicates the (unweighted) average employment share of workers across manors. The column denoted by '% Manors at least one' indicates the share of manors which employ at least one of the different occupational groups.

Source: Authors' database

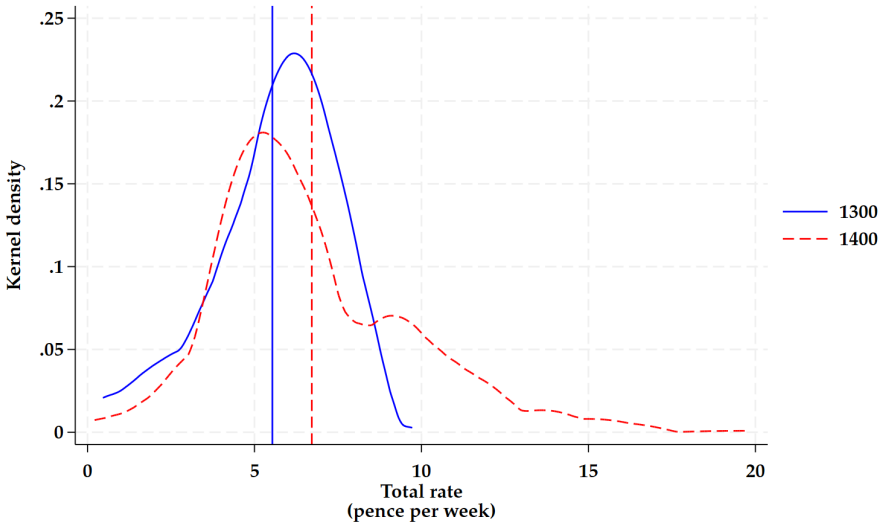
C.2 Robustness check: balanced panel

In this section, we reassess the results presented in Figure 2 and Table 2 in the main text by moving from an unbalanced panel data set to a balanced panel data set. The latter is created by selecting workers only at the 54 manors which we observe in both 1300 and 1400. The results are reassuring. Figure A3 shows a similar pattern of wage inequality, in which a large group of *famuli* experience little to no wage rate growth throughout the fourteenth century, complemented by a smaller group of *famuli* which experience large wage rate increases following the Black Death. Similarly, the variance decomposition in Table A3 largely confirms the findings of our main analysis. Furthermore, in our balanced panel, wage inequality for all workers was higher in 1400 than in 1300, and the predictive power of occupational fixed effects also vastly increased between our two sample periods. Generally, the predictive power in the form of the adjusted R^2, as well as the share of variance explained by regional fixed effects for 'core' *famuli* seems to be higher in our balanced panel. This is likely explained by the fact that our balanced panel is dominated by manors held by the Bishop of Winchester, which likely led to a degree of estate-level wage coordination.

Figure A3: **Wage distribution of *famuli* (total rates), ca 1300 and 1400 England (balanced panel)**



(a) **Nominal rates**



(b) **Real rates**

Notes: The vertical lines represent the average total wage rate. The wage distributions are approximated through kernel density estimation using a Epanechnikov function with a smoothing parameter of 1. For panel (b), we deflated the 1400 wage distribution using the ratio of the average value of the Allen consumption basket for the period 1390-1410 over the average value for the period 1290-1310.

Source: Consumption baskets: Allen (n.d.). Wage rates: Authors' database.

Table A3: **Variance decomposition for *famuli* labourers, c. 1300 and 1400 (balanced panel)**

(a) **All workers**

Rate	Year	Gini	Individual	Occupation	Region	N	R^2
Cash	1300	0.510	0.831 %	0.062 %	0.109 %	428	0.141
	1400	0.602	0.390 %	0.421 %	0.057 %	393	0.595
Livery	1300	0.167	0.747 %	0.193 %	0.080 %	431	0.228
	1400	0.277	0.537 %	0.518 %	0.018 %	398	0.442
Total	1300	0.169	0.694 %	0.177 %	0.128 %	312	0.281
	1400	0.227	0.540 %	0.208 %	0.140 %	380	0.438

(b) **Core workers only**

Rate	Year	Gini	Individual	Occupation	Region	N	R^2
Cash	1300	0.443	0.550 %	0.065 %	0.347 %	363	0.435
	1400	0.412	0.644 %	0.058 %	0.259 %	267	0.331
Livery	1300	0.131	0.762 %	0.124 %	0.133 %	366	0.217
	1400	0.113	0.740 %	0.085 %	0.185 %	272	0.231
Total	1300	0.138	0.674 %	0.139 %	0.162 %	265	0.305
	1400	0.158	0.440 %	0.115 %	0.392 %	258	0.542

Notes: Column 'R^2' reports the adjusted R^2 of regressing wage rates on occupational and regional dummies.

C.3 *Famuli* workforce size

This appendix lays out how we generated estimates of the total number of *famuli* employed on English demesnes in c.1300 and c.1400. To create these figures, we draw on the methodology laid out by Claridge and Langdon (2015) but update this with the data in our two cross sectional samples.

Firstly, we use an estimate of the total acreage of sown demesnes in 1300 and 1400 (as there is no available estimate for the latter, we take the midpoint of available estimates for 1380 and 1420 from Broadberry et al. (2015)). We then divide this figure by the average sown acreage per *famuli* ploughman drawn from Claridge and Langdon (2015) to produce a plausible minimum estimate of the number of ploughmen would would have been necessary to plough this acreage.

To convert this number of ploughmen into an estimate for the whole *famuli* workforce, for each cross section we apply the ratio of total weeks worked by ploughmen in the total weeks worked by all *famuli*. This provides us with an estimate of the total full-time equivalent *famuli* working in medieval England in 1300 and 1400.

Finally, as some *famuli* were only hired for part of the year, we convert our estimates for full-time equivalent estimates into figures for the total number of workers using the average number of weeks worked by *famuli* in each cross section. We also contextualise these estimates of total *famuli* against total population estimates and estimates of the population of rural non-landholding households for 1290 and 1381.[53]

Table A4 provides a breakdown of these calculations for each of our cross section and that of Claridge and Langdon (2015) for c.1300. As can be seen, our 1300 estimate is relatively close to their estimate, which is unsurprising as our 1300 cross section is based in part on their dataset.

[53] Estimates of the population of rural non-landolding households specifically include the following: cottagers, labourers, rural craftsmen, paupers, and vagrants. See Broadberry et al. (2015).

Table A4: **Calculation of number of total famuli and their population share, c. 1300 and 1400**

(a) **Calculation of number of total famuli**

Estimate	Sown acreage[a]	% demesne[a]	Sown demesne	Mean sown acreage per ploughman[b]	Min ploughmen	Total weeks ploughmen worked	Total weeks all famuli worked	Full-time equivalent famuli	Average weeks worked per year	Total famuli
C&L 1300[c]	8.16 mil	20	1.63 mil	46.8	34829	65520	157974	84388	42.1	104232
CDG 1300[d]	8.16 mil	25	2.04 mil	46.8	43590	76505	175022	100660	41.1	127355
CDG 1400[e]	5.48 mil	15	0.84 mil	46.8	17949	10064	30256	54116	50.8	55394

(b) **Population shares**

Estimate	Total famuli	Population[a]	Share (%)	Non-landholding rural pop[a]	Share (%)
C&L 1300	104232	4.75 mil	2.21	1.4 mil	7.50
CDG 1300	127355.2	4.75 mil	2.69	1.4 mil	9.14
CDG 1400	55394.05	2.08 mil	2.69	0.47 mil	11.91

[a] These figures are derived from Broadberry et al. (2015).
[b] These figures are derived from Claridge and Langdon (2015).
[c] The figures in this row refer to the estimates by Claridge and Langdon (2015) for the year 1300.
[d] The figures in this row refer to our estimates for the year 1300.
[e] The figures in this row refer to our estimates for the year 1400.

C.4 Long-term trends in full-time versus part-time *famuli* labour

In addition to our cross-sectional material presented in Table 5, we can observe an increased proportion of full-time workers in long-run evidence we have collected for individual manors.[54] Figure A4 shows the proportion of full-time and part-time workers at four manors between the thirteenth to fifteenth centuries. While in nearly all years part-time workers were a minority of the workforce, their proportion declined significantly in the last quarter of the fourteenth century at both Hinderclay and Redgrave.[55] While Esher's accounts stopped recording labourers when the manor was leased in 1366, we can see that part-time workers were not recorded in the final years of the manor being directly managed. Barnhorn exhibits a different trend, with the retention of a large number of part-time workers into the fifteenth century. This reminds us that national trends were driven by the individual decision making of many different demesne managers under the direction of their lords, who had varying priorities in the exploitation of their estates. Overall, however, this exercise using a panel-data set reassures us that the trends we observe in our two cross-sections are bourne out at the micro-level.

[54] For a more detailed discussion of the data gathered for this exercise, see Claridge et al. (2024).

[55] For instance, at Hinderclay in the 1290s, about 43% of *famuli* were part-time; by the 1390s this share declined to less than 5%. A similar pattern emerges in Redgrave, where about 36% of *famuli* were part-time during the 1340s and only about 15% in the 1380s and about 10% in the 1390s.

Figure A4: **Proportions of full-time and part-time *famuli* labour across four manors**

Notes: The full-time/part-time distinction of workers is made based on whether they worked less or more than 300 days respectively.

Source: Authors' database