Inequality

The IFS Deaton Review

Labour market inequality

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Executive summary

- Earnings inequality is considerably higher in the UK than it was 40 years ago, moving the UK up to being one of the higher earnings inequality countries in the developed world by 2019.

- The evolution of earnings inequality over the four decades between 1980 and 2019 shows distinct temporal and distributional differences. In the 1980s, earnings inequality went up sharply at all points in the distribution. In the 1990s and 2000s, upper-tail inequality rose significantly but lower-tail inequality grew less, especially in the 2000s. After the global financial crisis, the 2010s saw a modest narrowing of upper-tail earnings inequality and a more pronounced reduction of lower-tail earnings inequality.

- The long-run structural trend of rising earnings inequality was driven by technical changes that benefited skilled workers doing more complex tasks, whilst the minimum wage that was introduced in April 1999 played a crucial role in stopping and reversing the upward trend of lower-tail earnings inequality.

- The past 10 or 15 years have seen real earnings growth of most workers slow down and stagnate, giving the labour market a double whammy of more inequality coupled with little or no earnings improvement in real terms (with the exception of the low-paid who benefited from above-inflation upratings of the minimum wage).

- The nature of work has changed dramatically over the past 40 years. Traditional work patterns have become less delineated in the face of big compositional shifts in who works and the definition and structure of modern jobs. Worker power has fallen in the light of rapid union decline and increased employer power in pay determination.

- Two related significant shifts have been the rise in solo self-employment and the emergence of new informality via the gig economy. These have radically changed the jobs landscape and the way people work. In addition, the share of the lowest-earning quintile who are self-employed has increased by 54%, or 8 percentage points, from 15% to 23%, between 1999 and 2019.

- Higher earnings inequality, with low real earnings growth, and a very different labour market from 40 years ago have placed the world of work in a much more unequal and divisive place. To halt or reverse this trend requires significant attention be devoted to ways to restore and reinvigorate real earnings growth and to generate decent jobs with good career opportunities in an inclusive way.

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[1] Martina Cuneo, Emiliano Sandri and Neus Torres Blas provided excellent research assistance.

1. Introduction

Wage and earnings inequality has been on the rise in the UK since the late 1970s / early 1980s, and with faster increases than comparator countries it is now one of the countries with the highest levels of wage and earnings inequality in the developed world. Labour market inequality arises in various forms: inequalities in employment opportunities, wages and hours worked, but also in other dimensions of employment, such as job security.

The inequality rise of the past four decades has occurred as the UK labour market has undergone profound changes. The earnings gap between the top and bottom parts of the distribution has widened substantially. There has been rapid growth in employment in occupations at the bottom and at the top of the skill distribution, with a hollowing out of occupations in the middle. Non-standard work arrangements – such as independent contractors, on-call workers, temporary-help workers and zero-hours contracts – have increased in their prevalence and policy relevance, being characterised by high levels of earnings insecurity and low job protection. Solo self-employment has become much more widespread. Changes in the world of work are central to changes in the distribution of employment, earnings and – in turn – other dimensions of inequality.

Inequalities in the labour market are affected by workers' skills, technological developments, the behaviour of firms, and labour market institutions, such as the minimum wage, the regulation of employment contracts and trade unions. Technological advancement has made skilled workers more attractive, pushing up the earnings premium received by graduates as compared with non-graduates, in spite of a large increase in skilled labour. Import competition and the automation of routine tasks have led to the replacement of some middle-income occupations – such as manufacturing or administrative jobs. Yet, technological development and globalisation are not the sole drivers of changes in the distribution of wages and earnings.

Changes in the role and importance of labour market institutions affect the distribution of bargaining power both across worker types and between workers and firms. The huge decline of unionisation and the diffusion of contractual arrangements at the boundary between dependent employment and self-employment are both likely to have weakened the bargaining power of traditional employees, in favour of employers and top executives within the firm. Minimum wages have become a popular policy tool to lift earnings at the bottom. Their ability to tackle inequality depends on whether they target the right groups and on whether firms respond by changing hours, employment or other non-wage benefits. Understanding the interplay between economic trends and labour market institutions is therefore key to better assess the role of policies in mitigating or exacerbating inequalities.

This chapter considers key factors that have shaped labour market inequality in the United Kingdom over the last four decades, with a focus on technological changes and skill demand, labour market institutions and contract regulation. Other important factors, such as the role of firm behaviour and monopsony power, are discussed in other parts of the Review (De Loecker, Obermeier and Van Reenen, 2022; Manning and Petrongolo, 2022).

Part I. The UK labour market over the past 40 years

2.   Real earnings trends and inequality

This section lays out basic facts on relevant aspects of the evolution of earnings inequality in the UK in the last four decades. It starts by looking at trends in real weekly earnings and compares the UK experience with that of other OECD countries.

Real weekly earnings growth

From 1980 until the onset of the global financial crisis, real weekly earnings of employees grew consistently throughout the distribution (panel A of Figure 1). Real earnings growth displayed pronounced differences across the distribution, being faster at the top (around 2.6% per year), modest at the median and slow at the bottom (just below 2% and 1% per year respectively). Since the financial crisis in 2008, and following slower growth since a little earlier in the decade, workers' real earnings have experienced a fall of unprecedented magnitude and length. The typical (median) worker has suffered a real earnings loss of approximately 4% between 2008 and 2019. A more pronounced slowdown of approximately 5% affected the top of the distribution. The profile of the bottom decile had bounced back to pre-crisis levels by 2016, and has increased by an additional 3% since then.

If we focus instead on full-time workers, weekly earnings growth has been faster, especially at the bottom of the distribution. If we compare the 10th percentile in panels A and B, weekly earnings growth has been twice as large among full-timers as among all workers – differences at the median and at the top being almost negligible. Consequently, the rise in inequality has been less dramatic, though still pronounced, among full-time employees. The main reason for the slower earnings growth at the bottom among all workers as opposed to part-timers is the role played by hours worked. Indeed, if we look at the evolution of real hourly wages among full-time workers (panel C), these have evolved pretty much in the same fashion as weekly earnings for that group. We return to the central role played by hours of work later in the chapter, and focus on weekly earnings among full-time employees in the remainder of this section.[2]

Data from the Survey of Personal Incomes – starting in 1992 – provide some evidence on the evolution of income at the top of the distribution. Real income growth in the top 1% has outstripped by far growth at lower percentiles. Fastest growth occurred up to the onset of the global financial crisis in 2007, when top incomes experienced a sharper contraction than that in lower percentiles. Starting in 2012, growth in the top 1% of the distribution has rebounded and has been faster than at the median and the 90th percentile.[3]

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[2] The choice of focusing on weekly earnings rather than hourly wages for full-time employees is due to the better measurement of the former in the survey data that we will use for the analysis.

[3] See Jenkins (forthcoming) in this Review for a detailed discussion of income inequality and its measurement.
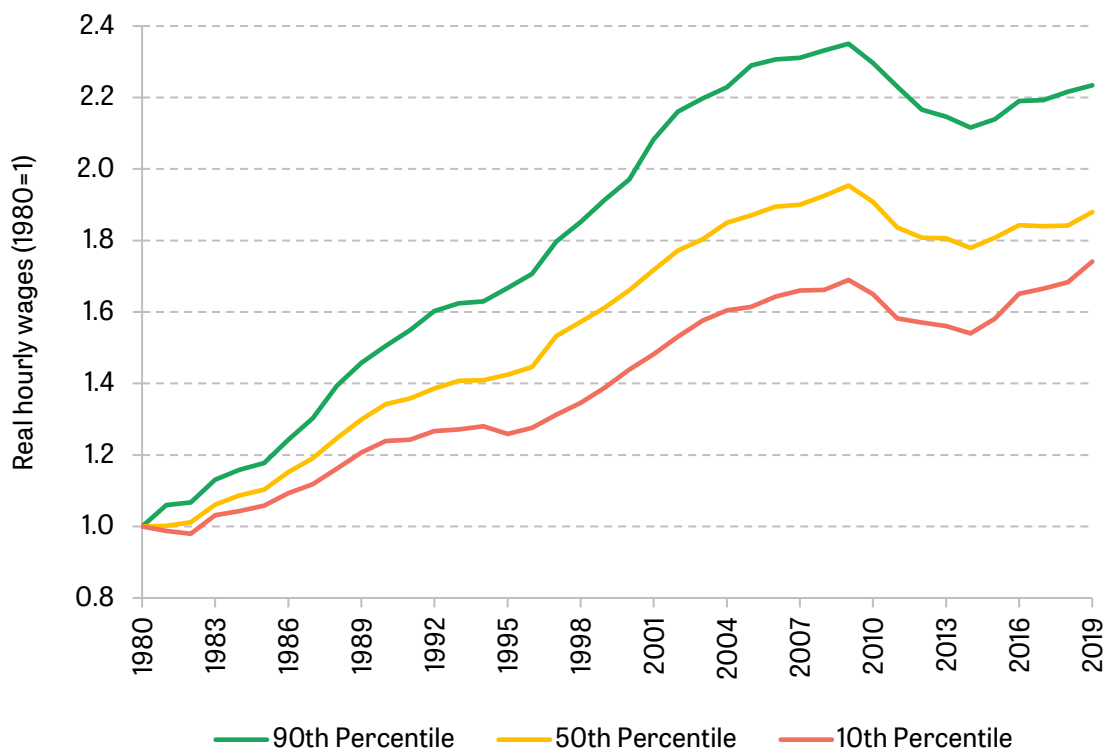
Figure 1. Trends in real earnings and wages at different percentiles

Panel A. Real weekly earnings, all workers
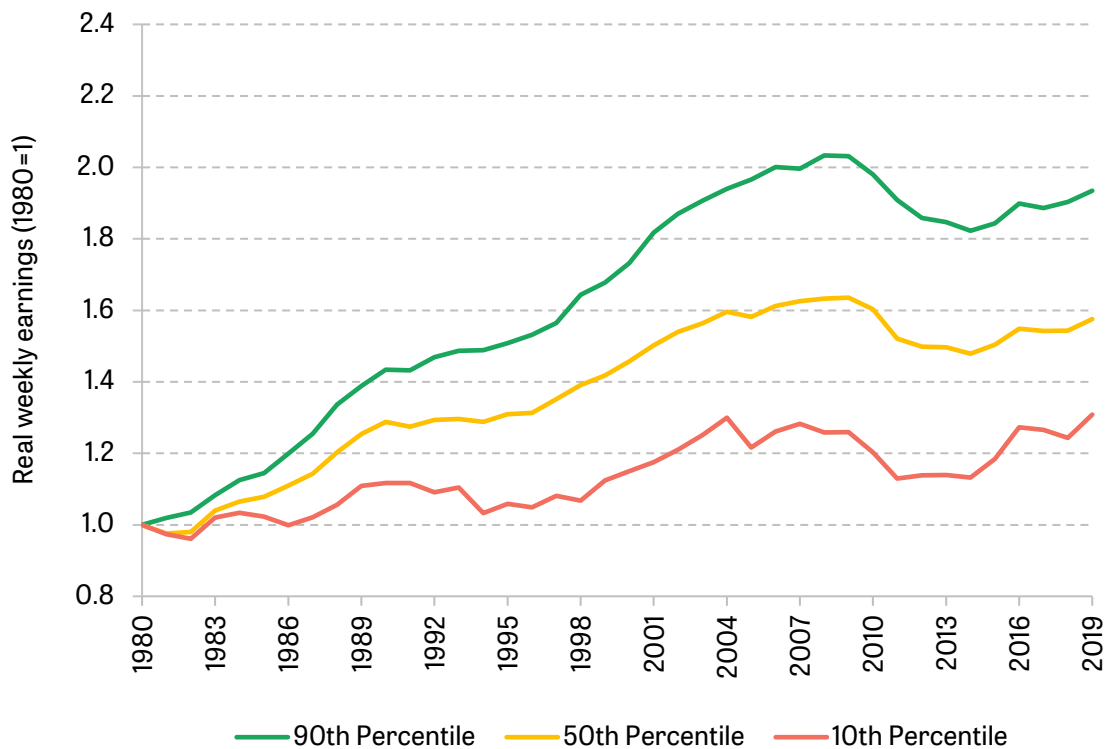
Panel B. Real weekly earnings, full-time workers
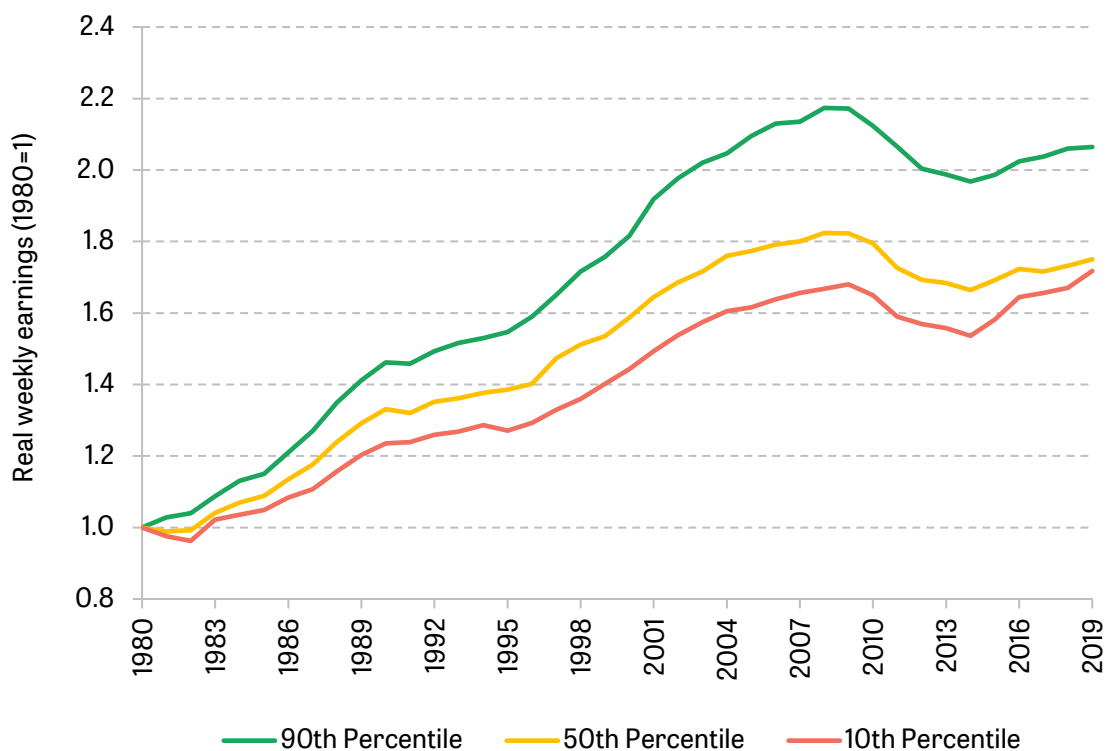
Panel C. Real hourly wages, full-time workers

Note: Panel A shows the evolution of CPI-deflated weekly earnings at different percentiles relative to 1980 for both full-time and part-time workers. Panel B restricts the sample to full-time workers. Panel C shows the evolution of CPI-deflated hourly wages at different percentiles relative to 1980 for full-time workers. Full-time workers are defined as those who work more than 30 paid hours per week or those in teaching professions working 25 paid hours or more per week.

Source: Annual Survey of Hours & Earnings.

As documented in Joyce, Pope and Roantree (2019), the top 1% of income tax payers are disproportionately male, middle-aged and London-based. Employment income is the most important single source of income for this group, accounting for 60% of total income. However, relative to those at lower percentiles, the top 1% of income tax payers receive more of their income in the form of partnership income or dividends. People receive partnership income when they are the owner of a multiple-owner unincorporated business. Dividends are the major form of remuneration for company owner-managers and executives due to the strong tax advantage to obtaining remuneration in this way. According to data collected by the Chartered Institute of Personnel and Development (2020), mean and median CEO pay packages of FTSE 100 companies have continued to oscillate around the £5.1 million and £3.8 million marks since the early 2010s, and have decreased only slightly since 2017.[4] Strikingly, the median ratio of CEO pay to their employee pay package for 2019 was 73:1, uncovering dramatic disparities within companies – disparities that are further exacerbated if we consider the ratio of the median CEO pay to the median UK full-time worker pay, which in 2019 stood at 119:1.

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[4] In 2019, mean CEO pay was around £4.7 million and median pay around £3.6 million.

Earnings inequality

The real earnings trends in panel B of Figure 1 can be recast in terms of inequality ratios. The 90:10 ratio rose by 20% between 1980 and 2019, reaching a peak (30% higher than 1980) in 2008, and dropping back a little subsequently. This highlights what has by now become well known, that earnings inequality is now considerably higher than it used to be.

Figure 2. Real weekly earnings growth at different percentiles by decade

Panel A. Men
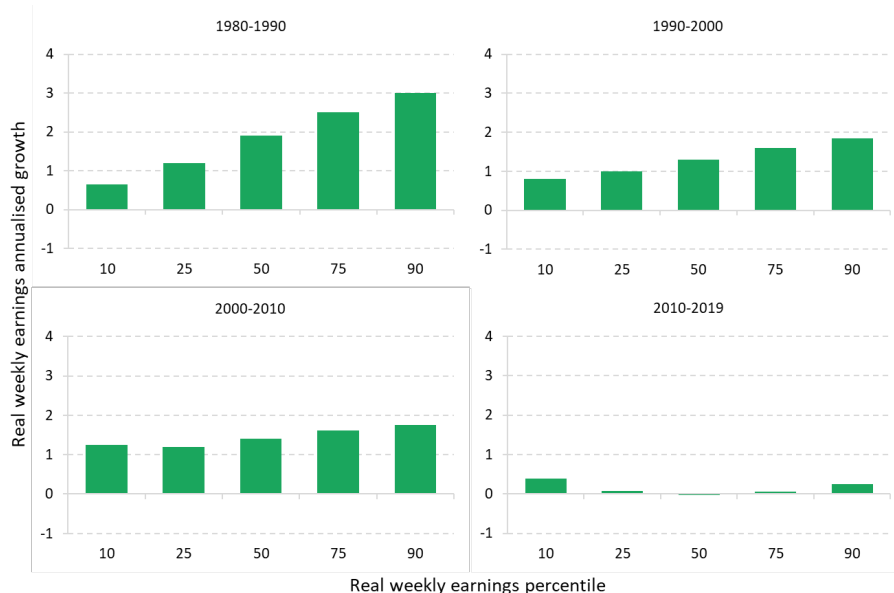
Panel B. Women
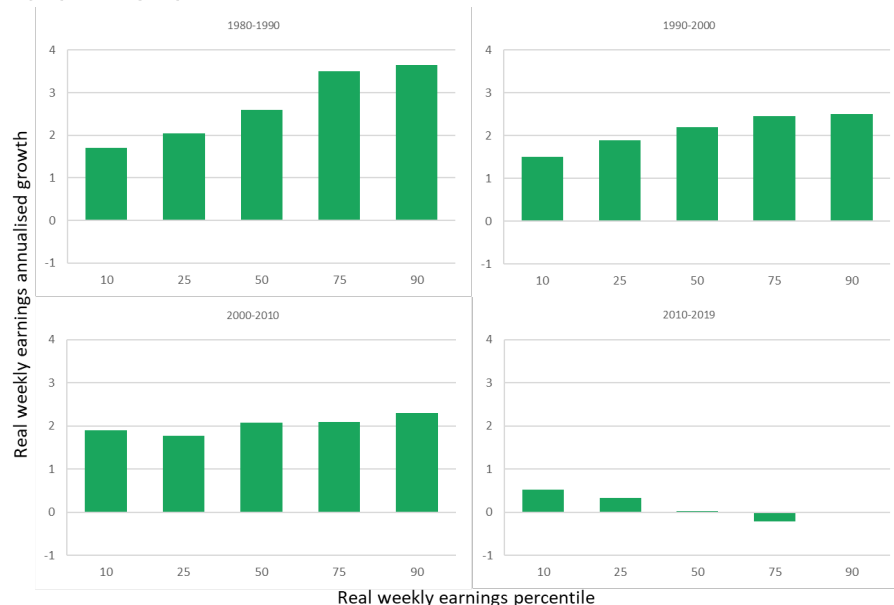
Note: The figure shows CPI-deflated weekly earnings growth at the 10th, 25th, 50th, 75th and 90th percentiles of the distribution for full-time employees by decade. Panel A shows results for men and panel B for women. Data for 1980–90 and 1990–2000 are taken from Machin (2010).

Source: Machin (2010) and Labour Force Survey.

Both upper-tail and lower-tail inequality increased – the 90:50 ratio is 18% higher in 2019 than in 1980, while the 50:10 ratio is now 2% higher. However, panel B of Figure 1 and the associated evolution of inequality ratios mask some important differences over time and by gender, as shown in Figure 2. First of all, a closer look reveals a different evolution of upper- and lower-tail inequality across decades. The 1980s were clearly the years of fastest growth in earnings inequality, with earnings gaps widening in both the upper and lower parts of the distribution. The 1990s appear to be a toned-down version of the 1980s, with slower but still positive increases in earnings inequality. Up to the 1990s, earnings inequality evolved similarly for men and women (Figure 2).

A more nuanced picture emerged in the 2000s. Upper-tail inequality continued to rise among men, reaching its peak in 2011. For women, upper-tail inequality grew at a much more modest rate. Interestingly, lower-tail inequality slowed down substantially, a pattern which was more pronounced among women and that continued in the 2010s. The stagnation in lower-tail inequality appears to coincide with the introduction of the National Minimum Wage in 1999 (this is discussed in more detail in Section 9). As was already clear from Figure 1, the 2010s have seen a sharp contraction in real earnings growth across the whole distribution, with a consequent reduction in inequality. Given that the drop in real earnings growth has been similar at the median and at the top, but less pronounced at the bottom, post-recession earnings dynamics have led to a reduction in lower-tail inequality and in the 90:10 ratio, but not in upper-tail inequality.

Overall, what is clear from the evidence presented so far is that the level of earnings inequality is significantly higher now than 40 years ago. The decade in which earnings inequalities rose fastest was the 1980s, and the one in which it reversed (albeit modestly) was the 2010s. Lower-tail inequality has stagnated since around the time at which the National Minimum Wage was introduced. It is also interesting to note that the 1980s and 1990s were decades of positive, but unequal, growth across the distribution; conversely, earnings changes in the 2000s and 2010s – decades characterised, respectively, by mild and stagnant earnings growth – were more uniform across the earnings distribution.

Appendix Figure A1 provides some additional evidence on the evolution of earnings inequality among full-time employees across different demographic groups between 1980 and 2019. All panels confirm the evidence discussed above, highlighting a widening of the distribution of real weekly earnings. This is true for men and women (panel A), university and less-than-university educated (panel B) and different age groups (panel C). Consistent with evidence presented elsewhere in the Review (Andrew et al., 2021), the graph also shows a narrowing of the average gender earnings gap. Conversely, the graduate earnings premium and the age premium have increased substantially over time. We will discuss the role of skills as drivers of wage inequality in the second part of the chapter.

International comparisons

Earnings inequality in the UK is now high by international standards. Figure 3 reports the 90:10 percentile ratio of gross earnings of full-time dependent employees by gender for a set of OECD countries over time. Countries are ranked based on the level of inequality among men in 1980 (or in the first year in which the data are available). The UK's 90:10 ratio has been increasing over time for both men and women, and is now the second-highest in this group of OECD countries (after the US) for men and the fourth-highest for women (after the US, Spain and Germany).

Figure 3. 90:10 percentile ratio of gross earnings by gender across OECD countries

Panel A. Men
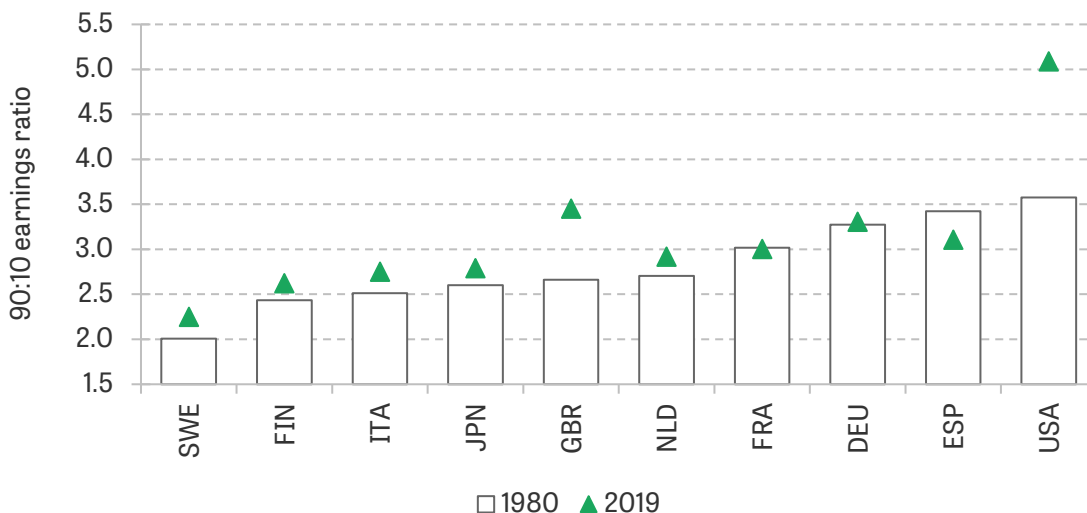
Panel B. Women
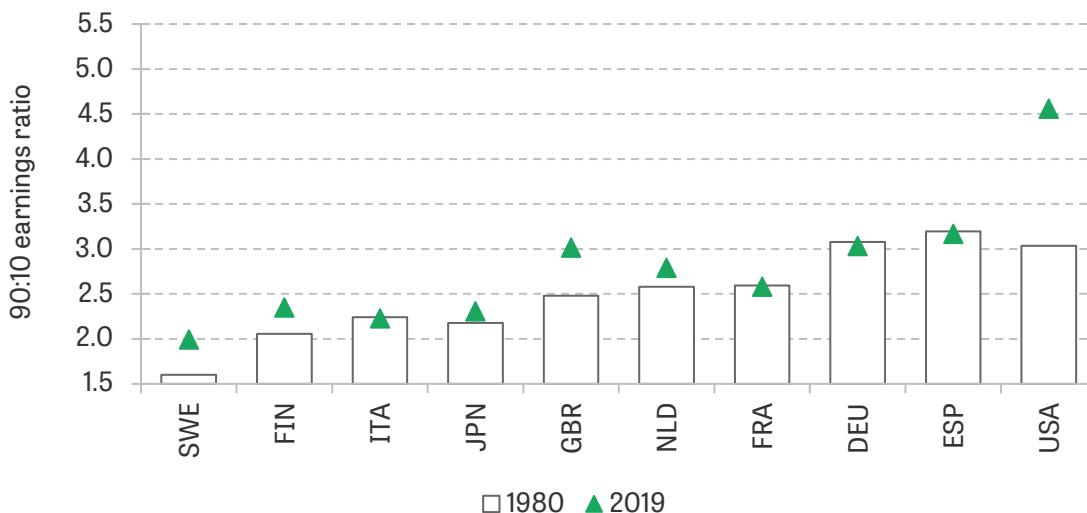
Note: The figure reports the 90:10 percentile ratio for men (panel A) and women (panel B) for a set of OECD countries over time. The percentile ratio is based on gross earnings of full-time employees. The data span 1992–2019 for Germany and Sweden and 2002–18 for France, Italy, the Netherlands and Spain.

Source: OECD.

If we consider the pattern of real annual earnings growth over the last three decades, international comparisons reveal that earnings growth in the UK from 1990 to the onset of the financial crisis has been one of the fastest among OECD countries, close to the rates achieved in South Korea and Norway (Figure 4). The UK is also among the countries in which the reversal of trend in earnings growth in the post-recession period has been sharpest. Indeed, the UK is one of the three countries – with Italy and Portugal – that experienced the slowest annual real earnings growth in the period following the financial crisis (2007–19).

Figure 4. Real growth in average annual earnings among OECD countries
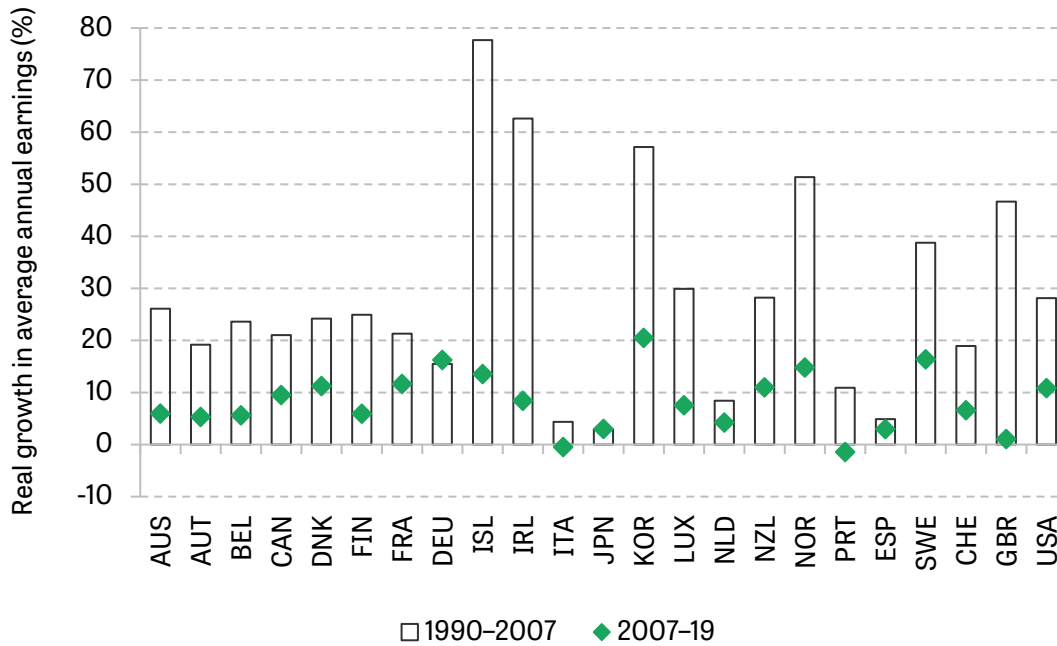
Note: The figure reports real growth in average annual earnings over the periods 1990–2007 (bars) and 2007–19 (diamonds) for the different countries. Data for Germany start in 1991. Data for Portugal start in 1995. Average annual earnings are per full-time- and full-year-equivalent employee in the total economy.

Source: OECD.

Figure 5. Average weekly earnings (AWE) and CPI: annual percentage growth
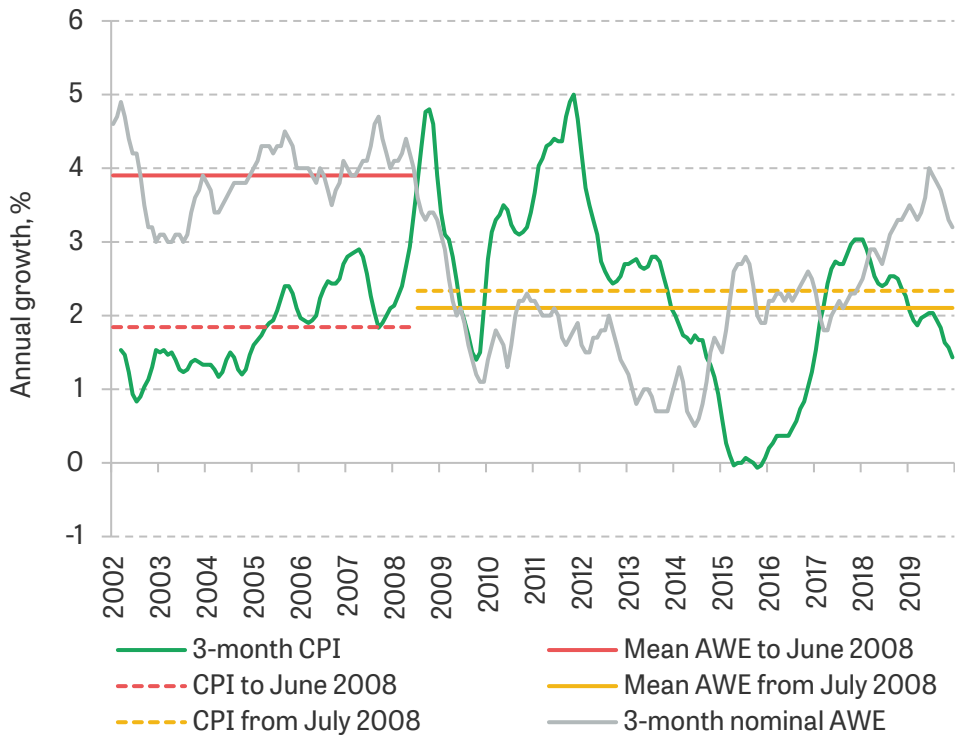
Note: The figure reports annual growth in three-month CPI and average weekly earnings among employees, and the average of each over the periods up to and after June 2008.

Source: Office for National Statistics.

Earnings growth and price inflation

Figure 5 shows that growth in average weekly earnings (AWE) exceeded consumer price inflation from the beginning of 2002 until June 2008. Real earnings did not grow from July 2008 until October 2014, when they showed a modest uptick. Since October 2014, growth in real earnings has been due predominantly to a decrease in price inflation, rather than to an increase in nominal earnings growth. The latter has been at an average of 2% per year after the recession. Since the Brexit referendum in June 2016, real earnings have again been weakened by rising inflation and nominal wage reductions due to the sizeable sterling depreciation that occurred.

3.   Employment and unemployment

Jobs

The slowdown of real earnings growth in the UK is not explained by a low employment rate or a high unemployment rate (Figures 6 and 7). Quite the contrary, the aggregate employment rate has outstripped its pre-global-financial-crisis level since 2014. This is in stark contrast to the patterns observed in the US, especially for male employment, in the post-global-financial-crisis period (Appendix Figure A2).

In fact, the UK has seen sustained employment growth – with the exception of economic downturns – since the mid 1980s (panel A of Figure 6). The gender and skills composition of employment has changed (panels B and C), with the greater contribution to employment growth coming from female labour and skilled (graduate) labour.
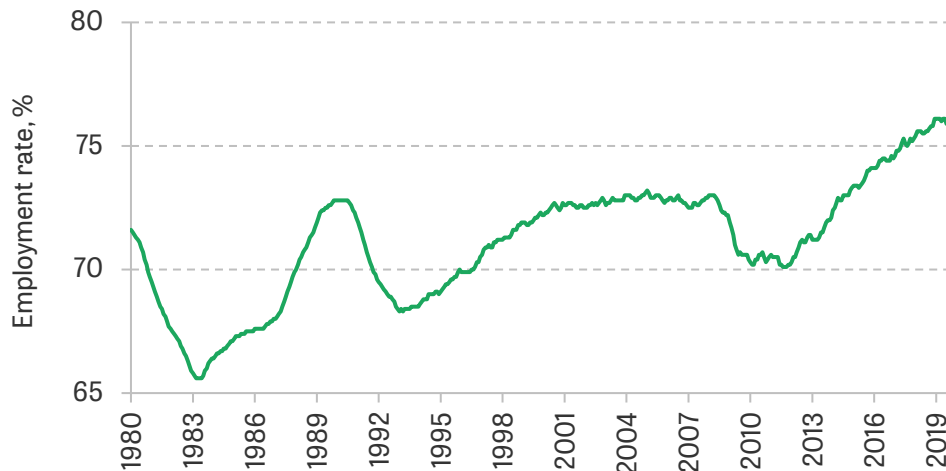
Unemployment

The International Labour Organisation (ILO) unemployment rate in the UK is, by 2019, at its lowest level for the past 40 years (Figure 7). Compared with previous downturns, the Great Recession has seen a more modest increase in the unemployment rate, which has rapidly decreased in the aftermath of the recession years to reach a rate of close to 4% among both men and women in 2019.

However, such record-low levels of measured unemployment mask a substantial degree of underemployment. Figure 8 reports the unemployment rate and a measure of underemployment as proposed by Bell and Blanchflower (2021). The latter is the unemployment rate plus the difference between the additional hours wanted by the underemployed and the fewer hours wanted by the overemployed translated into unemployment equivalents using average hours worked among those in employment.

As argued by Bell and Blanchflower (2021), the unemployment rate may no longer be fully capturing slack in the labour market. Figure 8 highlights how, before the financial crisis, low levels of unemployment were associated with even lower levels of underemployment, whereas the latter remained high in the aftermath of the recession, suggesting that the labour market is characterised by higher levels of slack than are picked up by the unemployment rate alone. Rather – in spite of the low levels of unemployment – a 'reserve army' of underemployed people who are at the margins of employment and unemployment may be putting downward pressure on wages. We turn to this issue in the next subsection.

Figure 6. Employment rate in the UK

Panel A. All workers

Panel B. By gender

Female   Male
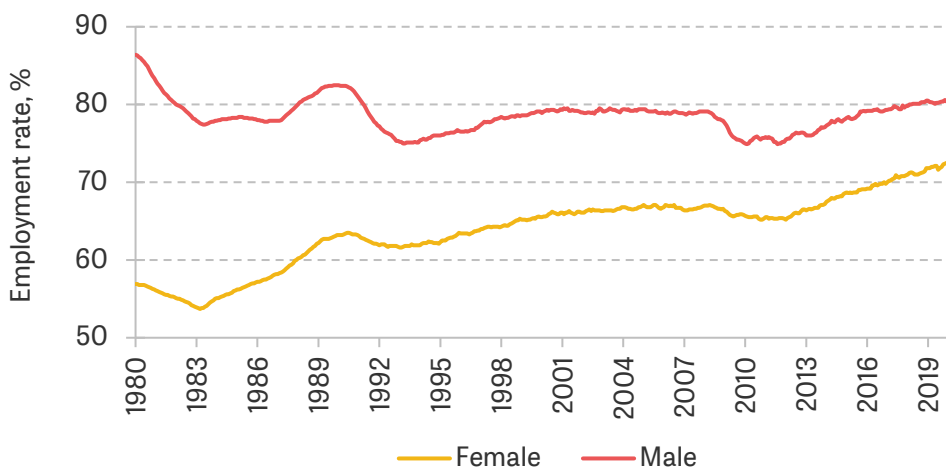
Panel C. By gender and skills level

Male non-graduates   — — Male graduates

Female non-graduates   — — Female graduates
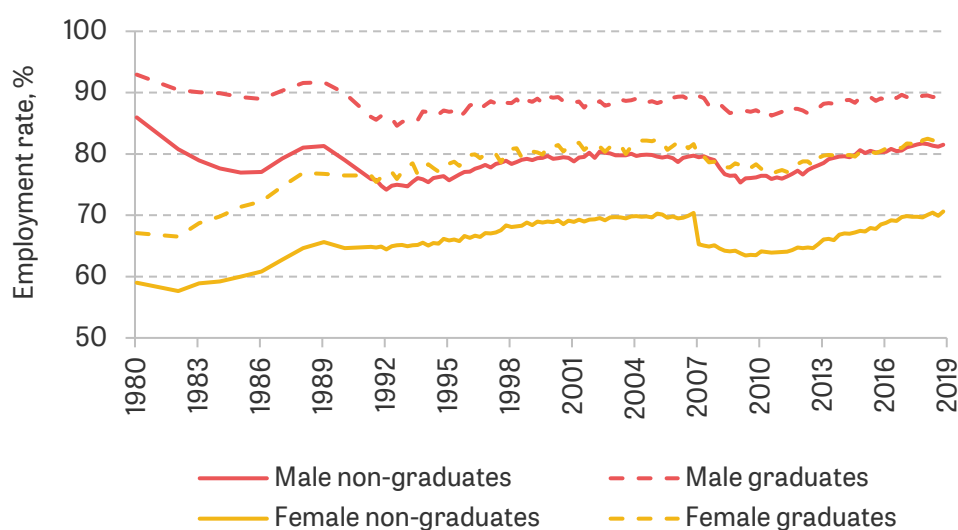
Note: The figure reports the evolution of the employment rate from 1980 to 2019, for the overall population (panel A), by gender (panel B) and by gender and skills level (panel C).

Source: Office for National Statistics and Labour Force Survey.

Figure 7. Unemployment rate in the UK

Panel A. All workers

Panel B. By gender

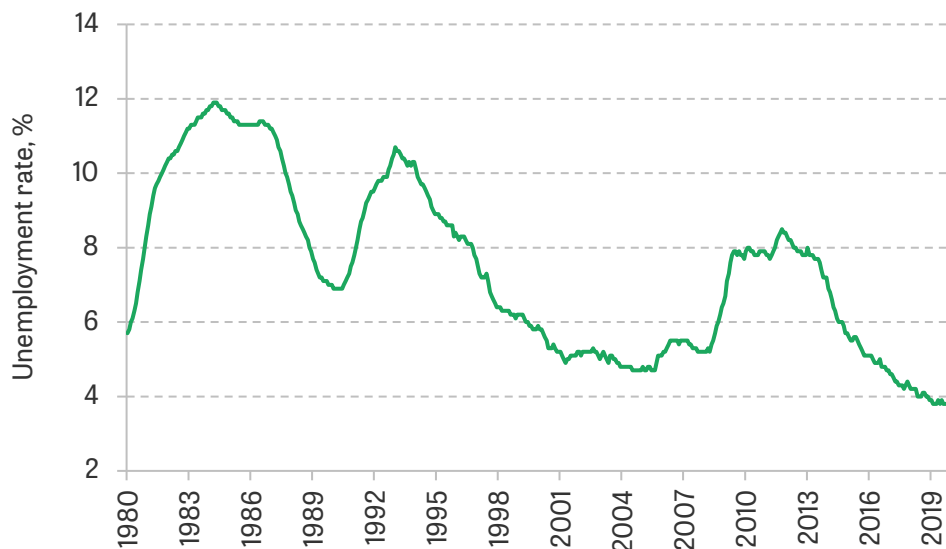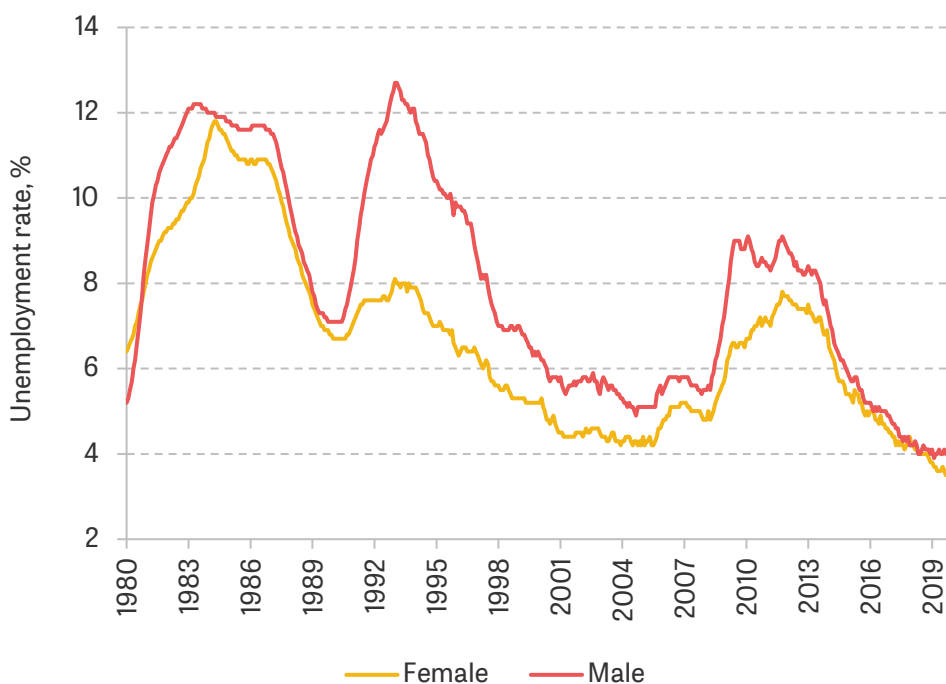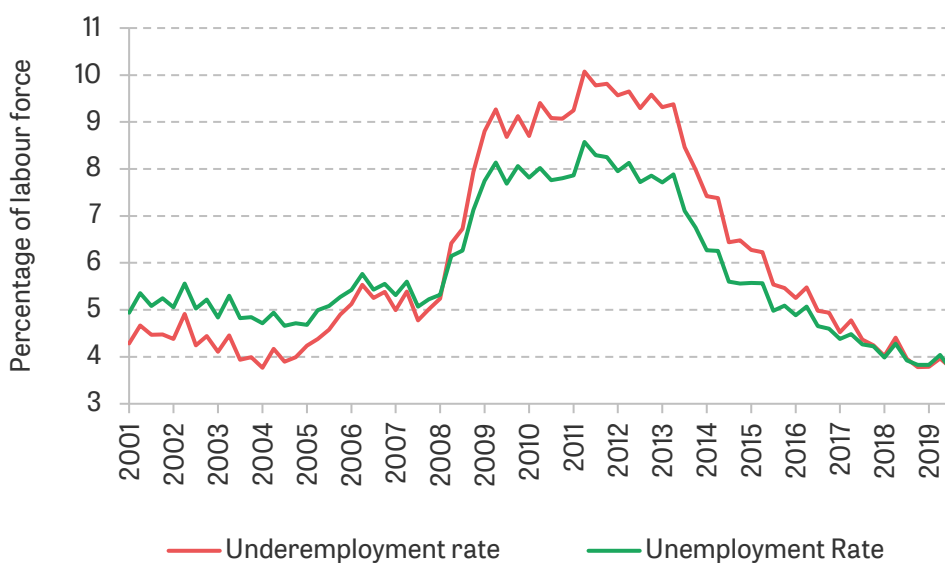

Note: The figure reports the evolution of the unemployment rate from 1980 to 2019, for the overall population (panel A) and by gender (panel B).

Source: Office for National Statistics.

Figure 8. Unemployment and underemployment in the UK

Note: The figure reports the evolution of the unemployment and underemployment rates from 2001 to 2019. The latter is the unemployment rate plus the difference between the additional hours wanted by the underemployed and the fewer hours wanted by the overemployed translated into unemployment equivalents using average hours worked among those in employment.

Source: Bell and Blanchflower, 2021.

Unemployment, underemployment and earnings growth

The argument that higher levels of unemployment restrain real wage growth has had a longstanding recognition in economics. In times of higher unemployment, greater competition for jobs among the unemployed and poorer outside options for the employed limit the scope for pushing for higher wages for both groups.[5] However, the stagnant real wages that have characterised the UK since the mid 2000s in spite of low unemployment levels is at odds with the conventional view that unemployment and wage growth are negatively associated. The puzzle has become even more striking in recent years, with record-low levels of unemployment not triggering wage growth.

It is important to understand the roots of sluggish real wage growth, given the implications of the latter for living standards. Moreover, weak real wage growth, especially at the bottom of the wage distribution, has taken on added significance in a context of high wage inequality such as the UK one.

The search for alternative explanations for the lack of wage growth has focused attention on underemployment (Bell and Blanchflower, 2021) and on the rise in contractual arrangements characterised by hourly constraints (Boeri et al., 2020). An argument similar to the one applied to unemployment can be made for underemployment in relation to wage growth. Since underemployed workers, who – as we have seen – are workers willing to increase their working hours without increasing their hourly pay, can be close substitutes for fully-employed workers

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[5] Moscarini and Postel-Vinay (2016) propose a more nuanced explanation for the relationship between unemployment and wage growth. Their theory posits that rather than the exit rate from employment to unemployment, it is the rate of job-to-job reallocation that best approximates a worker's ability to extract rents from his employer and thus generate wage growth. Using UK data, Postel-Vinay and Sepahsalari (2019) show that real pay growth is more strongly correlated with the job-to-job transition rate than with the unemployment-to-employment transition rate.

who are satisfied with their hours, elevated levels of underemployment can slow down wage growth.

The empirical relationship between wage growth and labour market slack – the so-called 'wage curve' – is traditionally estimated using a statistical regression which relates wage growth to the unemployment rate in the previous year (typically controlling for the change in the unemployment rate between the two years).[6] Panel A of Appendix Table B1 reports the estimated coefficients of this simple model estimated using data at the regional level in the UK from 1993 to 2019. Our outcome measure is median log real weekly earnings for full-time employees. The estimates indicate a negative association between unemployment and median real weekly earnings. If we look at the two most recent decades – the 2000s in column 4 and the 2010s in column 5 – the elasticity of real weekly earnings to unemployment is close to –0.09, indicating that a 1% increase in unemployment is associated with a 0.09% decrease in real earnings.

Moving to panel B and focusing again on the last two columns, we see that the underemployment rate also has explanatory power in this model. Interestingly, though, the sensitivity of real earnings growth to the underemployment rate appears to have increased over time – the elasticity of real earnings to underemployment has grown from –0.04 in the 2000s to –0.10 in the 2010s. Actually, if we compare the estimates for the 2010s in panels A and B, we can see that the underemployment rate has more explanatory power than the simple unemployment rate, indicating that the latter has become better at capturing labour market slack.

To understand how the effect of unemployment and underemployment on earnings differs across the wage distribution, we estimate the regression separately for wages in each decile of the wage distribution. The estimates are reported in panels A and B of Figure 9. Two main patterns emerge. First, the sensitivity of earnings to labour market slack is stronger at the bottom of the distribution. This is true both across decades and across measures of slack, and suggests that the unemployed and underemployed tend to be more of a substitute for workers at the bottom of the distribution. Second, the earnings sensitivity to the underemployment rate has become more pronounced over time.

The higher sensitivity of earnings to underemployment appears to be a structural shift in the functioning of the labour market. It suggests that the intensive margin of employment – i.e. the number of hours worked conditional on being employed – has gained greater relevance in determining equilibrium earnings outcomes.

Many factors could have contributed to this structural shift. First, as we will see in more detail in Section 9, the role of unions has weakened substantially over time, with union membership and coverage having now reached historically low levels. Second, the gains from productivity improvements have not been shared out equally among workers, and among workers and firms. There are two main dimensions to this decoupling of productivity and wages: on the one hand, the gap between average wages and total compensation per hour suggests that non-wage labour costs, mostly pensions, have taken a growing share of the productivity growth that has been achieved; on the other hand, productivity growth has translated into faster wage growth only for top earners. Productivity growth is necessary to generate real wage gains, but not sufficient. If productivity gains continue their (pre-recession) trend of not being shared out, then there is no reason why the median worker will gain. Third, the emphasis on 'welfare conditionality' may have

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[6] See Appendix Section B1 for more technical details.

Figure 9. Earnings curves by percentile of real weekly earnings

Panel A. Unemployment rate
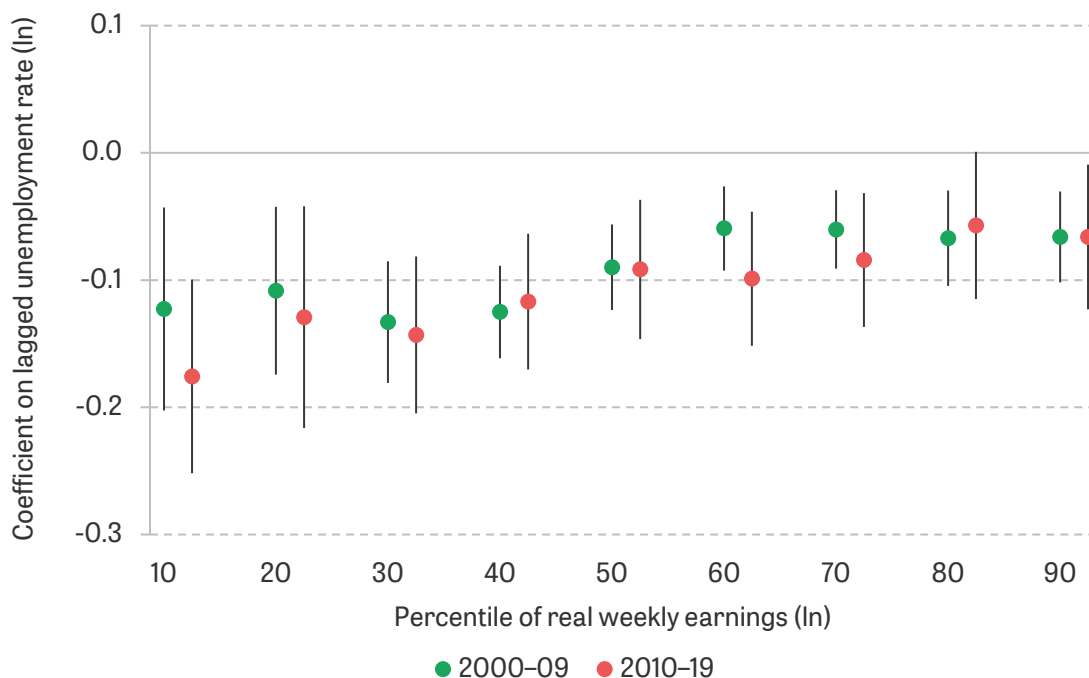
Panel B. Underemployment rate

Note: The figure reports the coefficient estimates of β_1 for equation 1 in Appendix Section B1 estimated using the different deciles of real weekly earnings of private sector employees as outcome and the unemployment rate (panel A) or the underemployment rate (panel B) as an explanatory variable. Estimates are conditional on region fixed effects and regional controls (the proportion of workers with a university degree, the proportion female, the proportion aged 16–25, the proportion white and the proportion in public employment in the regional labour force). Point estimates are illustrated by dots and 95% confidence intervals based on heteroskedasticity-robust standard errors are represented by the vertical lines.
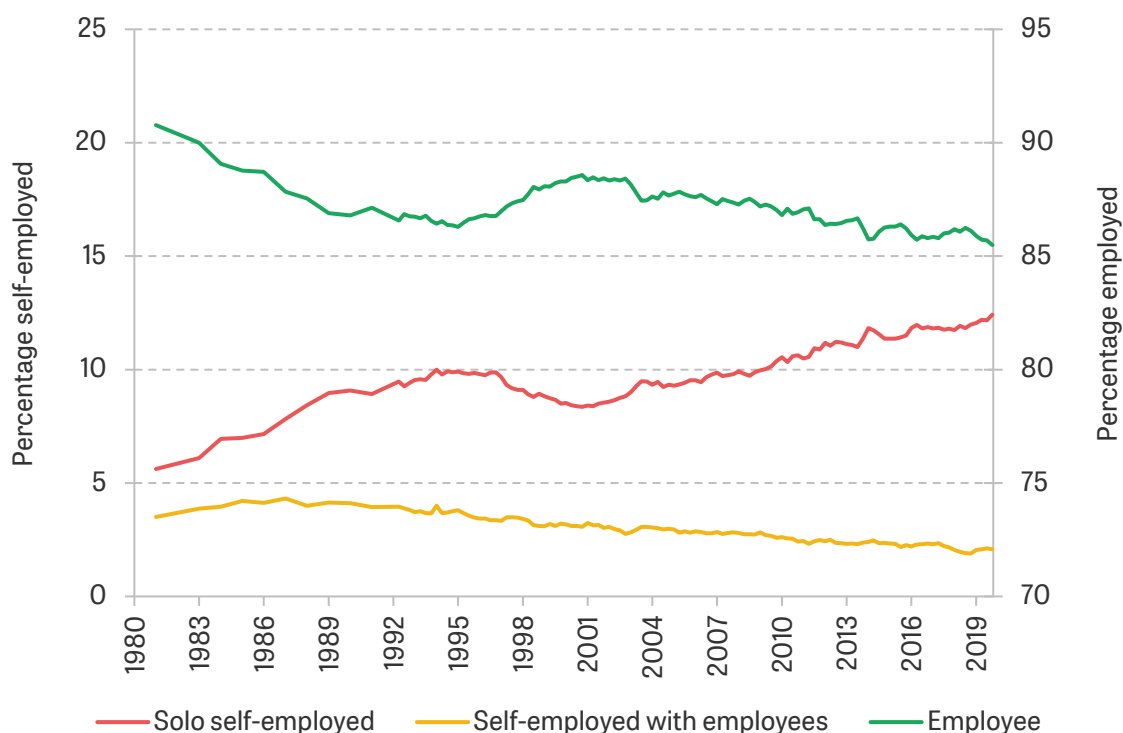
Source: Labour Force Survey.

given rise to increased substitutability of the unemployed with low-wage workers. The development of a system of tax credits that supplement low wages mainly for those with children has generated pressure to take low-waged work, and the compensation for doing so may have increased the willingness of workers to trade lower wages for employment. A final potential cause for the increased sensitivity of earnings to underemployment is the rise of low-wage, flexible work arrangements, in the form of self-employment and atypical contracts. We turn to this topic in Sections 4 and 5.

Employment composition

The composition of employment has altered substantially over the past 40 years. As Figure 10 shows, employees went from accounting for 90% of employment in the early 1980s to approximately 85% in 2019. Over the same period, the share of the solo self-employed has been on a steady rise, but for a slowdown in the late 1990s and early 2000s. The solo self-employed account nowadays for just above 12% of total employment. The share of employment accounted for by the self-employed with employees has been decreasing over time, making up around 2% of employment in 2019. Growth in solo self-employment accounts for 38% of all employment growth since the onset of the financial crisis (Figure 11). Notably, solo self-employment was the only employment type growing with positive figures during the recession.

Figure 10. Employment decomposition

Note: The figure shows a decomposition of the employment rate from 1980 to 2019 into the percentages due to solo self-employed (left-hand axis), self-employed with employees (left-hand axis) and employees (right-hand axis).

Source: Labour Force Survey.

Figure 11. Change in total employment by employment type since Q1 2008
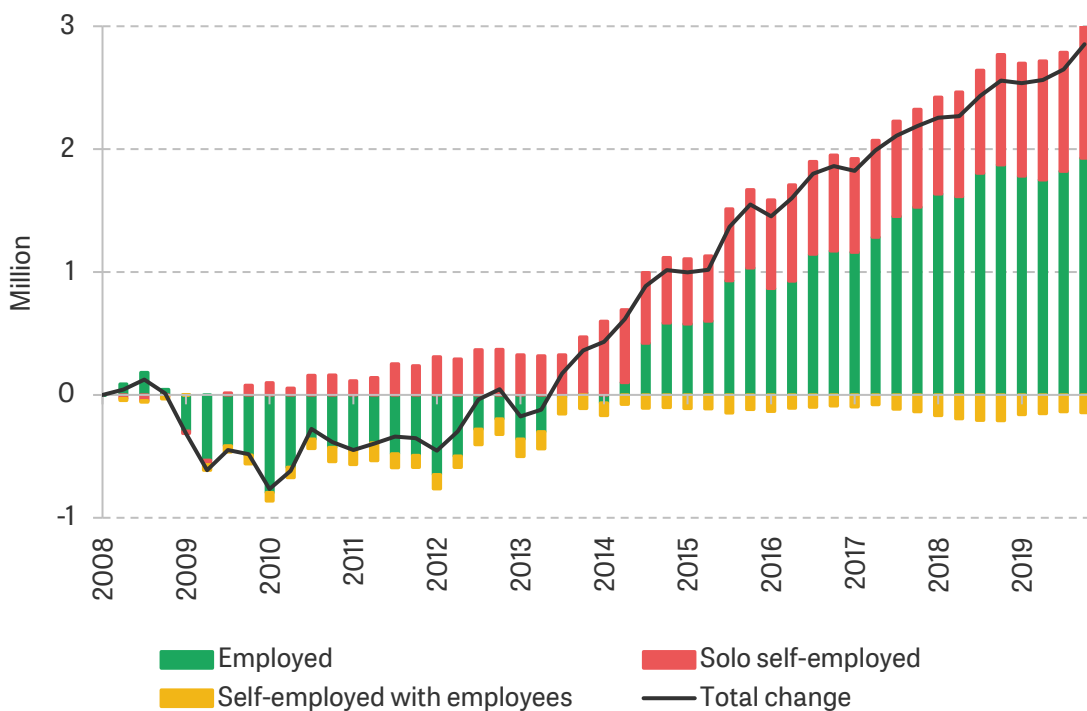
Note: The figure shows a decomposition of the total change in employment from 2008 to 2019 into the components due to solo self-employed, self-employed with employees and employees.

Source: Labour Force Survey.

4.   Self-employment[7]

Self-employment composition

The secular rise in self-employment has been one of the major shifts in the UK labour market over the last 40 years. It has also been key to aggregate employment rates (employed and self-employed) reaching record levels in 2019. While in 1980, one in eleven workers was self-employed, in 2019 this had increased to one in seven workers (Figure 12). Self-employment had been on a steep rise throughout the 1980s and most of the 1990s. It showed an inversion of trend in the late 1990s, but has been on a steady rise since 2000.

This rise has been entirely driven by growth in 'solo self-employment' – own-account workers without employees – which now accounts for 12% of employment. The vast majority (85% in 2019) of the solo self-employed are sole traders, that is unincorporated businesses with a single owner and no employees. Owner-managers – individuals who run their own incorporated business – make up the residual share of solo self-employment, but have increased in prevalence over time. The share of self-employed workers with employees has instead been declining since the late 1980s. As a result, the composition of self-employment has changed profoundly over the last four decades: nearly half of the self-employed had employees in 1980, compared with just 14% in 2019.

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[7] This section draws extensively from Giupponi and Xu (2020), who provide a comprehensive overview of solo self-employment in the UK over the last four decades.

Figure 12. Self-employed as a percentage of employment, by self-employment type
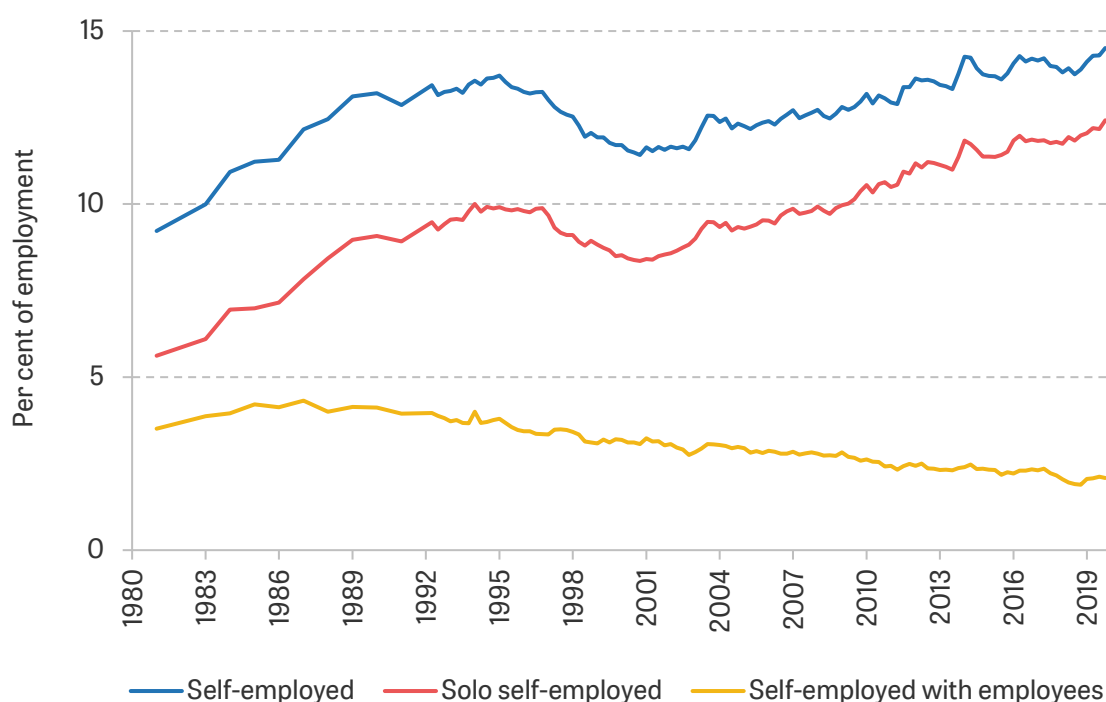
Note: The figure shows the evolution of self-employment as a percentage of total employment from 1980 to 2019, both as an aggregate and separately for the solo self-employed and the self-employed with employees.

Source: Labour Force Survey.

A host of drivers have been suggested for the rise in self-employment, including tax incentives (Adam, Miller and Pope, 2017) and an ageing population (Tatomir, 2015). More recently, especially in the aftermath of the Great Recession, there has been a growing concern that the rise in solo self-employment and the 'gig economy' reflects weak employment opportunities, which leave workers with little bargaining power and few options for traditional employment. There has also been increased focus on 'bogus self-employment', which is masking a traditional employment relationship as self-employment in order to avoid the costs of employment protection and other employment rights, such as social insurance contributions and minimum wages.

However, the solo self-employed are an extremely diverse group, ranging from cleaners and taxi drivers, to barristers and management consultants. Blundell (2020) proposes a taxonomy of self-employed workers, classifying them into six clusters based on demographic and work characteristic. These range from 'London professionals', who are typically highly educated workers in the finance sector, to 'low-educated young men', who are more likely to belong to ethnic minorities and work mainly as road transport drivers (e.g. ridesharing and delivery drivers).[8]

The shift in the contractual nature of work from traditional employment to solo self-employment has occurred across a wide range of occupations, i.e. both in low-skilled, low-wage jobs and in higher-skilled, higher-paid occupations. A corollary of this is that the rise in solo self-employment has taken place relatively evenly across the wage distribution (Giupponi and Xu, 2020).

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[8] Giupponi and Xu (2020) document that the prevalence of and growth in solo self-employment have been relatively similar across ethnic groups, education levels and regions outside the South of England.

Figure 13. Self-employment across countries

Panel A. Self-employment as a percentage of workforce

☐ Self-empl. rate 2019   ◆ Solo self-empl. rate 2019   ○ Schedule C filers rate (2017)
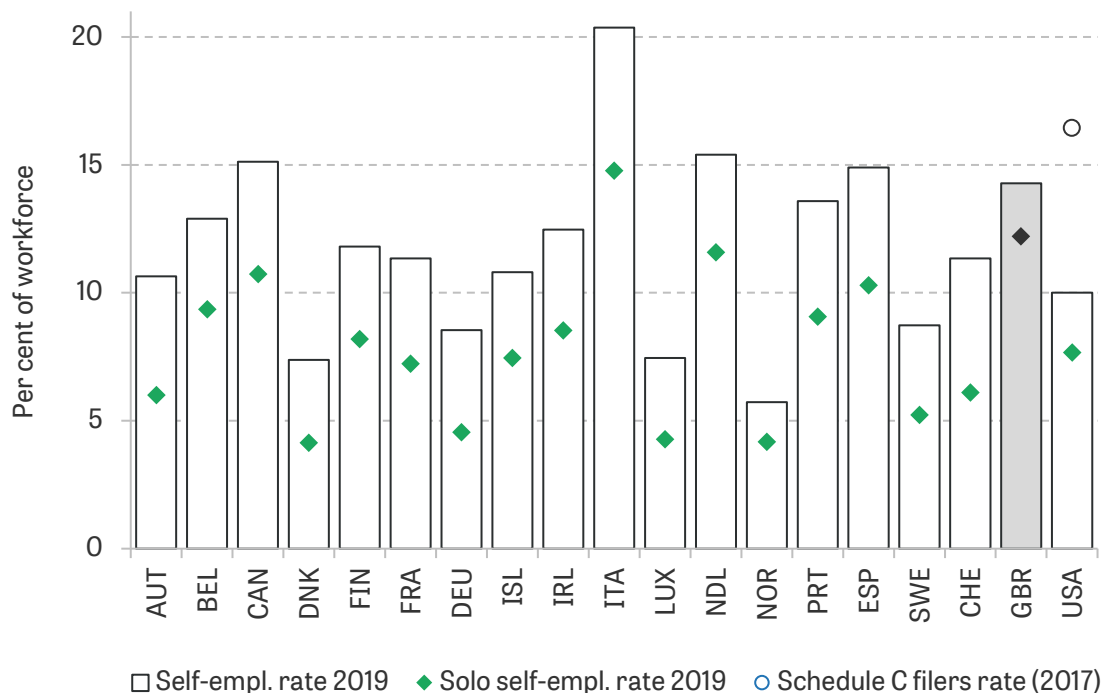
Panel B. Self-employment growth

☐ Change in self-employment rate 2000–19
◆ Change in solo self-employment as percentage of self-empl. 2000–19
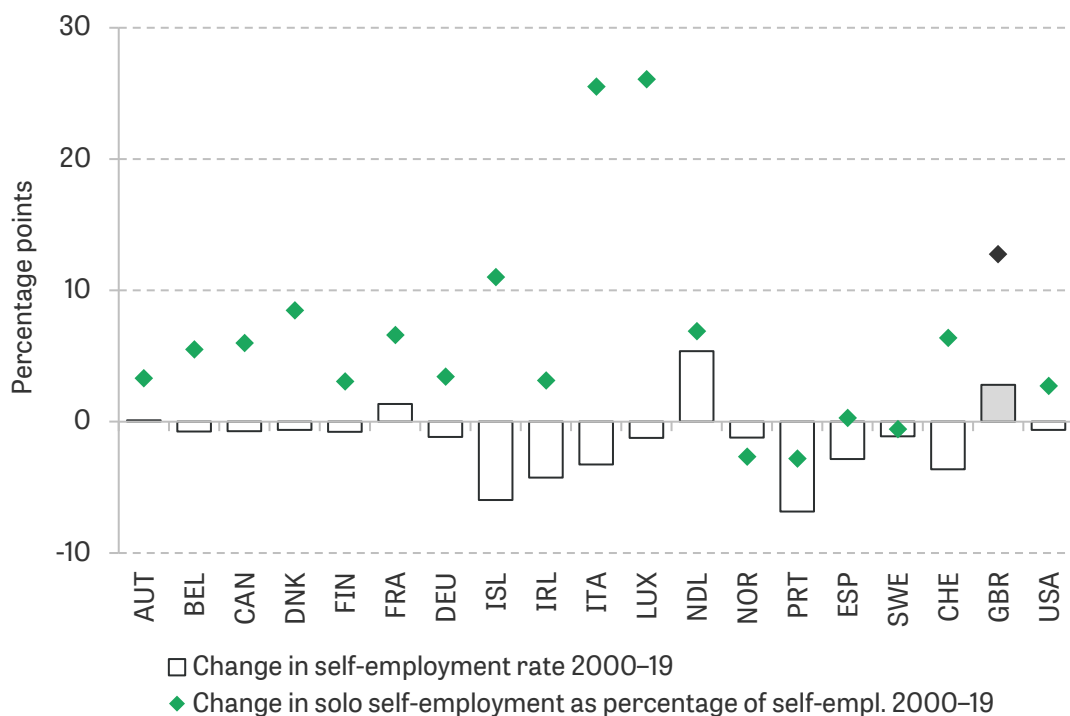
Note: Panel A reports the self-employment rate across countries. The self-employment rate is computed as the percentage of self-employed in the workforce. The data on the self-employment rate and the solo self-employment rate for Canada and the United States are for 2017. The data on Schedule C filers are for 2017. Panel B reports the change in the self-employment rate and in the number of solo self-employed as a percentage of self-employment between 2000 and 2019, except for Canada and the US, for which the change is computed between 2000 and 2017.

Source: Eurostat, OECD and Internal Revenue Service.

International comparisons

International comparisons show that the UK has one of the highest self-employment rates (as a percentage of total employment) and highest proportions of solo self-employed among all self-employed individuals (panel A of Figure 13).[9] The growth in solo self-employment in the UK has also been remarkable by international standards. Whilst rates of self-employment have been decreasing amongst almost all European countries since 2000, the share of solo self-employment out of total self-employment has been increasing across the board. The UK stands out as one of the countries in which the latter has seen the largest increases (panel B of Figure 13).

Income from self-employment

Analysis of survey data from the Family Resources Survey indicates that median pre-tax earnings were £276 a week among the solo self-employed in 2018–19, compared with £395 a week among employees (Giupponi and Xu, 2020). This data point, however, masks substantial variation in earnings. Over half (55%) of sole traders earn less than £300 a week, compared with a third (33%) of employees. The earnings of owner-managers without employees are more polarised: 50% earn less than £300 a week, but 11% have very high earnings of over £1,200 a week, compared with just 5% of employees and 3% of sole traders. Moreover, the tax system incentivises owner-managers to retain income within their companies. Cribb, Miller and Pope (2019) show that this is the case, implying that owner-managers' true earnings will be higher than those they report.

Appendix Figure A3 complements this evidence by showing the share of self-employed by decile of the weekly income distribution among all workers in 1999 and 2019. Self-employed individuals are strikingly over-represented in the lowest two deciles of the weekly income distribution – a pattern that has become more pronounced over the last two decades. In 2019, even though they made up 9.5% of employment, the self-employed formed 27% and 19% of earners in the first and second deciles respectively. The share of the lowest-earning quintile who are self-employed has increased by 54%, or 8 percentage points, from 15% to 23%, between 1999 and 2019. As we will discuss more later in the chapter, non-traditional forms of employment cannot be reached by policies such as the minimum wage that are aimed at boosting wages and income at the bottom. The growing share of workers in non-traditional work arrangements at the bottom therefore poses important policy challenges that are not always easy to solve with the traditional policy toolkit.

The gap in earnings between sole traders and employees has widened over the last decade.[10] Figure 14 shows that sole traders have seen their median real weekly earnings drop substantially since the onset of the financial crisis, mainly due to a reduction in hours worked. Their real weekly earnings were more than 30% lower in 2013–14 than in 2006–07, and still more than 15% below pre-crisis levels in 2019–20. By comparison, employees have experienced significantly less

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[9] For the US, numbers on self-employment are shown from both survey and administrative (IRS) data. The remarkable difference that comes out of the two data sources has been attributed to survey respondents not being fully aware of their status as self-employed workers (Krueger, 2017).

[10] Unfortunately, solo self-employed owner-managers cannot be reliably identified in the Family Resources Survey prior to 2010. Solo self-employed owner-managers will generally be classed as employees in Figure 14; however, the fraction incorrectly classified will be very low as a share of all employees (1.5% in 2018–19) and therefore unlikely to affect average figures for employees.

marked drops in earnings, with a less than 10% drop by 2013–14 and a rebound to pre-crisis levels since then.[11]

Figure 14. Real median weekly income by employment type

Note: The figure reports the evolution of CPI-deflated median weekly income relative to 2006, for employees and solo self-employed individuals.

Source: Family Resources Survey.

Solo self-employment and wage moderation

Despite variation in the nature of solo self-employed jobs and incomes, evidence on the labour market history of solo self-employed individuals and their employment conditions while in work portrays solo self-employment as a form of work on the margins of employment. First, many people enter solo self-employment after losing their jobs (Cribb and Xu, 2020). Of those entering solo self-employment, 44% were unemployed or inactive at some point in the year before entry. Second, as we will see more clearly in Section 6, the solo self-employed are characterised by high rates of underemployment. Throughout the past 20 years, they have consistently been the employment group with the largest fraction of workers wanting to work longer hours – higher than for the employees and the self-employed with employees.

If the rise of solo self-employment, especially of the gig-economy type, is, at least partly, a symptom of poor opportunities in the traditional employer–employee labour market, there are reasons to believe that the rate of solo self-employment may be capturing slack in the labour market. As such, the prevalence of solo self-employment – similarly to unemployment and underemployment – can put downward pressure on wage growth by reducing the bargaining power of employees. Boeri et al. (2020) advance this hypothesis and test it using cross-country data. Analysing panel data on OECD countries, they show that the share of solo self-employment contributes to explaining wage moderation over and above unemployment and

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[11] Analysis of administrative data from HM Revenue & Customs paints a similar picture (Cribb, Miller and Pope, 2019).

underemployment. Giupponi and Xu (2020) extend the analysis to the UK labour market, estimating wage curves at the travel-to-work-area level. They show that, in the UK labour market, solo self-employment makes a small but significant contribution to explaining wage moderation over and above canonical forms of labour market slack (unemployment and underemployment). Notably, and contrary to what we have seen for unemployment and underemployment in Section 3, the effect of solo self-employment on wage moderation is seen across the wage distribution, which is consistent with it being a fall-back option for some professionals as well as those in lower-paid occupations.

5.   Alternative work arrangements

'Alternative', 'non-standard' or 'atypical' work are terms typically used to indicate all temporary, part-time and self-employment arrangements, i.e. employment forms that deviate from the 'standard' of full-time, open-ended employment with a single employer (OECD, 2014). However, as emphasised in the *OECD Employment Outlook 2019* (OECD, 2019), the notion of 'alternative' work arrangements has gained a more specific connotation in recent years, which encompasses 'situations in which workers are less well covered than standard employees by existing labour market regulations and social protection programmes – partly because they have developed at the fringes of existing legislation'. Examples of these forms of work, which are often referred to as 'new forms of work', are platform-mediated or gig-economy work, temporary contracts of very short duration, contracts with no guaranteed hours of work (on-call and zero-hours contracts), and more generally contracts falling under the umbrella of solo self-employment, such as freelance and contract work.

The nuances of these definitions and the evolving nature of 'non-standard' arrangements make it hard to measure the magnitude and trends in these phenomena in traditional survey and administrative data. In a series of papers, Katz and Krueger (2019a, 2019b) attempt to quantify the incidence and growth of alternative work arrangements in the US from 2000 to 2015. Using data from the Contingent Worker Survey (CWS), the 2015 RAND-Princeton Contingent Work Survey, and administrative tax data from the Internal Revenue Service, they conclude that there has been a modest upward trend in the share of the US workforce in alternative work arrangements from 2005 to 2015, probably in the order of 1–2 percentage points from a baseline of 10.7% of the workforce. These results should nonetheless be taken with caution, as it has been shown that survey data tend to suffer from underreporting, especially of multiple job holding, and misclassification of employment types (Abraham et al., 2021).

The OECD usually looks at the share of the workforce engaged in temporary work, involuntary part-time work and solo self-employment as an indicator of the prevalence of alternative work arrangements. According to this indicator, when compared with European countries, the UK has a percentage of the workforce engaged in alternative work arrangements that is around average, while the temporary work and involuntary part-time components are relatively small. Alternative work arrangements thus appear almost synonymous with solo self-employment in the UK, when looking at both their current level and their growth since 2000. As we have already seen, in the UK the proportion of workers who are solo self-employed has doubled since the early 1980s.

Another form of atypical work that has increased in recent years is the zero-hours contract. Zero-hours contracts are employment contracts with no minimum guaranteed hours or times of work. They are a form of casual work or on-call working, in which hours can be offered at short notice, as and when an employer needs them. Employers are not obliged to offer any work and, at

least in principle, workers are similarly not obliged to accept work that has been offered to them. Estimates from the Office for National Statistics suggest that the number of workers on zero-hours contracts has skyrocketed from 143,000 in 2008 to approximately 1 million in 2019. Although part of this rise may reflect measurement issues, 3% of the workforce are on zero-hours contracts nowadays.

Data from the UK Labour Force Survey analysed by Datta, Giupponi and Machin (2019) show that zero-hours contract workers earn on average around £5 less per hour than the average employee and they work on average 10 fewer hours per week. The median hourly wage for zero-hours contract workers is very close to the prevailing minimum wage. A large fraction of zero-hours contract workers are paid at or near the minimum wage, so that more than half of them are affected by minimum wage upratings, compared with just 20% of all employees on average. Zero hours contracts are associated with a high degree of precariousness, since when looking at transitions across labour market statuses over time, they have the lowest persistence compared with other forms of employment, unemployment and inactivity.
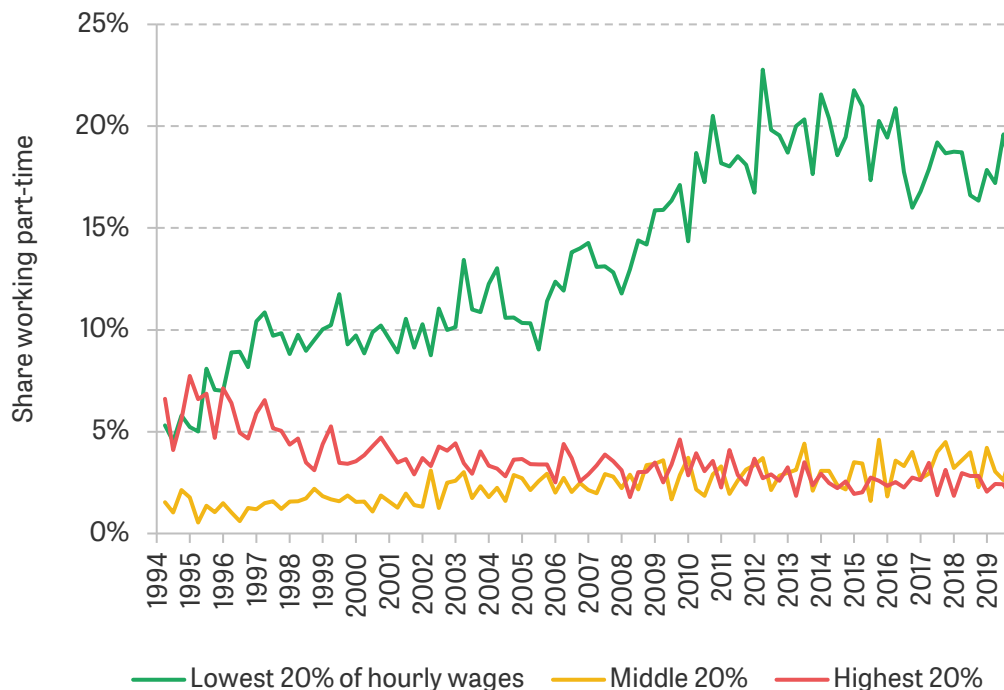
6.   Trends in hours

It is not just wages and the extensive margin of employment that have been driving changes in earnings inequality. In fact, hours of work – the intensive margin of employment – have played an important role too. After rising during the 1980s, average hours of work among women have remained stable in the past three decades. There has been a fall in the prevalence of jobs with very low hours (less than 16 hours per week) for women in the bottom 20% of the hourly wage distribution. For men, instead, there have been large reductions in hours worked by those in the bottom quintile of the hourly wage distribution. This reduction can be attributed to both a reduction in long hours and an increase in part-time work (Blundell et al., 2018; Cribb, Joyce and Wernham, 2022). Figure 15 reports the fraction of employees aged 25–55 working part-time by quantile of the hourly wage distribution and gender (panel A for men and panel B for women). For men, the fraction of low-paid working part-time increased sharply from 5% in 1994 to 20% in the early 2010s and has only mildly declined ever since. For women, the same measure is much higher to start with, but has declined from 70% to below 60% over the same period.

In their assessment of the drivers of the increase in earnings inequality, Cribb, Joyce, and Wernham (2022) show that, for male employees, the secular decline in hours of work at lower wage percentiles – which has been particularly pronounced for the lower-educated – has been the driver of increased earnings inequality in the past two decades. For female employees, the picture is reversed: hours increases at the bottom of the wage distribution have reduced earnings inequality.[12]

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[12] The findings in Cribb, Joyce and Wernham (2022) cover the period from 1994–95 to 2019–20, and update previous evidence from Blundell et al. (2018). In their analysis, they investigate the role of wages, hours and redistribution in shaping household income inequality over the past 25 years.

Figure 15. Percentage working part-time

Panel A. Men

Lowest 20% of hourly wages — Middle 20% — Highest 20%

Panel B. Women

Lowest 20% of hourly wages — Middle 20% — Highest 20%
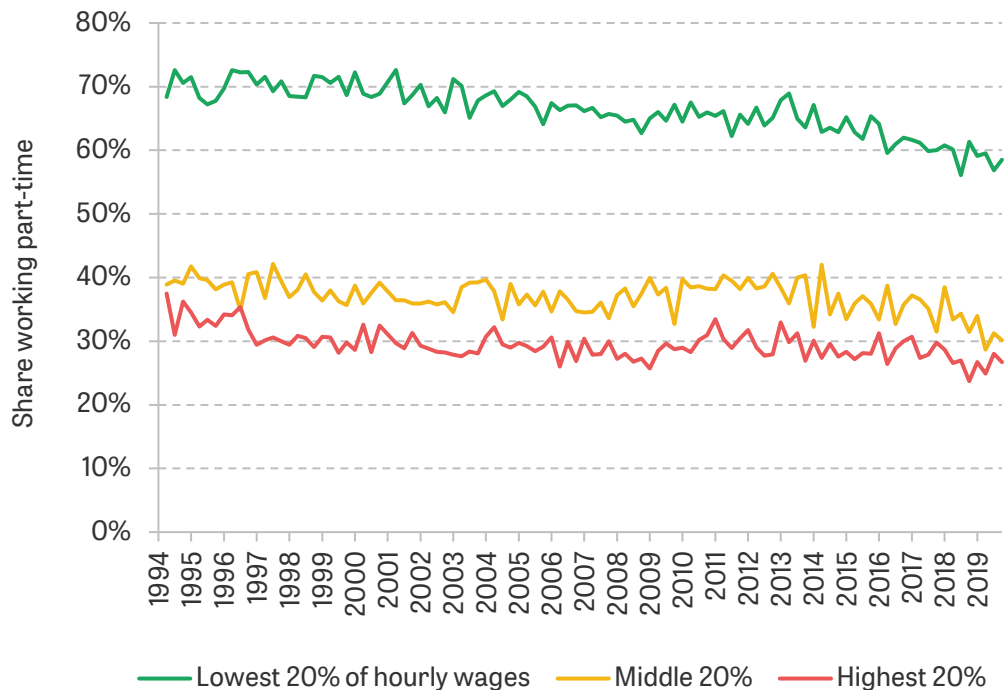
Note: The figure reports the share of part time workers by hourly wage quantile for men (panel A) and women (panel B) from 1994 to 2019. 'Part-time' is defined as working less than 30 paid hours a week, based on usual hours worked. The sample is employees aged 25–55, excluding those with hourly pay in the bottom 1% or top 1% of the overall hourly pay distribution. To be in the lowest-paid group requires being in the lowest quintile (fifth) of hourly wages. The middle group is those in the third quintile of hourly wages, and the highest-paid group is those in the top quintile of hourly wages. Hours include paid but not unpaid overtime.

Source: Labour Force Survey.

Figure 16. Changes in wages and earnings by percentile and gender, 1997–2019
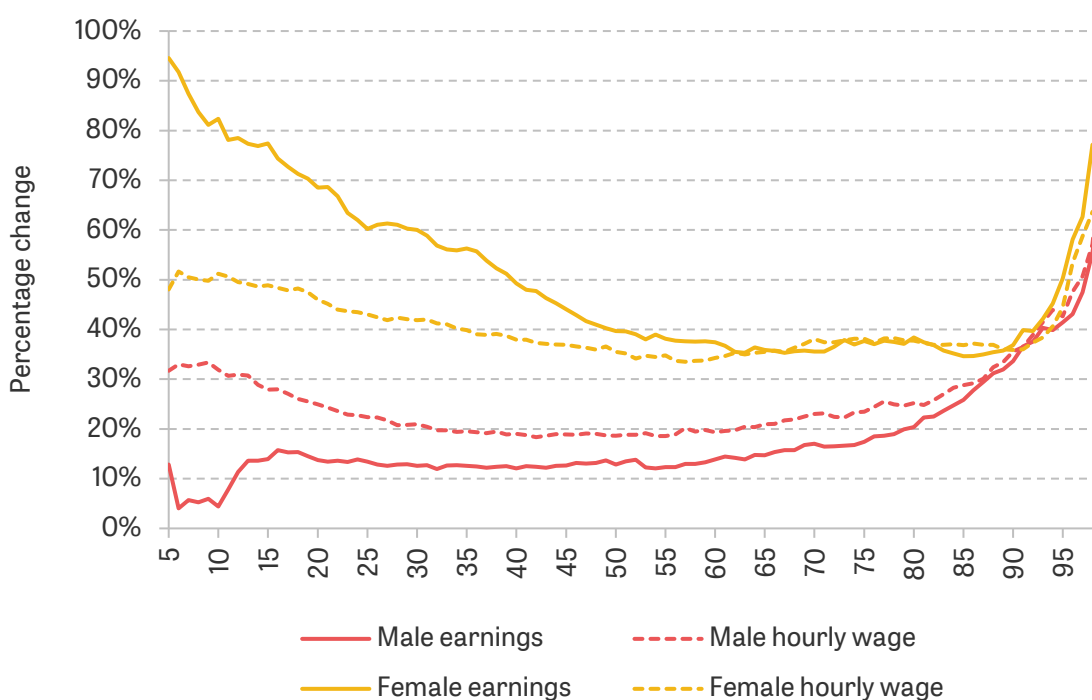
Note: The figure reports changes in hourly wages and earnings of employees by percentile between 1997 and 2019, separately for men and women. Hourly wages are based on paid hours only.

Source: Family Resources Survey.

Building on the analysis in Cribb, Joyce and Wernham (2022), Figure 16 highlights how influential intensive margin trends have been in shaping earnings inequality among employees in the UK. The graph shows the percentage change in earnings (solid lines) and hourly wages (dashed lines) between 1997 and 2019, by percentile and gender (red lines for men and yellow lines for women). The growth in male earnings has been much greater at the top of the distribution than at the bottom. Conversely, growth in wages has been relatively smoother along the distribution, with faster growth at the bottom and at the top. These dynamics imply that, for men, growth in earnings inequality is largely explained by drops in hours at the bottom of the wage distribution. The pattern for women is the mirror image of that for men. Growth in female earnings at the bottom of the distribution has outpaced growth in wages, indicating that the intensive margin of employment has also been responsible for the reduction in earnings inequality among women.

Hours constraints are strikingly unevenly distributed across employment types. Panel A of Figure 17 reports the share of workers who would like to work more hours without increasing their hourly pay. Underemployment is predominantly concentrated among the solo self-employed, followed by the employees and – at greater distance – the self-employed with workers. Even though the share of underemployed has decreased after the financial crisis, it is still above its pre-crisis level in all groups. The flip side of the coin is illustrated in panel B of Figure 17, which reports the share of overemployed, i.e. workers who would rather work shorter hours, even if for less pay. Here the self-employed with employees stand out as the category that is more likely to be overemployed, followed by the employees and the solo self-employed. The dynamics of overemployment appear less cyclical than those of underemployment.

Figure 17. Percentage of workers who would like to work longer or shorter hours (for less pay) by employment type

Panel A. Longer hours
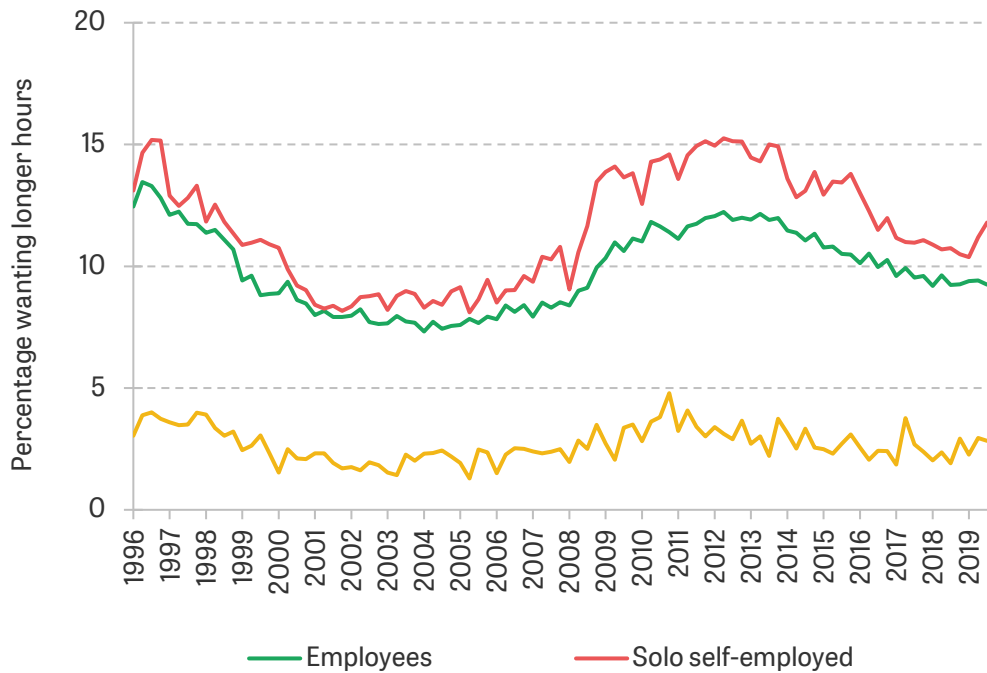
Panel B. Shorter hours for less pay
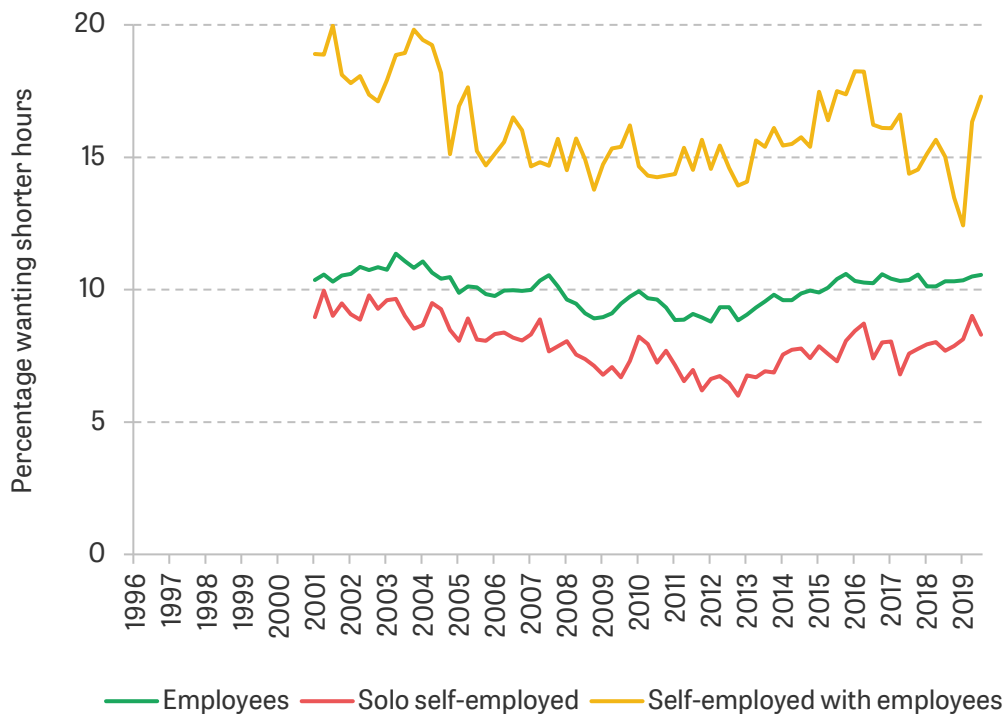
Note: The figure reports the percentage of individuals wanting longer hours (panel A) and shorter hours (panel B), by employment type. Workers are classed as 'wanting longer hours' if they (i) would prefer longer hours in their current job, (ii) want longer hours in a new job or (iii) are looking for an additional job. Workers are classed as 'wanting shorter hours' if they would work shorter hours for less pay. The data start recording underemployment in Q2 1996 and overemployment in Q2 2001.

Source: Labour Force Survey.

7.   Job quality

The analysis so far has described the evolution of earnings, hours and employment over the last 40 years. A picture emerges of high employment levels, stagnant real earnings and increased earnings inequality, coupled with sizeable shifts in the composition of work. These are all dimensions that affect individuals' and households' living standards. In this section, we consider 'job quality' as an additional dimension of work that can affect living standards and well-being. We define 'job quality' as the welfare the workers derive from their jobs. Arguably, the wage rate is a key dimension of job quality, since it represents the monetary compensation received for an hour of work, but it is not the only one.

Here we focus on workers' perceptions of their jobs as measures of job quality. In particular, we consider their perceptions of attributes of their job related to job security, flexibility, career progression and overall job satisfaction. Using data from the British Social Attitudes Survey, Figure 18 shows the percentage of respondents agreeing with each statement about their job, splitting the sample between employees, and self-employed workers with and without employees. Results are shown for 2015, the most recent available year.

Figure 18. Perceptions of job quality, 2015
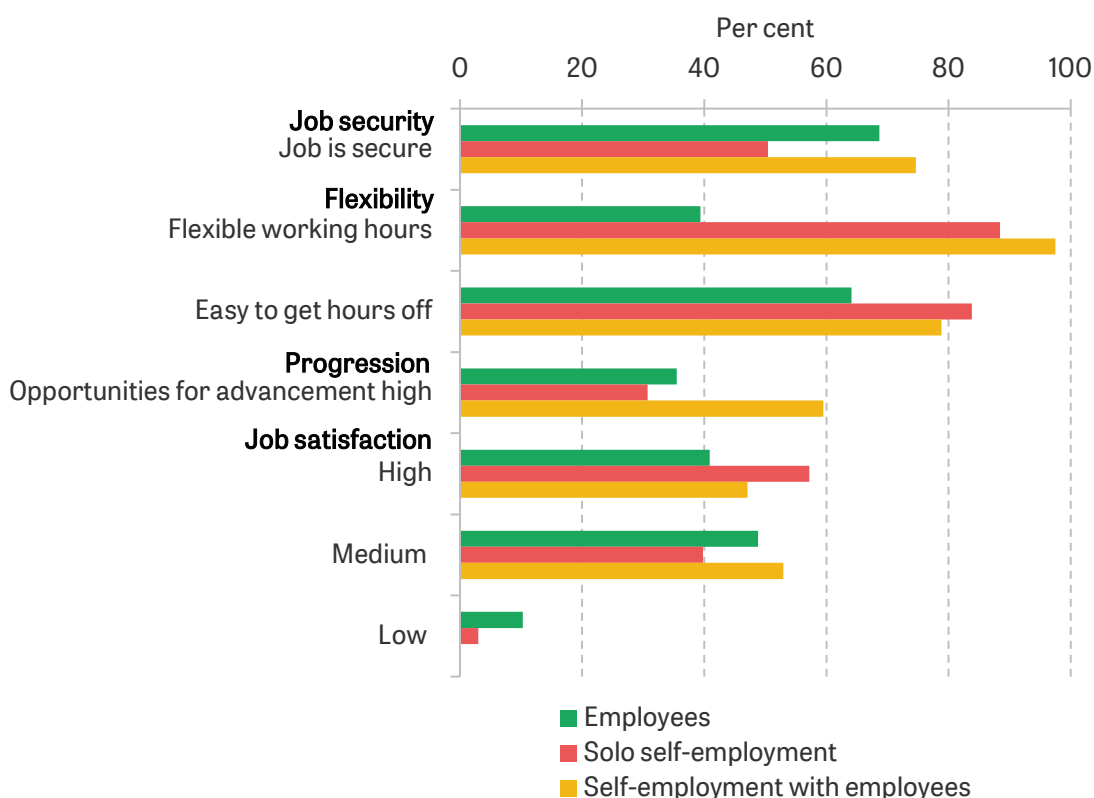
Note: The figure reports answers to a set of questions on job quality by employment type in 2015.

Source: British Social Attitudes Survey.

Results in the top half of the chart epitomise the security–flexibility trade-off that is typically associated with the employee–self-employed dichotomy. In 2015, 70% of employees considered their job secure, while on average only 60% of the self-employed thought that. Interestingly, this average masks substantial heterogeneity between the solo self-employed and those with

employees, with only half of the former and three-quarters of the latter considering their job secure. Conversely, the degree of flexibility offered by self-employment is substantially greater than that enjoyed by employees (90% versus 40% have flexible working hours). Among the solo self-employed, only 30% perceive good opportunities for career advancement, the lowest share across the three groups. Job satisfaction, however, is highest in that group, followed by the self-employed with employees and the employees.

Part II. Modelling trends in wage and earnings inequality in the UK

8.   Empirical models of labour market inequality

This section reviews and updates evidence on the drivers of changes in wage inequality in the UK. It begins by analysing the role played by changes in the supply of and demand for skills in shaping wage inequality, then moves on to consider the role of technological changes, and ends with the phenomenon of job polarisation and its emphasis on task-specific drivers of earnings inequality.

### Supply and demand à la Katz and Murphy (1992)

Rising wage inequality has been accompanied by increasing gaps within and between different groups of workers. The wage premium received by graduates as compared with non-graduates is a between-groups wage differential that has received considerable attention in the literature, especially in early developments of the literature in the early to mid 1990s. Panel A of Figure 19 shows the earnings gap between UK graduates and non-graduates from 1980 to 2019. The premium rises sharply from 1.49 in 1980 to 1.60 by 1990 and remains quite stable until 2010. This is in line with the idea, recognised in various places in the literature, that education has become more highly valued in the labour market and that this is one of the key features of rising earnings inequality. However, in the face of very big increases in the number of graduates, the graduate earnings premium has declined in the 2010s.

In the orthodox supply and demand model, wage inequality increases come about because of an increase in the relative demand for skilled workers. Katz and Murphy (1992) first formalised the issue of changing wage gaps between different workers at different points in the wage distribution in a simple model of relative demand and supply of skills. They specified a production function where output is produced with two labour inputs – skilled and unskilled workers – and where these two sorts of workers are substitutes. The basic logic of their argument is that the relative wage of the two worker types varies with their relative demand and supply. If demand outstrips supply, the relative wage will increase (and it will fall if demand lags behind supply).

A simple way to test this notion empirically is through a time-series model that relates the relative earnings of university-educated versus high-school-educated workers to shifts in the relative demand and supply of skills. We provide more details of how we estimate this type of model in Appendix Section B2. Our estimates for UK data from 1980 to 2019 are reported in Appendix Table B2. As theory predicts, the relationship between the relative supply of skills and relative wages is negative, consistent with the notion that greater supply of skills depresses the skill premium. Most importantly, the results show that, despite the very sharp increase in the relative supply of graduates, there has been an even faster growth in relative demand for graduates. Depending on specification, this effect is of the order of around 1% per year over and above the supply changes. In the sense of Tinbergen (1974) and the original Katz and Murphy (1992) paper

Figure 19. Graduate/Non-graduate weekly earnings differential

Panel A. Graduate earnings differential
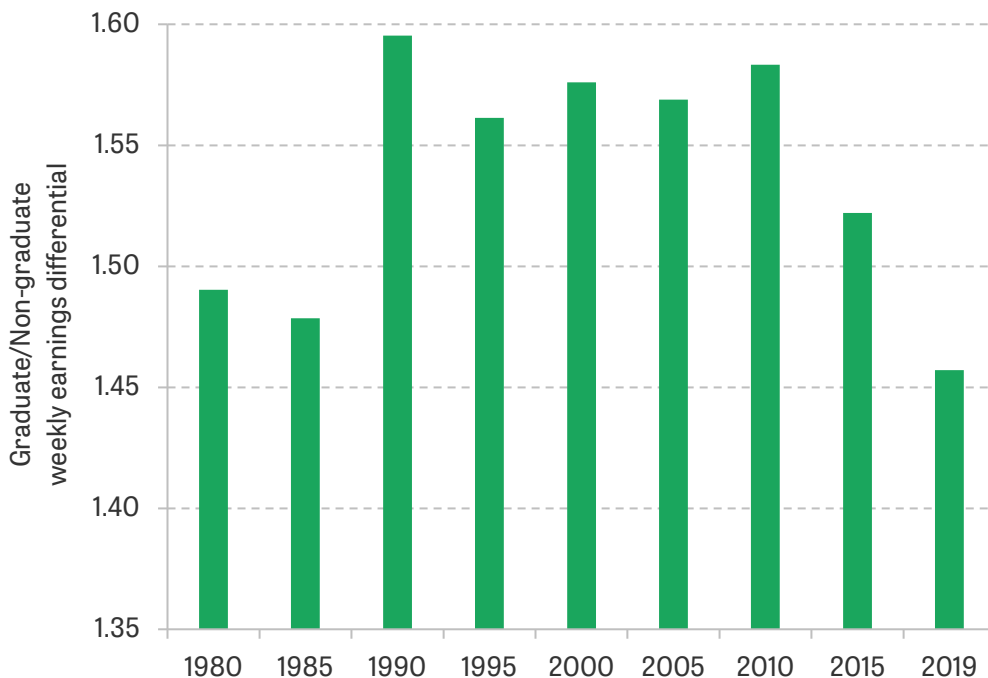
Panel B. Supply of skills and supply-adjusted graduate earnings differential

Legend:
- ■ Graduate/Non-graduate earnings differential
- □ Supply-adjusted graduate earnings differential (left axis)
- --○-- Graduate share
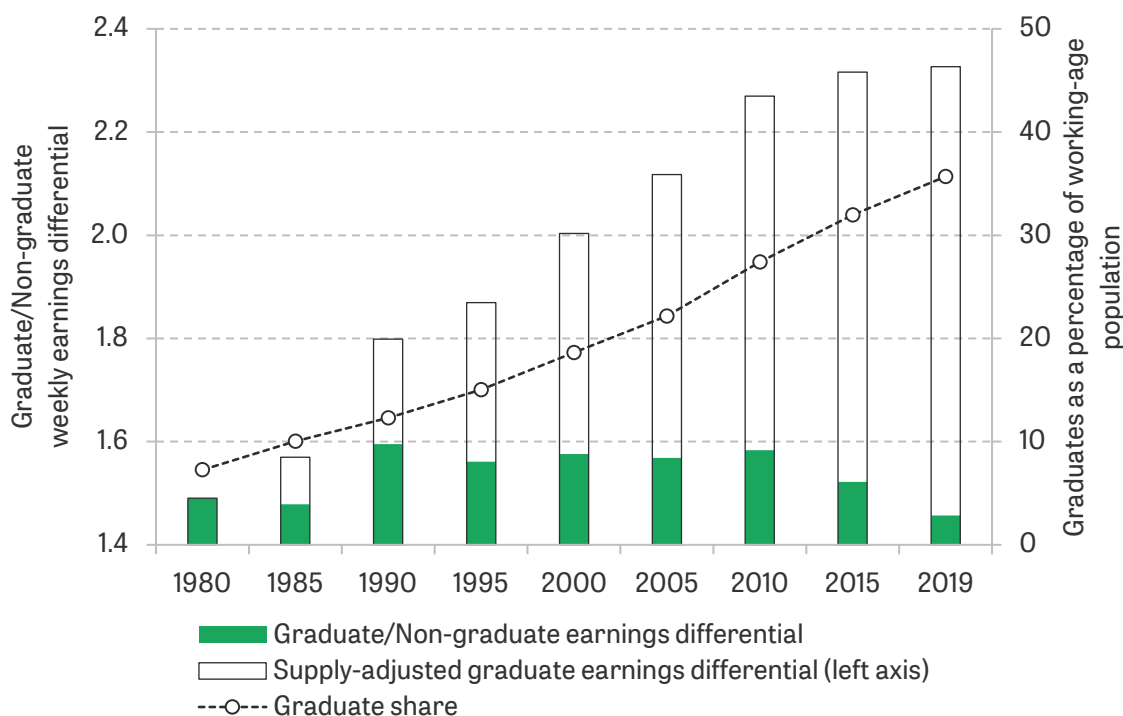
Note: Panel A shows the earnings gap between UK graduates and non-graduates from 1980 to 2019. Panel B reports the graduate earnings premium (as in panel A) on the left-hand axis, and the share of graduates in the working-age population on the right-hand axis. The graph also reports an estimate of how the graduate earnings premium would have evolved absent growth in the supply of skills (left-hand axis). The estimate is based on the coefficient estimates of the time trend in column 2 of Appendix Table B2. The earnings premium is based on full-time weekly earnings.

Source: General Household Survey data between 1980 and 1992; Labour Force Survey data from 1993 to 2019.

using US data, plus the many extensions that have been undertaken since (see Acemoglu and Autor (2011) and the most recent update using US time-series data over 200 years by Autor, Goldin and Katz (2020)), demand has won the race between demand and supply and pushed educational earnings differentials up.

Panel B of Figure 19 provides a visualisation of the race between the demand and supply of skills. The graph reports the graduate earnings premium (in green, as in panel A) and the share of graduates in the working-age population (circles). The graph also reports an estimate of how the graduate earnings premium would have evolved absent the massive growth in the supply of skills. The estimate is based on the estimates in column 2 of Appendix Table B2, where we use the estimated coefficient on the time trend (proxying for the trend-increase in the demand for skills) to predict a supply-adjusted graduate earnings premium.

The canonical model therefore turns out to have some use in a rather descriptive manner for showing how one metric – the between-education-groups earnings differential – has risen because of relative demand shifts skewed in favour of more educated workers. The real question of relevance, however, is what lies behind the observed demand shifts. Like the evolution of the research literature on inequality trends, we turn to this next.

Skill-biased technical change

The first round of research that studied the nature of relative demand shifts that underpin rising earnings inequality honed in on two potential key drivers: technology and trade. Reasonably rapidly, this work reached a conclusion that the former, operating with a skill bias, was more important and that trade with low-wage developing countries (many people's 'first guess') was not empirically very important (at least when stated in the conventional Heckscher–Ohlin way).

Stated in its simplest form, the skill-biased technical change (SBTC) hypothesis says that new technologies lead to higher productivity, but only some (more skilled) workers possess the necessary skills to operate them. Therefore, in response to introducing these kinds of technologies into their workplace, employers raise demand and/or wages for highly skilled workers who are complements with the new technologies. A typical approach adopted to test this notion comes from estimating statistical models that relate the skilled wage bill share (to capture relative demand shifts that occur through rising relative wages and/or relative employment of skilled workers) to observable measures of technical change.

Many studies from many settings reported evidence in line with SBTC, usually using data on workplaces or industries. And, despite not being causal in the modern sense, the approach is still useful to understand whether more technologically advanced workplaces or industries experienced faster skill demand shifts. Appendix Table B3 shows updated evidence for the UK, suggesting that SBTC remains an important phenomenon in the 2000s and 2010s. This new evidence complements a set of earlier studies that used data from periods of fast-rising wage inequality (Machin, 1996; Machin and Van Reenen, 1998).[13]

As time progressed, it became clear that the high skill / low skill distinction emphasised in the SBTC research was limited and less suited to the ways in which the nature of work was evolving. More nuanced extensions arose, especially those emphasising the importance of the task content of jobs done by more and less skilled workers, and how the interaction of skills, tasks and

[13] For more details on the estimated model and results, see Appendix Section B3.

technology impacted wages and employment. The research on job polarisation is central to this, and next we apply this to UK data.

Job polarisation and task-biased technical change

Autor, Levy and Murnane (2003) were the first to recast the SBTC hypothesis, especially the impact of computerisation, in a more nuanced light. They argue that the nature of jobs, and the tasks done by workers in their jobs, are key to thinking about the way in which technological changes impact on the wage distribution. They also argue that technology raises the demand for jobs where non-routine tasks are required of more skilled and educated workers, but it substitutes for jobs with routine tasks done by middle-educated workers (such as manufacturing production or secretarial jobs). Thus routine non-manual tasks may be replaced by computers, whilst some non-routine tasks done by manual workers (such as cleaning) are largely unaffected by ICT. This area of work has become known as task-biased technical change (TBTC). It provides an explanation for the patterns of job polarisation that we document next. Much more research has continued in this vein, including very up-to-date research on the impact of technical change (including artificial intelligence and robotics) and the importance of tasks in influencing wage inequality (e.g. Acemoglu and Restrepo, 2021).

In terms of employment, a feature of rising labour market inequality has been the polarisation of job growth (Goos and Manning, 2007). Panel A of Figure 20 reports the original estimates by Goos and Manning for 1979–99 and our estimates for 1999–2019. Over both periods, there has been very rapid growth over time in the top deciles of job quality (as measured by median occupational hourly wages in 1979 or 1999). Except for some modest growth in the bottom decile in the earlier period, employment has fallen in the lower and intermediate deciles of job quality, showing a hollowing out of the distribution. The J-shaped schedule of employment growth is the dominant feature of panel A, and – as shown in panel B – is a pattern common to both men and women.[14]

Appendix Figure A4 documents the geography of polarisation in the UK.[15] The left-hand panel shows the number of jobs in the bottom six deciles of the national distribution of job quality, as a share of regional employment in 1999. The right-hand panel illustrates the same figures for jobs in the top four deciles of the national distribution. Wales and the North East, followed by the Midlands and Yorkshire and Humber, were the regions with the largest shares of jobs in the bottom deciles of the distribution, in which employment has fallen for the past 20 years. London and the South East have been instead the location of job creation.

Following work by Autor, Salomons and Seegmiller (2021), we document that new work creation has polarised for low-skilled workers and has become more skill intensive (i.e. more J-shaped) for high-skilled workers. Figure 21 shows the 2019 distribution of employment across broad occupations – ranked from left to right from elementary to managerial – distinguishing between job titles that were already present in the 1981 Census and job titles that have been created since then. Panel A refers to workers with a high-school qualification or less and panel B to individuals with at least some university education. In Autor et al.'s jargon, the 'locus' of new work creation has moved to the tails of the occupational distribution, generating a bifurcation in the quality of new work.

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[14] Appendix Table A1 reports the 10 occupations (at three-digit level) with fastest and slowest employment growth over the 1999–2019 period. The types of tasks associated with occupations in the two groups support the notion of TBTC.

[15] The analysis is restricted to employees.

Figure 20. Polarisation

Panel A. All workers, 1979–99 and 1999–2019

■ Goos and Manning (2007), 1979–99   ■ Authors' calculations, 1999–2019
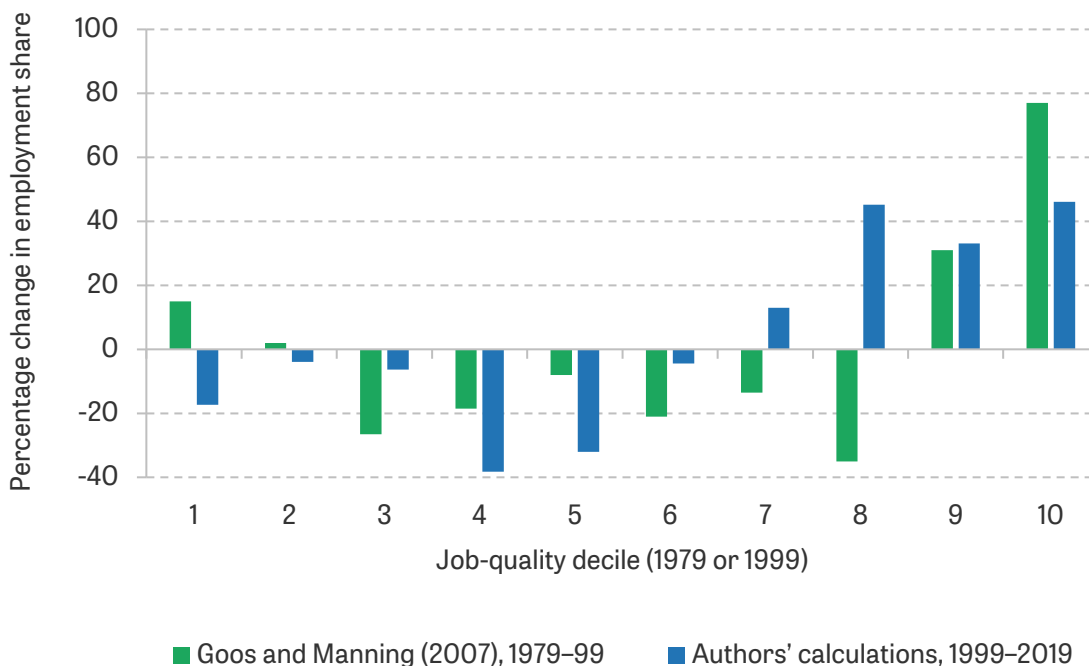
Panel B. By gender, 1999–2019

■ Females, 1999–2019   ■ Males, 1999–2019

Note: The figure reports the percentage change in the employment share by hourly wage decile. Quality deciles are based on base-year median hourly wages by four-digit Standard Occupational Classification (SOC) codes.

Source: Goos and Manning (2007) and Labour Force Survey.

Figure 21. Occupational shares in new and pre-existing work, 2019

Panel A. High school or below
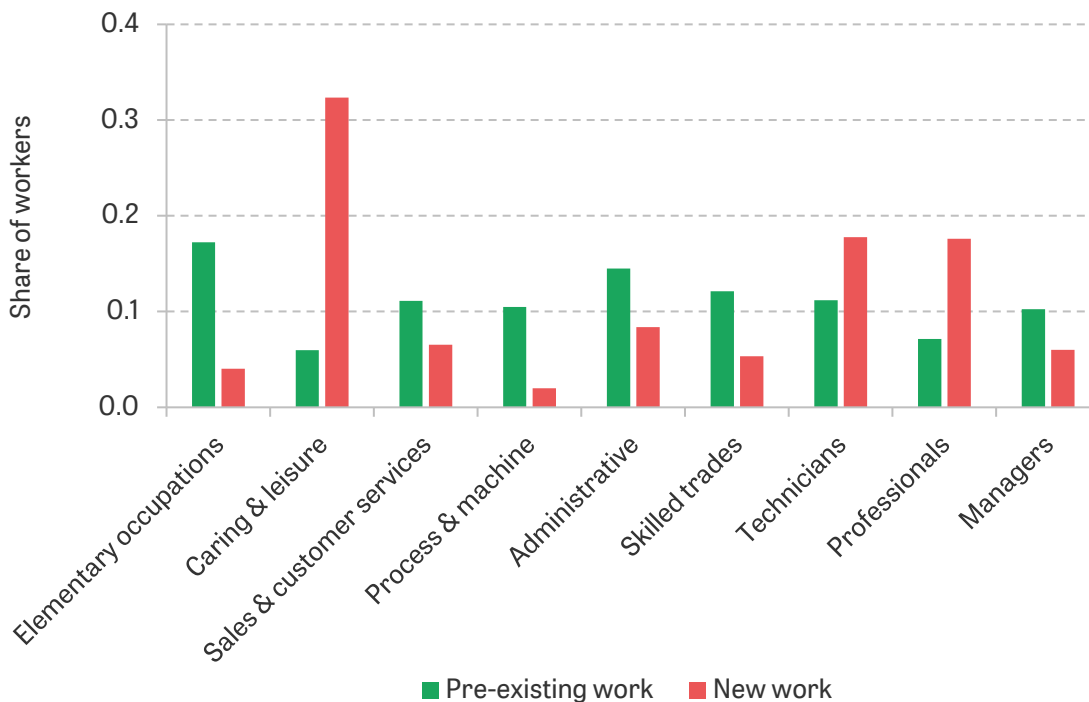
Panel B. Some university or above
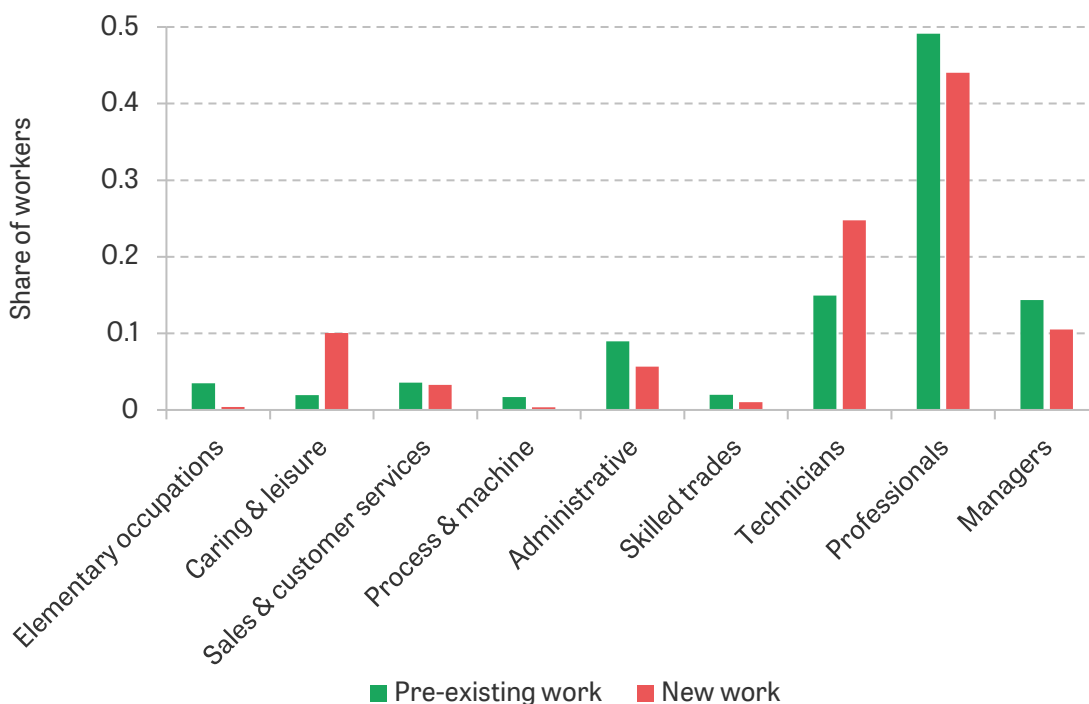
Note: The figure shows the 2019 distribution of employment across broad occupations – ranked from left to right from elementary to managerial – distinguishing between job titles that were already present in the 1981 Census and job titles that have been created since then. Panel A refers to workers with a high-school qualification or less and panel B to individuals with at least some university education.

Source: Labour Force Survey.

The conclusion that emerges for UK earnings inequality from these established approaches is that they are of use in explaining the observed trends. Rising earnings inequality has come about because of relative demand shifts that have been driven by technical change. But this is not the whole story, especially over all four decades since 1980. There are at least two other relevant developments, the first being rising labour market concentration that has weakened the bargaining power of workers – an issue discussed in Manning and Petrongolo (2022) in this Review – and the second being the role played by labour market institutions, in particular unions and minimum wages. We turn to the latter in the next section.

9. Labour market institutions

In this section, we look at how labour market institutions interact with broader economic patterns in affecting labour market inequalities. Our policy focus will be on minimum wages and unions. We will provide evidence on the impact of these two labour market institutions on changes in the wage distribution.
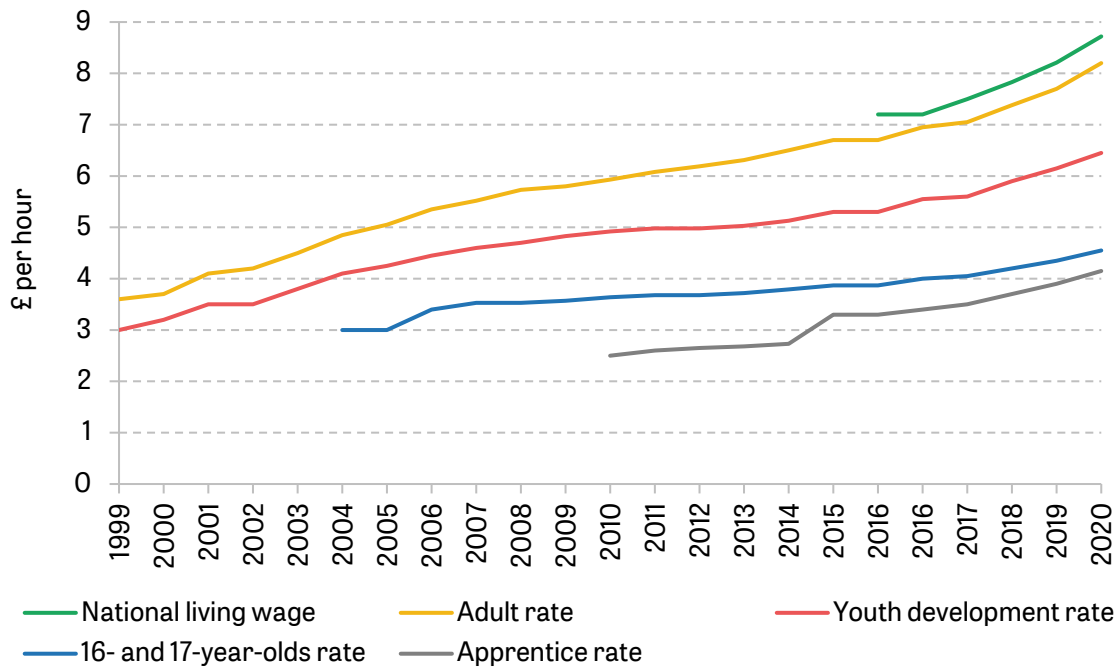
Minimum wages

The National Minimum Wage (NMW) was first introduced in the UK in 1999.[16] At the time, a nationwide, statutory minimum wage did not attract universal support, as the conventional wisdom was that minimum wages would harm employment at the bottom of the wage distribution. However, the stagnant profile of wages at the bottom of the distribution and the dramatic increase in wage inequality that had taken place in the previous 20 years required new policy actions to lift wages at the bottom. Moreover, the pioneering work of Card and Krueger (1995) challenged the belief that minimum wages lead to disemployment.

When first introduced, the NMW had two age-specific rates, one for workers aged 18–21 and one for those aged 22 and over. Since then, the structure of the NMW rates has changed multiple times. At the time of writing, there are five minimum wage rates in place: the National Living Wage (NLW) for those aged 25 and over, the National Minimum Wage (NMW) for those aged 21–24, a youth development rate for those aged 18–20, a youth rate for those aged 16 and 17, and an apprentice rate for all apprentices aged 16–18 and for older apprentices in the first year of their apprenticeship. Figure 22 shows minimum wages from 1999 to 2020.

Figure 23 shows the evolution of the adult minimum wage rate in real terms since the 1999 introduction compared with the percentiles of the real wage distribution we considered in Section 2. It is apparent from the chart that there have been four phases of increases: an initial phase of cautious changes (1999–2001); a second phase of more ambitious developments, where the NMW rose faster than average earnings and inflation (2001–07); a third, more cautious phase in response to the economic challenges of the years following the financial crisis (2008–15); and, finally, a fourth phase in which the NLW introduction has again put the minimum wage on a steeper growth path. The NLW was introduced with the objective of reaching a target of 60% of the median wage by 2020. The target has now been raised to two-thirds of the median wage by 2024. Since its introduction in 1999, the main minimum wage rate has grown faster than prices, average wages and GDP per capita (Low Pay Commission, 2019). It has also grown faster than in other OECD countries, placing the UK among the countries with the highest real minimum wages in recent years (Appendix Figures C1 and C2).

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[16] See Appendix C for an illustration of minimum wage setting practices in the UK and for international comparisons of minimum wage policy.

Figure 22. Minimum wages

Note: The figure shows the evolution of minimum wage rates in the UK from 1999 to 2020.

Source: Low Pay Commission.

Figure 23. Trends in real hourly wages at different percentiles, 1999 to 2019
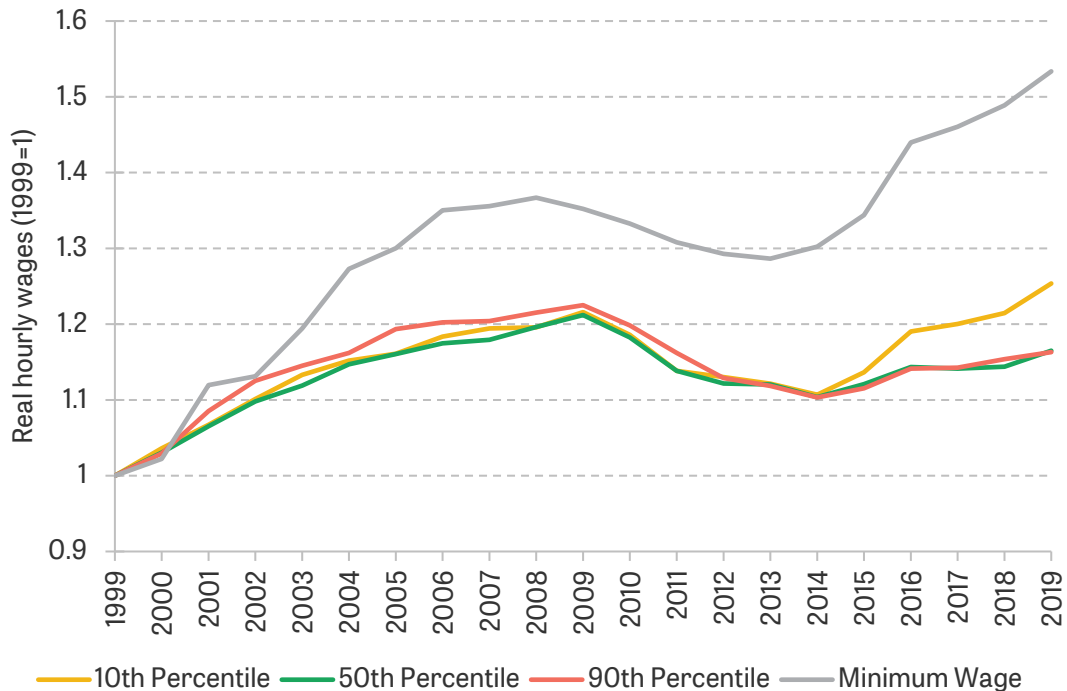
Note: The figure shows the evolution of CPI-deflated hourly wages for full-time workers at different percentiles and at the adult minimum wage relative to 1999.

Source: Annual Survey of Hours & Earnings and Low Pay Commission.

Minimum wage coverage – i.e. the number of jobs paid at the minimum – has more than doubled since its introduction, both in absolute terms and as a fraction of total jobs. At the time of its introduction, the NMW covered 830,000 jobs (3.4% of all jobs); by 2019, coverage had reached 2 million individuals (7% of all workers). The introduction of the NLW in April 2016 has been a major contributor of this expansion, leading to an increase in the number of people paid at their age-specific minimum from 1.5 million in 2015 to 2 million in 2016 (Low Pay Commission, 2019, 2020). In fact, these figures underestimate the number of people who benefit from a minimum wage. It has been widely documented that minimum wages have upward spillover effects – that is, faster wage growth for those earning just above the minimum (Dickens, Manning and Butcher, 2012). Spillover effects arise because employers raise wages of low-pay workers by more than the minimum wage change to maintain wage differentials, attract talent or boost individual productivity. There is also evidence that the NLW introduction generated 'downward' spillover effects, where workers aged under 25 had their wages raised in tandem with those aged 25 and over, in spite of the NLW formally covering only the older workers (Cribb et al., 2021; Giupponi and Machin, 2022).

For 20 years now, low-wage workers have benefited from minimum wage increases. They have experienced consistently higher wage growth than groups higher up the wage distribution, especially since the introduction of the NLW in 2016 (Figure 23). The only exception was the period following the onset of the financial crisis, in which the minimum wage rate increased only modestly with the objective to preserve employment. Ever since though, the bottom decile of real hourly wages has rebounded to pre-crisis levels, while the median and top decile are still lagging below.

To illustrate the importance of minimum wage policy in compressing the bottom of the wage distribution and reducing wage inequality, Figure 24 provides a visual representation of the impact of the minimum wage on the distribution of wages, by applying a semi-parametric approach proposed by DiNardo, Fortin and Lemieux (1996). The left-hand panels plot the hours-weighted kernel estimates of the density of real hourly wages for men (panel A) and women (panel B), in 1998 – i.e. one year prior to the NMW introduction – and 2019. The dashed vertical line indicates the location of the 2019 NLW in real terms. From these figures, there is evidence that the minimum wage compressed the lower tail of the wage distribution, especially for women.

The right-hand panels decompose changes in the distribution of wages due to changes in the composition of employment and changes in minimum wage policy over time. Intuitively, the decomposition is based on counterfactual densities. A first counterfactual density shows what the density of wages in 2019 would have been if no minimum wage had been introduced (MW adjusted series). A second counterfactual asks what the density of wages in 2019 would have been, had the minimum wage not been introduced and had workforce composition stayed at its 1998 level (covariates and MW adjusted series). The charts also report the actual density of wages in 2019 (actual series). The influence of the minimum wage is apparent, especially for women, since there is excess mass below the minimum. Workforce composition has also had an impact, but this appears rather minor compared with the minimum wage policy.

A large body of empirical evidence agrees in showing that these developments did not come at the expense of employment. Negative employment effects of minimum wage legislation have been traditionally elusive to track down, both in the UK (Machin, Manning and Rahman, 2003; Stewart, 2004a, 2004b; Dube, 2019; Cribb et al., 2021) and in the US (Card and Krueger, 1994, 1995; Dube, Lester and Reich, 2010, 2016; Cengiz et al., 2019).

Figure 24. Density of real ln hourly wages in 1998 and 2019, adjusted for the indicated factors (real wages in 2015 pounds)

Panel A. Men
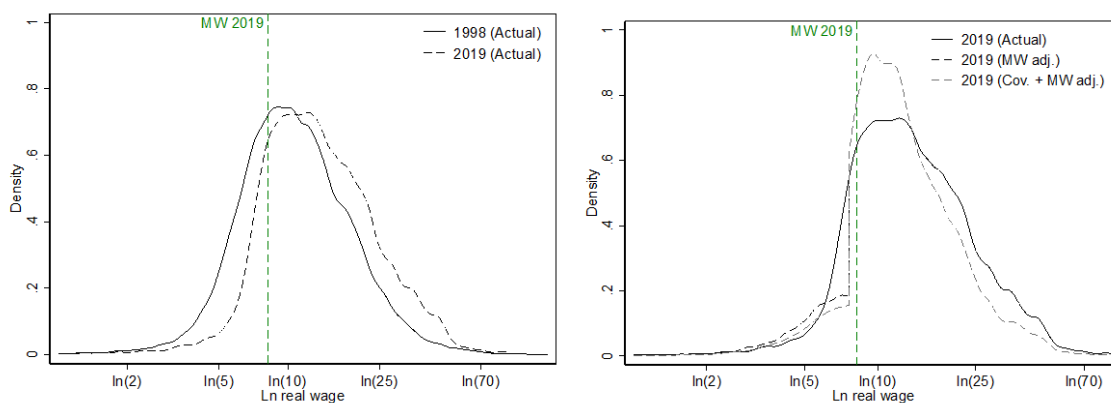
Panel B. Women
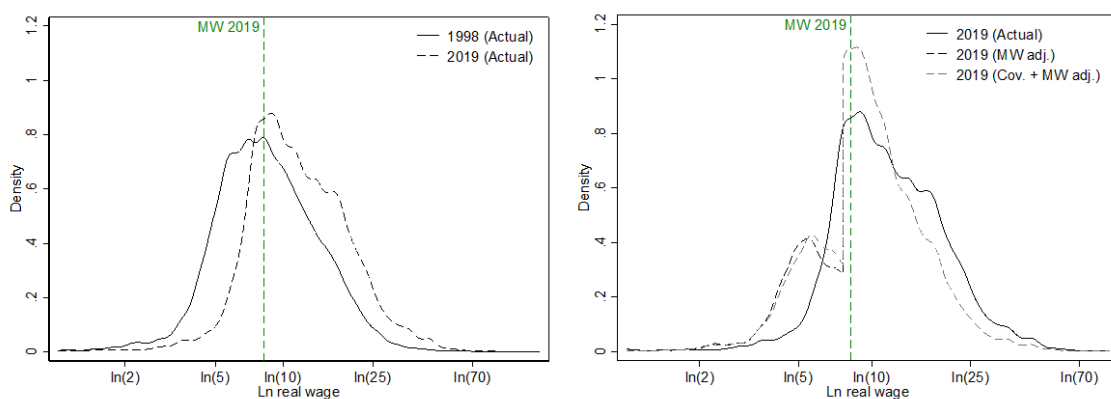
Note: The left-hand panels plot the hours-weighted kernel estimates of the density of real hourly wages for male (panel A, left chart) and female (panel B, left chart) employees, in 1998 and 2019. The dashed vertical line indicates the location of the 2019 NLW in real terms. The right-hand panels decompose changes in the distribution of wages due to changes in the composition of employment and changes in minimum wage policy over time. A first counterfactual density shows what the density of wages in 2019 would have been if no minimum wage had been introduced (MW adjusted series). A second counterfactual shows what the density of wages in 2019 would have been, had the minimum wage not been introduced and had workforce composition stayed at its 1998 level (covariates and MW adjusted series). The charts also report the actual density of wages in 2019 (actual series). Covariate adjustment is based on age (cubic), university education, marital status, ethnicity (white versus non-white), working full time, working in the public versus private sector, occupation, industry and region of work.

Source: Labour Force Survey.

Unions

The fraction of trade union members in the UK has fallen precipitously in the last four decades. Union membership rates have decreased across the board from the early 1980s to 2019. As Table 1 reports, while 51% of employees were union members in 1983, only 24% were in 2019. The drop has occurred for both men and women, across age groups, and in both the private and public sectors. The latter remains substantially unionised, with 51% of public employees being union members in 2019. Female employees in the public sector are the group that has experienced the mildest drop in unionisation (from 69% in 1983 to 54% in 2019). Failure of unions to organise workers in new establishments has been the principal cause of such rapid union decline (Machin, 2000).

Table 1. Union membership rates by gender in 1983 and 2019

		All		Men		Women	
		1983	2019	1983	2019	1983	2019
All		0.51	0.24	0.58	0.20	0.43	0.28
By age:	Under 30	0.42	0.13	0.45	0.12	0.38	0.14
	30+	0.55	0.28	0.63	0.23	0.45	0.32
By sector:	Private	0.36	0.14	0.42	0.14	0.26	0.13
	Public	0.78	0.51	0.85	0.46	0.69	0.54

Note: The table reports union membership rates among employees, by age, sector and gender.

Source: General Household Survey and Labour Force Survey.

Whilst the scale of decline is big, the UK is not unique in having a massive fall in union presence. Figure 25 reports union density across OECD countries in 1980 and 2018. In all cases but Spain – which nonetheless had very low rates of union membership to start with – union density has declined. Together with Australia and Ireland, the UK is among the countries in which the rate of unionisation dropped the most. Nordic countries, despite also experiencing drops – albeit mild – in union density, still have membership rates above 50%.

Figure 25. Union density in OECD countries, 1980 and 2018
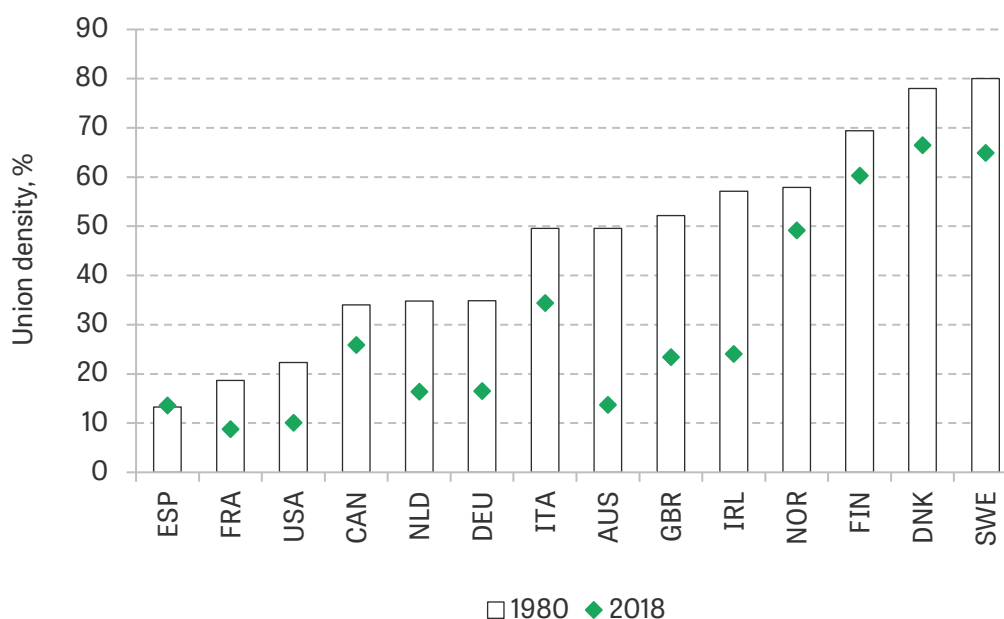
Note: The figure shows union density across OECD countries in 1980 and 2018.

Source: OECD.

There is a large research literature on the union/non-union wage differential, which has consistently found that union membership is associated with a positive wage premium. This premium often benefits workers who, whilst not members of a trade union, are employed under contracts covered by collective bargaining agreements. In their review, Freeman and Medoff (1984) consistently found a 10–20% wage markup from union membership in many studies of the

US setting. For the UK, Booth (1995) estimates an average differential of 8%. Unions tend to reduce firm profitability (yet with no detrimental consequences on firm survival) and the within-firm or within-establishment variance of wages. Hence the profit reduction ends up being disproportionately allocated to workers at the top of the wage hierarchy, leading to an overall reduction in wage inequality.

The weakening of trade unions – and consequent deterioration of protection for low-wage workers – is considered a factor in the rise of wage inequality. A large negative time-series correlation between the 90:10 log weekly wage gap and union density has been found for the UK (Machin, 2010), revealing a strong macro association between rising inequality and falling unionisation. Similar empirical associations – though not causal – have been documented both over time, and between and within countries.

US work pioneered by Freeman (1980, 1982) and DiNardo, Fortin and Lemieux (1996), which was further developed by Card (2001) to deal with selection into union jobs, presents decompositions of how much of rising wage inequality can be attributed to union decline (see also similarly motivated UK work from Gosling and Machin (1995), Machin (1997) and Bell and Pitt (1998)). These studies look at data sources ending at the latest in the mid 1990s, and tend to conclude that a reasonably sizeable part of the rise in male wage inequality up to then can be attributed to union decline – of the order of 25% for the US, which is dampened somewhat when the Card (2001) selection approach is adopted, and about 20% of rising UK male wage inequality. For women in the same period, there is no discernible effect.

We have revisited this in the UK over a longer period, from 1983 to 2019, to quantify the equalising effect of trade unions on weekly earnings among men and women over the past four decades (see also a longer time window exercise for Canada and the US in Card, Lemieux and Riddell (2020)). Table 2 reports – separately for men and women, and for the years 1983 and 2019 – the union membership rate, the variance of log weekly earnings (both in total and separately for union and non-union workers) and the union earnings gap. It also reports a set of estimates for the effect of unions on the change in the earnings variance. The basic decomposition is the 'naïve' union decomposition of Freeman (1980, 1982), the quintile variations additionally allow for selection into union jobs, where quintiles are allocated for all workers from predicted non-union weekly earnings (as in Card (2001)) and the composition adjustment controls for age, education and ethnicity. The sample covers full-time, private sector employees.

Among men, the variance of log weekly earnings has increased by 0.146 over the past four decades, from 0.228 in 1983 to 0.374 in 2019. The decline in unionism is found to account for approximately a third of this increase (0.045). This can be attributed almost entirely to the within-sector effect, that is the drop in union density (from 43% to 16%) combined with a weakening of the earnings compression effect of unions. For women, there is essentially no effect, with union decline accounting for only 4% of the increase in female earnings inequality in the simple decomposition and for zero once selection is accounted for. Thus union decline is a factor in rising earnings inequality over the past 40 years, but one which varies across gender groups (not surprisingly given the history of who was more likely to be in a union in the past).

Table 2. Estimates of the contribution of unions to rising earnings inequality, 1983 to 2019

	1983	2019	Change
Men			
Union membership	0.428	0.156	−0.231
Variance, all	0.228	0.374	0.146
Variance, union	0.138	0.273	0.135
Variance, non-union	0.290	0.391	0.101
Union earnings differential	0.115	0.056	0.059
Union effects:			
Basic decomposition	−0.062 (27%)	−0.017 (5%)	0.045 (31%)
Quintile variations	−0.056 (25%)	−0.018 (5%)	0.038 (26%)
Quintile variations, composition adjusted	−0.044 (19%)	−0.019 (5%)	0.025 (17%)
Women			
Union membership	0.340	0.130	−0.210
Variance, all	0.169	0.353	0.183
Variance, union	0.118	0.289	0.171
Variance, non-union	0.185	0.362	0.177
Union earnings differential	0.175	−0.010	−0.185
Union effects:			
Basic decomposition	−0.016 (9%)	−0.009 (3%)	0.007 (4%)
Quintile variations	−0.013 (8%)	−0.011 (3%)	0.002 (1%)
Quintile variations, composition adjusted	−0.012 (7%)	−0.010 (3%)	0.002 (1%)

Note: Based on General Household Survey in 1983 and Labour Force Survey in 2019. The sample covers full-time private sector workers. The basic decomposition is the 'naïve' union decomposition of Freeman (1980, 1982), the quintile variations additionally allow for selection into union jobs, where quintiles are allocated for all workers from predicted non-union earnings (as in Card (2001)) and the composition adjustment controls for age, education and ethnicity.

Source: General Household Survey and Labour Force Survey.

International typology of labour market institutions

Figure 26 offers an international characterisation of the evolution of labour market institutions in 1980 (panel A) and 2019 (panel B). The UK moves from the north-west quadrant of high union coverage / low minimum wages to the south-east quadrant of low union coverage / high minimum wages over these years. The figure makes it clear that labour market institutions have shifted big time in some places – the UK being a very clear example – and much less in others. But both western quadrants almost disappear by 2019, with only the US appearing in that year in the south-west segment of low unionisation and minimum wages.

Figure 26. Collective bargaining coverage and minimum wage

Panel A. 1980
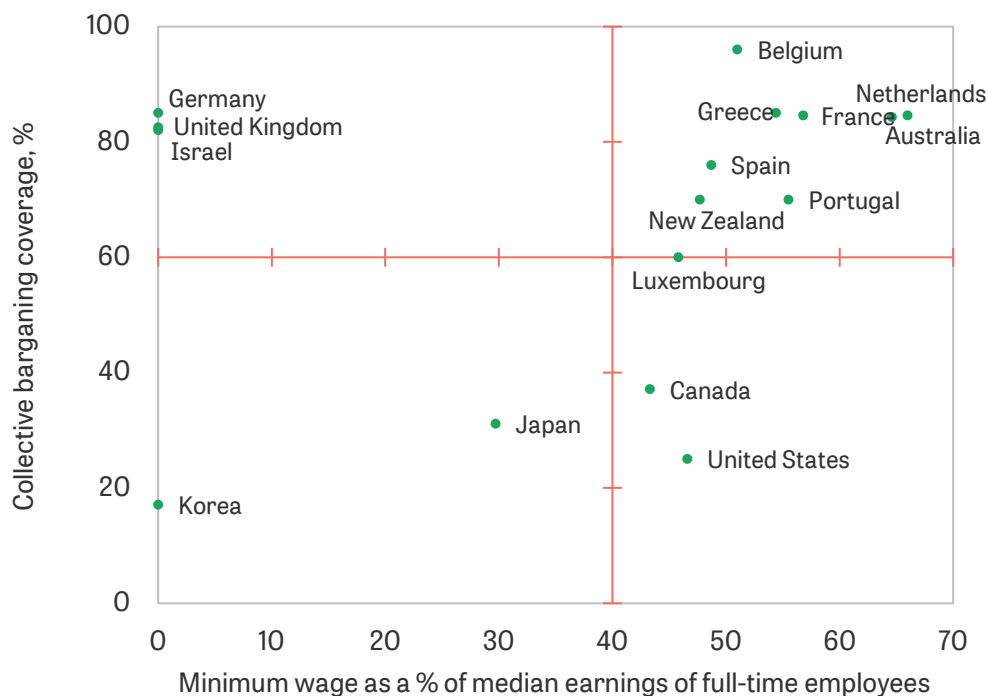
Panel B. 2019

Note: The figure shows the correlation between collective bargaining coverage and the minimum wage as a percentage of median earnings of full-time employees across OECD countries in 1980 and 2019. Countries that did not have a minimum wage in place in 1980 are reported in panel A as having a minimum as a percentage of the median equal to zero (Germany, Israel, Korea and the UK).

Source: OECD.

Part III. Policy aspects of labour market change and implications

This final part of the chapter discusses some policy aspects of the labour market change that was documented in the previous two parts and discusses their implications. First it discusses labour market institutions and contract issues that arise from the rise of alternative work arrangements. It concludes with a discussion of policy challenges to reinvigorating inclusive real wage growth and ensuring the provision of decent work.

10.   Labour market institutions

Minimum wages

Since its introduction in 1999, the National Minimum Wage has been considered a successful policy initiative that boosted wages of low-wage workers and reduced wage inequality, driven by shifts in the bottom half of the wage distribution, without having detrimental effects on employment. Earlier it was shown that, in the period of real wage stagnation that has recently characterised the UK labour market, workers paid the minimum wage experienced better wage growth than most workers. This is why the minimum wage reduced wage inequality.

But there are issues with an increased reliance on minimum wages as a policy lever to keep wages up. As minimum wage rates have kept rising, the minimum wage has become the established rate in a number of low-wage sectors of the economy, as more and more workers have become paid at the minimum wage and the bite of the minimum wage is high. Moreover, firms seem to have cut back on pay scales above the minimum wage, which has implications for wage and career progression of workers paid at the minimum wage. Another relevant dimension for policy is the extent to which relatively high levels of the minimum wage – as appear to be the case currently in the UK – may induce firms to substitute towards flexible contractual arrangements, outsourcing and contracting. For example, recent work by Datta, Giupponi and Machin (2019) has shown that the National Living Wage introduction has been partly responsible for the increased utilisation of zero-hours contracts in the UK adult social care sector.

Bargaining

As time has progressed, the minimum wage has become one of the only levers that ensures wage growth higher than inflation. Evidence was presented in Part II that the UK has moved from a high-unionisation/low-minimum-wage economy to a low-unionisation/high-minimum-wage country, which has had the net effect of generating the wage growth patterns driven by an increased reliance on the minimum wage. Whilst that has done its job at the lower end of the labour market, union decline and reduced worker power mean that higher-wage workers have not done so well. Hence the falls in wage inequality that have occurred since the global financial crisis, but with most workers not earning more than they did before real wage growth slowed and stagnated.

Beyond unionisation, there is evidence that worker power has declined through time. The big literature on the decline in the labour share and the decoupling of wage growth from productivity growth is consistent with this (see the Review evidence from De Loecker, Obermeier and Van Reenen (2022)). Moreover, there is UK evidence of falling rent-sharing over time – see Bell, Bukowski and Machin (2018). And on labour market concentration conferring more power on employers in wage determination, see the Review piece by Manning and Petrongolo (2022). The

extent to which these patterns have caused the real wage growth slowdown is important for evaluating if, how and to what extent real wage growth can be invigorated in future.

11.   Regulation of contract types

The nature of alternative work arrangements

The drivers and implications of the changing world of work have been at the centre of the policy debate. Evidence from both sides of the Atlantic shows that alternative work arrangements are often associated with low and insecure pay (Boeri et al., 2020; Mas and Pallais, 2020). Being mostly outside the scope of regulation applying to traditional employment contracts, alternative work arrangements are usually not covered by certain employment rights, such as holiday pay, unfair dismissal protection, minimum wage regulation and social insurance provision (e.g. unemployment insurance, health insurance, retirement benefits, paid sick leave and paid family leave). At the same time, such work arrangements can in principle offer other non-pecuniary benefits, such as work and location flexibility, autonomy, and more generous tax treatment.

The dual nature of alternative work arrangements points to two potential drivers of their growth in recent years: on the one hand, a labour supply explanation, according to which workers' preferences have changed so that workers are willing to trade in pay and security for flexibility and autonomy; and on the other hand, a labour demand explanation, whereby weak labour demand conditions have pushed workers into more precarious, lower-paid and less-protected contract types. Part of this second explanation is also the distorted incentives generated by employment and tax regulations, which encourage firms to hide de facto dependent employment positions under self-employment conditions. Which of these two competing explanations is more relevant has different implications for workers' welfare.

The flexibility versus insecurity trade-off has been looked at in some studies that have tried to estimate workers' preferences over non-pecuniary job attributes. Mas and Pallais (2017) elicit individuals' willingness to pay for a more flexible job using a sample of US employees. They find the majority of workers do not value workplace flexibility and have a strong distaste for irregular and short-noticed scheduling. Only a small proportion have a high willingness to pay for flexibility. Datta (2019) studies preferences over a range of job attributes that are usually considered as distinguishing factors of traditional employment and self-employment jobs, such as job security, holiday and sick pay, hours and location flexibility, workplace autonomy, and tax treatment. His results suggest that the majority of workers prefer the attributes of traditional employment relationships – a result that holds even among those in alternative work arrangements. Overall, these results do not support the hypothesis that the rise of alternative work arrangements is the result of a shift in workers' preferences.

This said, flexibility can be especially valuable in that it offers a self-insurance mechanism in response to income shocks by providing short-term and flexible employment opportunities. Recent work documents the consumption smoothing role of gig-economy work. Koustas (2018) examines rideshare work in the US economy, showing that, in the period after starting ridesharing, rideshare income replaces 73% of income losses from main payroll jobs. Cribb and Xu (2020) also document the self-insurance role of solo self-employment against income shocks in the UK context. However, data from the US show that the additional short-run insurance value of gig-economy work comes at the expense of less attachment to traditional work in the long run (Jackson, 2019). Short-term work in the gig economy is found to delay re-entrance into traditional employment, with negative consequences for long-run earnings. The discussion above for

employees about career opportunity concerns is highly relevant for these groups as well, especially regarding wage progression, promotion prospects, career advancement and having a sense of belonging at work.

Taxes and social insurance

Employment and tax policies are likely to have had an important role in the large increase in the incidence of alternative work arrangements. The long-run trends in solo self-employment that we have seen for the UK have been attributed in large part to the incentives generated by the tax system (Adam, Miller and Pope, 2017). The more favourable tax treatment of the self-employed relative to employees provides a strong incentive to operate through a business structure. It also distorts firms' incentives to hire under traditional employment contracts, incentivising the creation of 'bogus' self-employment. Minimum wage and employment protection legislation can also generate incentives for employers to alter the contractual composition of the workforce towards more flexible or independent forms of work.

In most countries with a formalised welfare state, those in employment are covered by a range of employment rights including minimum wages, statutory holiday and sick pay, and parental leave. The self-employed are not eligible for these non-wage benefits, and this is sometimes put forward as a justification for their differential tax treatment. The rise of solo self-employed jobs, and in that group gig work, makes the issue of social insurance an even more difficult question as there has become an even hazier distinction of who is or is not an employee to be eligible for social protection. The 2017 UK Taylor Review of Modern Working Practices very much emphasised this, especially in the context of gig workers (Taylor et al., 2017). And it has been seen in high-profile court cases, in the UK for example with currently self-employed individuals legally challenging companies such as Uber and Pimlico Plumbers on their classification of them as self-employed independent contractors, rather than as employees. Similar cases have been brought to court by Foodora riders in Italy, Take Eat Easy delivery people in France and Dynamex delivery drivers in California.

A key input into the debate around social insurance provision for the self-employed is the extent to which the self-employed demand it. Though scant, the existing survey and experimental evidence suggests that self-employed workers highly value government support. Boeri et al. (2020) document strong preferences for social protection among the self-employed in the UK, the US and Italy. Using a hypothetical valuation method, Blundell and Machin (2020) show that self-employed workers would be prepared to sacrifice 10% of their income to be assured income support in the face of future pandemics and other economic shocks. Over three-quarters would be prepared to sacrifice 2% of their pre-tax income in order to receive such support.

Designing social insurance for the self-employed is challenging. A first question is who should pay the equivalent of employer contributions. If the self-employed person has a single client, then the latter could be made liable for contributions, but with multiple clients it is not obvious how to share this burden. One option is to use platforms to coordinate employers, such as in Italy. However, when demand is elastic, these costs will be transferred onto the self-employed worker, in terms of lower compensation for their services. Setting compensation floors for services provided, especially in the case of a single client, can partly overcome this limitation. A second option is to place the contributory burden entirely on the self-employed. Though potentially administratively simpler, liquidity constraints and income volatility might make this option less viable. Moreover, to the extent that one of the reasons those jobs exist is to avoid paying contributions, this option may end up making the jobs themselves not viable. Finally, paying social

security contributions out of general government revenues may raise issues of fairness vis-à-vis other categories of workers.

12.   Policy challenges looking forward

Rising wage inequality, the stagnation of real wages and the changing nature of work all have implications, with associated policy relevance, for the future labour market. There are a number of relevant, pressing questions that are discussed in this concluding section. Broadly these can be lumped into two key sets of arguments which we briefly outline, the first about trying to leverage inclusive real wage growth and the second about securing decent and fair employment.

Inclusive real wage growth

In practice, government has few direct policy levers it can use to deliver wage growth to workers. This limited scope has been magnified by the relatively weak productivity performance of the UK economy in the recent past (the reasons for which are covered in detail in De Loecker, Obermeier and Van Reenen (2022) in this Review). Hence it is not surprising the one driver that government has been able to effectively look to – the minimum wage – has been the key driver of the reduction in wage inequality that has occurred in the lower part of the wage distribution since minimum wage introduction in 1999. This minimum-wage-induced compression has become even more marked in the period of real wage stagnation described in this chapter. And the minimum wage has been introduced without having detrimental effects on employment.

But what can be done about the workers who have fared less well in the 2010s, as there was very weak real wage growth experienced by workers paid above the minimum wage? Is there a role for bargaining? Would that be through collective bargaining, or through routes other than traditional union ones? In particular, is there a means of sharing rents more fairly? What are the means to generate better income growth for the self-employed? This is especially applicable to the solo self-employed who are not covered by minimum wages and who did badly in terms of income generation in the 2010s and whose incomes and work prospects took a huge hit under the COVID-19-induced downturn since 2019. These are all areas that require significant attention if the recent episodes of falling or stagnant real wages – and negative implications for living standards – are to be circumvented in future.

Decent and fair work

The changing composition of work that was documented earlier also offers significant challenges, if the aim is to ensure decent and fair work in future (see Rodrik and Stantcheva (2021) for an up-to-date discussion and strategy offering on the question of good jobs). The work landscape has dramatically changed in the past 40 years in the UK and across the world. Traditional work patterns have become less delineated in the face of big compositional shifts in who works and the definition and structure of modern jobs. One face of rising inequality has been a surge of highly paid jobs with good career structures and work security alongside more less-good jobs without career prospects and with greater insecurity and uncertainty and less worker rights.

Not least a key feature of these increased inequalities of career opportunities has been the new informality of work, heavily trumpeted in the case of the gig economy, but also an important aspect in the upsurge of solo self-employment. Evidence from both sides of the Atlantic shows that alternative work arrangements are often associated with low and insecure pay. Being mostly outside the scope of regulation applying to traditional employment contracts, alternative work

arrangements are usually not covered by certain employment rights, such as holiday pay, unfair dismissal protection, minimum wage regulation and social insurance provision (e.g. unemployment insurance, health insurance, retirement benefits, paid sick leave and paid family leave). At the same time, such work arrangements can in principle offer other non-pecuniary benefits, such as work and location flexibility, autonomy, and more generous tax treatment.

The increased haziness of defining what are employment and self-employment – with a growing hinterland between the two – raises policy questions on contracts and on social insurance. They are not straightforward, but are central to the aim of improving the world of work in an inclusive way. Employment contracts are muddied by the historical differences in the tax treatment of the self-employed, an area that requires policy attention and better clarity. The same is true of the complex issue of whether social insurance can be provided to the self-employed.

Adding to this the challenges of automation and globalisation (and indeed deglobalisation in the case of the UK through Brexit) makes the aim of securing decent and fair work vital for economic and social inclusion. Provision of good and fair wages, guarantees of social insurance and secure work with proper career opportunities need to be central planks of this aim to ensure the costs and negative consequences of increased inequality seen in the past 40 years are halted and do not continue to the future.

References

Abraham, K. G., Haltiwanger, J. C., Sandusky, K., and Spletzer, J. R. (2021), 'Measuring the Gig Economy: Current Knowledge and Open Issues', in C. Corrado, J. Haskel, J. Miranda and D. Sichel (eds), *Measuring and Accounting for Innovation in the 21st Century*, University of Chicago Press.

Acemoglu, D., and Autor, D. (2011), 'Skills, Tasks and Technologies: Implications for Employment and Earnings', in O. Ashenfelter and D. Card (eds), *Handbook of Labor Economics*, 4b.

Acemoglu, D., and Restrepo, P. (2021), 'Tasks, Automation, and the Rise in US Wage Inequality', National Bureau of Economic Research (NBER), Working Paper 28920.

Adam, S., Miller, H., and Pope, T. (2017), 'Tax, Legal Form and the Gig Economy', in C. Emmerson, P. Johnson and R. Joyce (eds), *The IFS Green Budget: February 2017*, Institute for Fiscal Studies.

Andrew, A., Bandiera, O., Costa-Dias, M., and Landais, C. (2021), 'Women and Men at Work', IFS Deaton Review of Inequalities, Institute for Fiscal Studies.

Autor, D., Goldin, C., and Katz, L. F. (2020), 'Extending the Race between Education and Technology', *AEA Papers and Proceedings*, 110, 347–51.

Autor, D. H., Levy, F., and Murnane, R. J. (2003), 'The Skill Content of Recent Technological Change: An Empirical Exploration', *Quarterly Journal of Economics*, 118(4), 1279–333.

Autor, D., Salomons, A., and Seegmiller, B. (2021), 'New Frontiers: The Origins and Content of New Work, 1940–2018', Working Paper.

Bell, B., Bukowski, P., and Machin, S. (2018), 'Rent Sharing and Inclusive Growth', Centre for Economic Performance (CEP), Discussion Paper 1584.

Bell, B. D., and Pitt, M. K. (1998), 'Trade Union Decline and the Distribution of Wages in the UK: Evidence from Kernel Density Estimation', *Oxford Bulletin of Economics and Statistics*, 60(4), 509–28.

Bell, D. N. F., and Blanchflower, D. G. (2021), 'Underemployment in the United States and Europe', *Industrial and Labor Relations Review*, 74(1), 56–94.

Berman, E., Bound, J., and Griliches, Z. (1994), 'Changes in the Demand for Skilled Labor within US Manufacturing: Evidence from the Annual Survey of Manufactures', *Quarterly Journal of Economics*, 109(2), 367–97.

Blundell, J. (2020), 'Clusters in UK Self-Employment', Centre for Economic Performance (CEP), Occasional Paper 48.

Blundell, J., and Machin, S. (2020), 'Self-Employment in the Covid-19 Crisis', Centre for Economic Performance (CEP), Covid-19 Paper 3.

Blundell, R., Joyce, R., Norris Keiller, A., and Ziliak, J. P. (2018), 'Income Inequality and the Labour Market in Britain and the US', *Journal of Public Economics*, 162, 48–62.

Boeri, T., Giupponi, G., Krueger, A. B., and Machin, S. (2020), 'Solo Self-Employment and Alternative Work Arrangements: A Cross-Country Perspective on the Changing Composition of Jobs', *Journal of Economic Perspectives*, 34(1), 170–95.

Booth, A. L. (1995), *The Economics of the Trade Union*, Cambridge University Press.

Card, D. (2001), 'The Effect of Unions on Wage Inequality in the U.S. Labor Market', *Industrial and Labor Relations Review*, 54(2), 296–315.

Card, D., and Krueger, A. B. (1994), 'Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania', *American Economic Review*, 84(4), 772–93.

Card, D., and Krueger, A. B. (1995), 'Myth and Measurement: The New Economics of the Minimum Wage', Princeton University Press.

Card, D., Lemieux, T., and Riddell, W. C. (2020), 'Unions and Wage Inequality: The Roles of Gender, Skill and Public Sector Employment', *Canadian Journal of Economics*, 53(1), 140–73.

Cengiz, D., Dube, A., Lindner, A., and Zipperer, B. (2019), 'The Effect of Minimum Wages on Low-Wage Jobs', *Quarterly Journal of Economics*, 134(3), 1405–54.

Chartered Institute of Personnel and Development (2020), 'FTSE 100 CEO Pay in 2019 and during the Pandemic', CIPD.

Cribb, J., Giupponi, G., Joyce, R., Lindner, A., Waters, T., Wernham, T., and Xu, X. (2021), 'The Distributional and Employment Impacts of Nationwide Minimum Wage Changes', Institute for Fiscal Studies (IFS), Working Paper 21/48.

Cribb, J., Joyce, R., and Wernham, T. (2022), 'Twenty-Five Years of Income Inequality in Britain: The Role of Wages, Household Earnings and Redistribution', IFS Deaton Review of Inequalities, Institute for Fiscal Studies.

Cribb, J., Miller, H., and Pope, T. (2019), 'Who Are Business Owners and What Are They Doing?', Institute for Fiscal Studies (IFS), Report 158.

Cribb, J., and Xu, X. (2020), 'Going Solo: How Starting Solo Self-Employment Affects Incomes and Well-Being', Institute for Fiscal Studies (IFS), Working Paper 20/23.

Datta, N. (2019), 'Willing to Pay for Security: A Discrete Choice Experiment to Analyse Labour Supply Preferences', Centre for Economic Performance (CEP), Discussion Paper 1632.

Datta, N., Giupponi, G., and Machin, S. (2019), 'Zero-Hours Contracts and Labour Market Policy', *Economic Policy*, 34(99), 369–427.

De Loecker, J., Obermeier, T., and Van Reenen, J. (2022), 'Firms and Inequality', IFS Deaton Review of Inequalities, Institute for Fiscal Studies.

Dickens, R., Manning, A., and Butcher, T. (2012), 'Minimum Wages and Wage Inequality: Some Theory and an Application to the UK', Centre for Economic Performance (CEP), Discussion Paper 1177.

DiNardo, J., Fortin, N. M., and Lemieux, T. (1996), 'Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach', *Econometrica*, 64(5), 1001–44.

Dube, A. (2019), 'Minimum Wages and the Distribution of Family Incomes', *American Economic Journal: Applied Economics*, 11(4), 268–304.

Dube, A., Lester, T. W., and Reich, M. (2010), 'Minimum Wage Effects across State Borders: Estimates Using Contiguous Counties', *Review of Economics and Statistics*, 92(4), 945–64.

Dube, A., Lester, T. W., and Reich, M. (2016), 'Minimum Wage Shocks, Employment Flows, and Labor Market Frictions', *Journal of Labor Economics*, 34(3), 663–704.

Freeman, R. B. (1980), 'Unionism and the Dispersion of Wages', *Industrial and Labor Relations Review*, 34(1), 3–23.

Freeman, R. B. (1982), 'Union Wage Practices and Wage Dispersion within Establishments', *Industrial and Labor Relations Review*, 36(1), 3–21.

Freeman, R. B., and Medoff, J. L. (1984), *What Do Unions Do?*, Basic Books.

Giupponi, G., and Machin, S. (2022), 'Minimum Wages and the Wage Policy of Firms', Working Paper.

Giupponi, G., and Xu, X. (2020), 'What Does the Rise of Self-Employment Tell Us about the UK Labour Market?', IFS Deaton Review of Inequalities, Briefing Note.

Goos, M., and Manning, A. (2007), 'Lousy and Lovely Jobs: The Rising Polarization of Work in Britain', *Review of Economics and Statistics*, 89(1), 118–33.

Gosling, A., and Machin, S. (1995), 'Trade Unions and the Dispersion of Earnings in British Establishments, 1980–90', *Oxford Bulletin of Economics and Statistics*, 57(2), 167–84.

Gregg, P., Machin, S., and Fernández-Salgado, M. (2014), 'Real Wages and Unemployment in the Big Squeeze', *Economic Journal*, 124(576), 408–32.

Jackson, E. (2019), 'Availability of the Gig Economy and Long Run Labor Supply Effects for the Unemployed', Working Paper.

Jenkins, S. (forthcoming), 'Getting the Measure of Inequality', IFS Deaton Review of Inequalities, Institute for Fiscal Studies.

Joyce, R., Pope, T., and Roantree, B. (2019), 'The Characteristics and Incomes of the Top 1%', Institute for Fiscal Studies (IFS), Briefing Note 254.

Katz, L. F., and Krueger, A. B. (2019a), 'The Rise and Nature of Alternative Work Arrangements in the United States, 1995–2015', *Industrial and Labor Relations Review*, 72(2), 382–416.

Katz, L. F., and Krueger, A. B. (2019b), 'Understanding Trends in Alternative Work Arrangements in the United States', *Russell Sage Foundation Journal of the Social Sciences*, 5(5), 132–46.

Katz, L. F., and Murphy, K. M. (1992), 'Changes in Relative Wages, 1963–1987: Supply and Demand Factors', *Quarterly Journal of Economics*, 107(1), 35–78.

Koustas, D. (2018), 'Consumption Insurance and Multiple Jobs: Evidence from Rideshare Drivers', Working Paper.

Krueger, A. B. (2017), 'Princeton Self-Employment Survey', Princeton University.

Low Pay Commission (2019), '20 Years of the National Minimum Wage: A History of the UK Minimum Wage and its Effects'.

Low Pay Commission (2020), 'Low Pay Commission Report 2019'.

Machin, S. (1996), 'Wage Inequality in the UK', *Oxford Review of Economic Policy*, 12(1), 47–64.

Machin, S. (1997), 'The Decline of Labour Market Institutions and the Rise in Wage Inequality in Britain', *European Economic Review*, 41(3–5), 647–57.

Machin, S. (2000), 'Union Decline in Britain', *British Journal of Industrial Relations*, 38, 631–45.

Machin, S. (2010), 'Changes in Wage Inequality in the Last Forty Years', in P. Gregg and J. Wadsworth (eds), *The Labour Market in Winter: The State of Working Britain*.

Machin, S., Manning, A., and Rahman, L. (2003), 'Where the Minimum Wage Bites Hard: Introduction of Minimum Wages to a Low Wage Sector', *Journal of the European Economic Association*, 1(1), 154–80.

Machin, S., and Van Reenen, J. (1998), 'Technology and Changes in Skill Structure: Evidence from Seven OECD Countries', *Quarterly Journal of Economics*, 113(4), 1215–44.

Manning, A., and Petrongolo, B. (2022), 'Monopsony in Local Labour Markets', IFS Deaton Review of Inequalities, Institute for Fiscal Studies.

Mas, A., and Pallais, A. (2017), 'Valuing Alternative Work Arrangements', *American Economic Review*, 107(12), 3722–59.

Mas, A., and Pallais, A. (2020), 'Alternative Work Arrangements', *Annual Review of Economics*, 12, 631–58.

Moscarini, G., and Postel-Vinay, F. (2016), 'Wage Posting and Business Cycles', *American Economic Review*, 106(5), 208–13.

OECD (2014), 'Non-Regular Employment, Job Security and the Labour Market Divide', in *OECD Employment Outlook 2014*, OECD Publishing.

OECD (2019), *OECD Employment Outlook 2019: The Future of Work*, OECD Publishing.

Postel-Vinay, F., and Sepahsalari, A. (2019), 'Labour Mobility and Earnings in the UK, 1992–2016', Understanding Society, Working Paper 9.

Rodrik, D., and Stantcheva, S. (2021), 'Fixing Capitalism's Good Jobs Problem', *Oxford Review of Economic Policy*, 17(4), 824–37.

Stewart, M. B. (2004a), 'The Impact of the Introduction of the UK Minimum Wage on the Employment Probabilities of Low-Wage Workers', *Journal of the European Economic Association*, 2(1), 67–97.

Stewart, M. B. (2004b), 'The Employment Effects of the National Minimum Wage', *Economic Journal*, 114(494), 110–16.

Tatomir, S. (2015), 'Self-Employment: What Can We Learn from Recent Developments?', *Bank of England Quarterly Bulletin*, Q1.

Taylor, M., Marsh, G., Nicol, D., and Broadbent, P. (2017), *Good Work: The Taylor Review of Modern Working Practices*, Department for Business, Energy & Industrial Strategy.

Tinbergen, J. (1974), 'Substitution of Graduate by Other Labour', *Kyklos,* 27(2), 217–26.
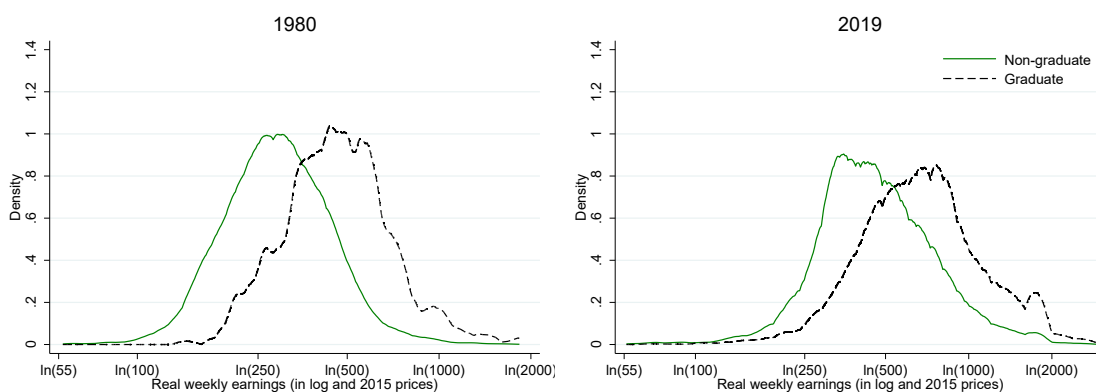
Appendix A. Additional figures and tables

Figure A1. Real weekly earnings distributions by individual characteristics for full-time employees in 1980 and 2019
Panel A. Men and women
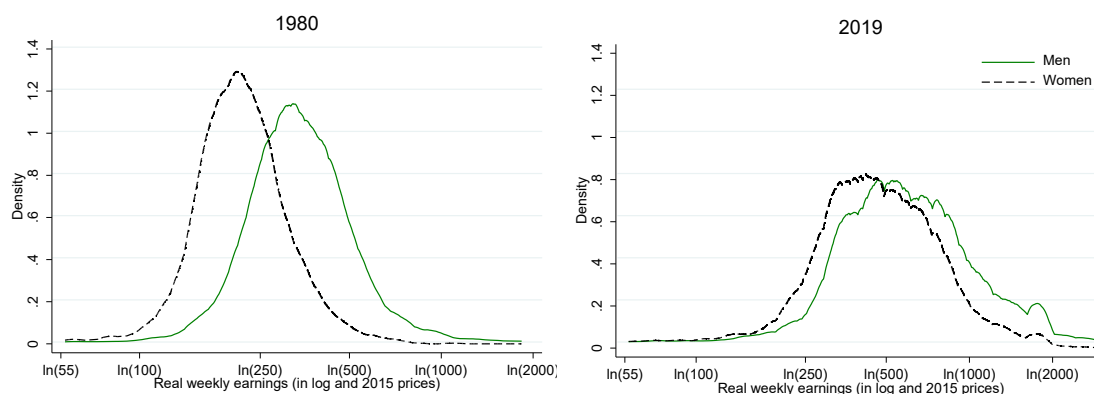
Panel B. Graduate and non-graduate

Panel C. Age groups
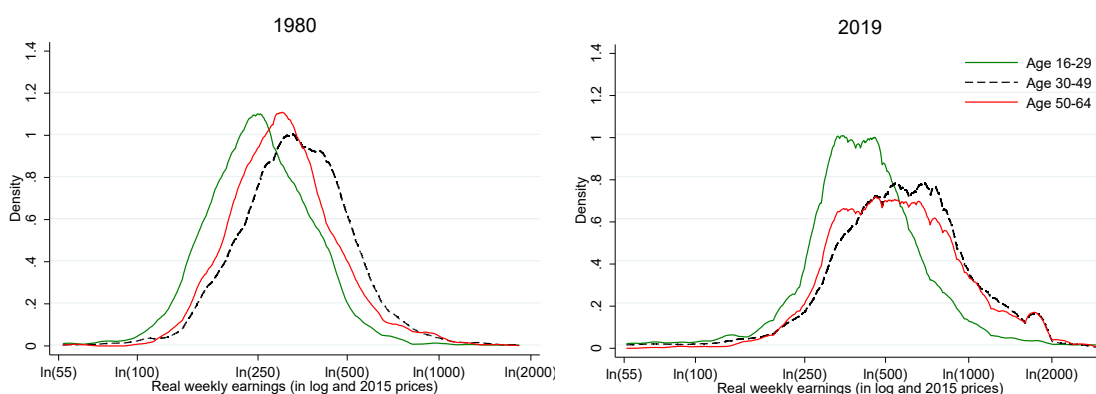
Note: The figure reports a set of real weekly earnings distributions for full-time employees in 1980 (left-hand side) and 2019 (right-hand side), splitting the sample by different demographic characteristics: gender (panel A), education (panel B) and age (panel C). The education split is based on whether the individual has university education or not. Real weekly earnings are expressed in logarithms and are CPI deflated relative to 2015 prices. Data for 1980 come from the General Household Survey and for 2019 from the Labour Force Survey.

Source: General Household Survey and Labour Force Survey.

Figure A2. Employment rate in the US
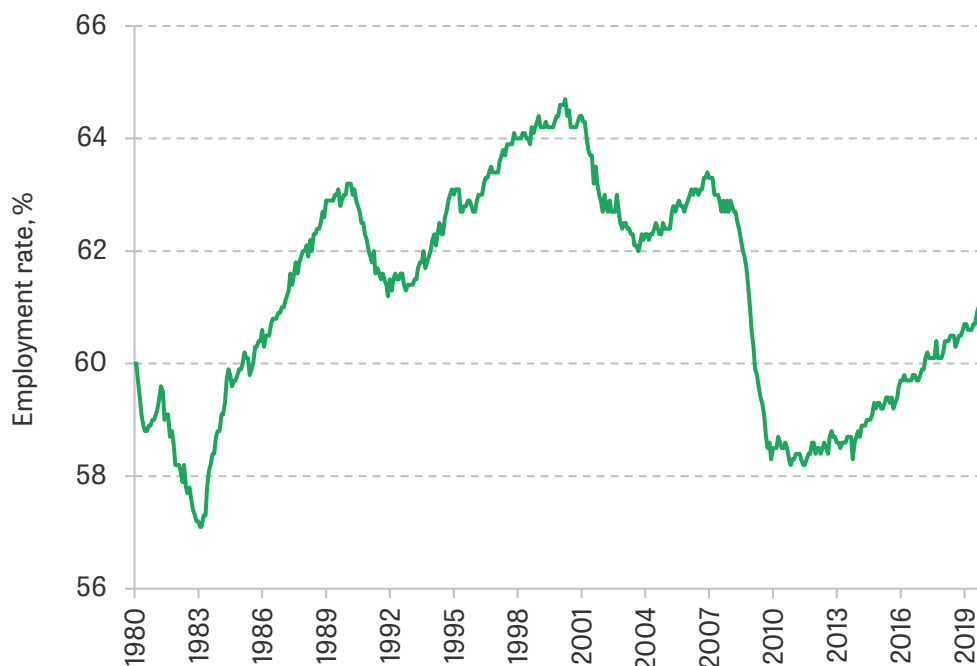
Note: The figure shows the evolution of the monthly employment rate in the United States from 1980 to 2019.

Source: Bureau of Labor Statistics.

Figure A3. Share self-employed in employment and by weekly income decile, 1999 and 2019
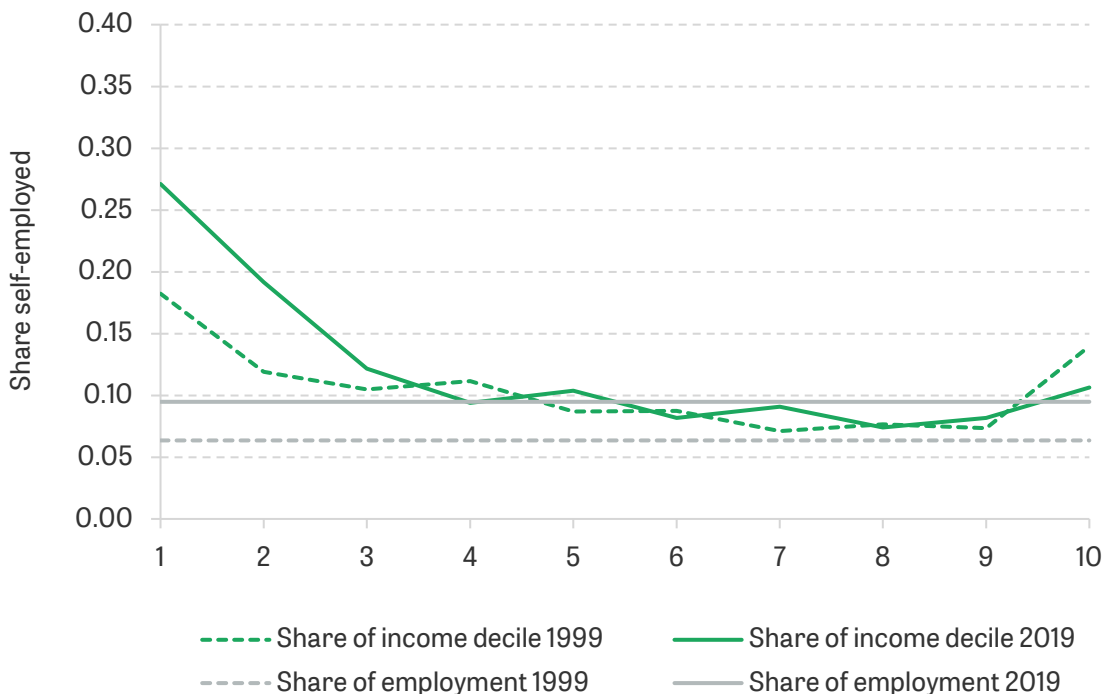
Note: The figure shows the share of self-employed by decile of the weekly income distribution among all workers in 1999 and 2019 (green lines), as measured in the Family Resources Survey. It also reports the share of employment made up by sole traders in 1999 and 2019 (grey lines), as measured in the Labour Force Survey.

Source: Family Resources Survey and Labour Force Survey.

Figure A4. Regional distribution of jobs by decile of median hourly wages, 1999
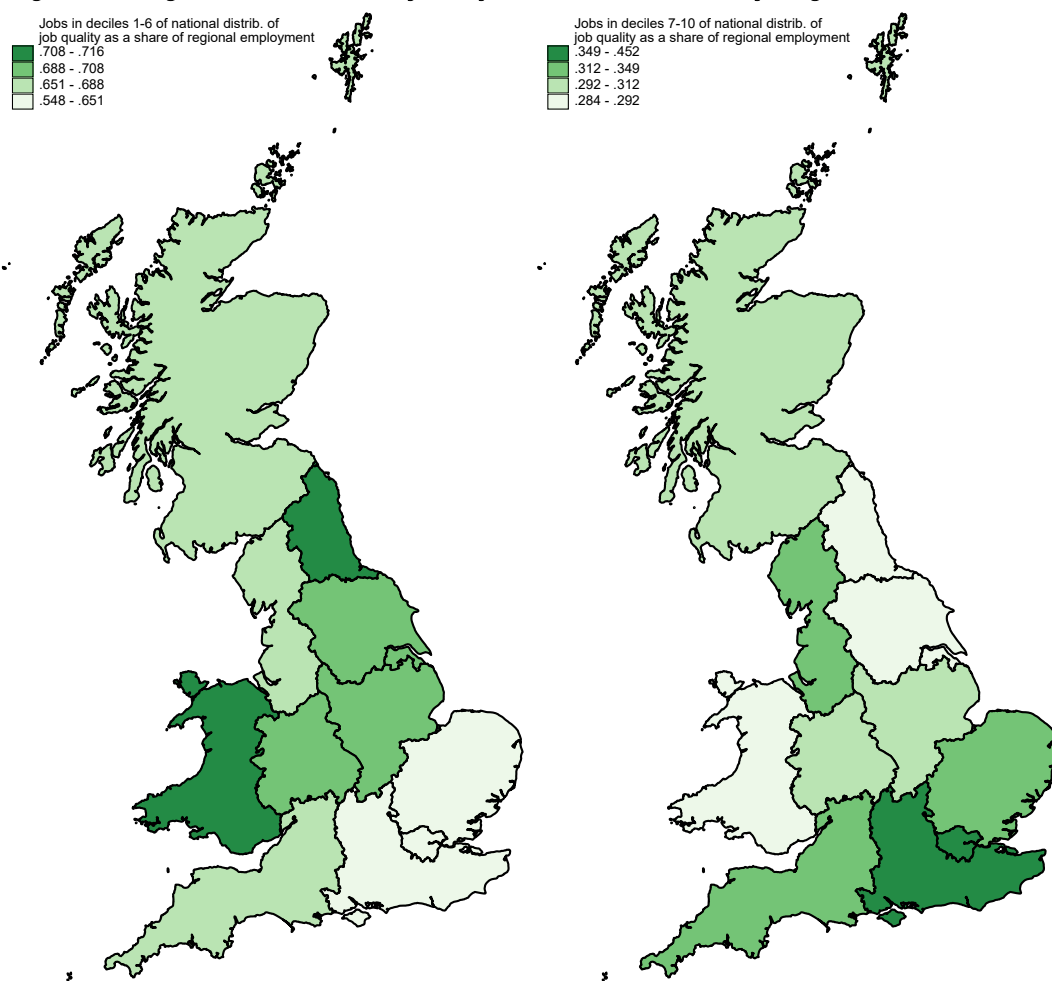
Jobs in deciles 1-6 of national distrib. of
job quality as a share of regional employment
- .708 - .716
- .688 - .708
- .651 - .688
- .548 - .651

Jobs in deciles 7-10 of national distrib. of
job quality as a share of regional employment
- .349 - .452
- .312 - .349
- .292 - .312
- .284 - .292

Note: The left-hand panel shows the number of jobs in the bottom six deciles of the national distribution of job quality, as a share of regional employment in 1999. The right-hand panel illustrates the same figures for jobs in the top four deciles of the national distribution of job quality. Job quality is measured by median occupational hourly wage in 1999.

Source: Labour Force Survey.

Table A1. Top and bottom 10 occupations by job growth

Occupation (three-digit, SOC 2010)	Median hourly wage in 1999
Top 10 occupations	
Information technology and telecommunications professionals	13.39
Health associate professionals	7.79
Functional managers and directors	13.39
Research and development managers	11.83
Quality and regulatory professionals	11.16
Conservation and environment professionals	10.42
Sports and fitness occupations	7.36
Health professionals	13.04
Therapy professionals	10.46
Customer service managers and supervisors	9.61
Bottom 10 occupations	
Printing trades	7.96
Building finishing trades	6.13
Assemblers and routine operatives	5.47
Plant and machine operatives	6.53
Secretarial and related occupations	6.37
Process operatives	6.19
Metal forming, welding and related trades	7.03
Other skilled trades	5.78
Textiles and garments trades	5.49
Elementary agricultural occupations	4.78

Note: The table reports the 10 occupations (at three-digit level) with fastest and slowest employment growth over the 1999–2019 period.

Source: Labour Force Survey.

Appendix B. Technical details

B1.   Estimation of earnings curves

To investigate the relationship between unemployment, underemployment and earnings growth, we estimate a standard earnings curve at the regional level, following the specification in Gregg, Machin and Fernández-Salgado (2014):

$$\ln w_{rt}^{p} = \alpha_r + \beta_1 \ln u_{rt-1} + \beta_2 \Delta \ln u_{rt} + \gamma t + \delta X_{rt} + \varepsilon_{rt} \qquad (1)$$

In the above model, $\ln w_{rt}^{p}$ is the natural logarithm of percentile p of the real weekly earnings distribution in government region r in year t; u is the unemployment rate, which enters the regression both lagged ($\ln u_{rt-1}$) and first differenced ($\Delta \ln u_{rt}$); X represents a set of regional controls, including the proportion of workers with a university degree, the proportion female, the proportion aged 16–25, the proportion white and the proportion in public employment in the regional labour force; and r indicates the 12 regions of the UK.[17] The regression model includes a time trend t and a set of region fixed effects α_r. Our coefficient of interest is β_1, which captures the association between earnings growth and labour market slack. We analyse real earnings growth at the median (i.e. we set p = 50). We also explore the explanatory power of both unemployment and underemployment as measures of slack.

Results are reported in panels A and B of Table B1, where we use the unemployment rate and the underemployment rate as measures of slack, respectively. Columns 1 and 2 of both panels report the estimates of the model without and with regional controls for the years in which all relevant variables are available in the UK Labour Force Survey. Subsequent columns report the estimated coefficients for the model with regional controls over selected subperiods.

Estimates of the canonical wage curve in panel A of Table B1 all indicate a negative association between unemployment and median real weekly earnings. If we look at the two most recent decades – the 2000s in column 4 and the 2010s in column 5 – the elasticity of real weekly earnings to unemployment is close to –0.09, indicating that a 1% increase in unemployment is associated with a 0.09% decrease in real earnings.

Moving to panel B and focusing again on the last two columns, we see that the underemployment rate also has explanatory power in this model. Interestingly, though, the sensitivity of real earnings growth to the underemployment rate appears to have increased over time – the elasticity of real earnings to underemployment has grown from –0.04 in the 2000s to –0.10 in the 2010s. Actually, if we compare the estimates for the 2010s in panels A and B, we can see that the underemployment rate has more explanatory power than the simple unemployment rate, indicating that the latter has become better at capturing labour market slack.

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[17] Real weekly earnings are measured among private sector employees. In the estimation, standard errors are heteroskedasticity-robust.

Table B1. Canonical earnings curves

Panel A. Unemployment rate (u) as measure of slack

	Regional median real weekly earnings (ln)				
	1993–2019	1993–2019	1993–99	2000–09	2010–19
	(1)	(2)	(3)	(4)	(5)
$\ln u_{rt-1}$	–0.116***	–0.152***	–0.082	–0.090***	–0.092***
	(0.010)	(0.010)	(0.062)	(0.017)	(0.028)
$\Delta \ln u_{rt}$	0.191***	0.095***	0.041	–0.024	0.013
	(0.017)	(0.020)	(0.048)	(0.020)	(0.034)
Trend	0.001**	–0.002	0.012	0.006**	–0.011***
	(0.000)	(0.002)	(0.009)	(0.002)	(0.004)
Observations	310	309	69	120	120
R-squared	0.936	0.947	0.981	0.985	0.979
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Regional controls	No	Yes	Yes	Yes	Yes

Panel B. Underemployment rate ($under$) as measure of slack

	Regional median real weekly earnings (ln)			
	2001–19	2001–19	2001–09	2010–19
	(1)	(2)	(3)	(4)
$\ln under_{rt-1}$	–0.052***	–0.067***	–0.036**	–0.100***
	(0.007)	(0.007)	(0.015)	(0.023)
$\Delta \ln under_{rt}$	0.077***	0.046***	–0.018	–0.011
	(0.013)	(0.015)	(0.019)	(0.022)
Trend	–0.004***	–0.004**	0.003	–0.011***
	(0.000)	(0.002)	(0.003)	(0.003)
Observations	216	216	96	120
R-squared	0.972	0.975	0.989	0.980
Regional fixed effects	Yes	Yes	Yes	Yes
Regional controls	No	Yes	Yes	Yes

Note: The table reports coefficient estimates for equation 1, using the unemployment rate (panel A) or the underemployment rate (panel B) as a measure of slack. Median real weekly earnings are for private sector employees. Regional controls include the proportion of workers with a university degree, the proportion female, the proportion aged 16–25, the proportion white and the proportion in public employment in the regional labour force. Heteroskedasticity-robust standard errors are shown in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

Source: Labour Force Survey.

B2.   Estimation of canonical model of skills supply and demand à la Katz and Murphy (1992)

In the orthodox supply and demand model, wage inequality increases come about because of an increase in the relative demand for skilled workers. Katz and Murphy (1992) first formalised the issue of changing wage gaps between different workers at different points in the wage distribution in a simple model of relative demand and supply of skills. They specified a production function where output is produced with two labour inputs – skilled and unskilled workers – and where these two sorts of workers are substitutes. The basic logic of their argument is that the relative wage of the two worker types varies with their relative demand and supply. If demand outstrips supply, the relative wage will increase (and it will fall if demand lags behind supply).

A simple way to test this notion empirically is through a time-series model that relates the relative earnings of university-educated versus high-school-educated workers to shifts in the relative demand and supply of skills. We do so by estimating a relative earnings equation of the form

$$\ln\left(\frac{w_s}{w_u}\right)_t = \gamma_0 + \gamma_1 \text{trend} + \gamma_2 \ln\left(\frac{N_s}{N_u}\right)_t + \gamma_3 X_t + \nu_t \tag{2}$$

where $\ln\left(\frac{w_s}{w_u}\right)_t$ is the log of the skilled to unskilled weekly earnings, the relative supply of skilled to unskilled labour is measured by the log of the ratio of the number of skilled to unskilled workers $\ln\left(\frac{N_s}{N_u}\right)_t$ and ν_t is an error term. Following Katz and Murphy (1992), we proxy relative demand by a time trend, based on the assumption that new technologies that drive the relative demand for skilled workers up have been trending up through time. In an alternative specification, we proxy relative demand with a set of decade dummies. We also control for a set of covariates X_t, such as the level of the unemployment rate and of the minimum wage (controlling for years over which the minimum wage was not in place).

Estimates of this model for UK data from 1980 to 2019 are reported in Table B2. The model fits the UK data reasonably. The estimated coefficient on the supply variable is (as predicted) negative and significant in most specifications. The positive coefficient on the trend variable shows that, despite the very sharp increase in the relative supply of graduates, there has been an even faster growth in relative demand for graduates. Depending on specification, this trend growth was of the order of around 1% per year over and above the supply changes. In the sense of Tinbergen (1974) and the original Katz and Murphy (1992) paper using US data, plus the many extensions that have been undertaken since (see Acemoglu and Autor (2011) and the most recent update using US time-series data over 200 years by Autor, Goldin and Katz (2020)), demand has won the race between demand and supply and pushed educational earnings differentials up.

Table B2. Estimates of the relative supply and demand model

	Relative full-time weekly earnings of graduates vs non-graduates (ln) (1980–2019)			
	(1)	(2)	(3)	(4)
Relative supply, $\ln(N_g/N_{ng})_t$	−0.168*** (0.053)	−0.183*** (0.062)	−0.057*** (0.022)	−0.044* (0.025)
Time trend	0.009*** (0.003)	0.012*** (0.003)		
Unemployment rate (ln)		0.064*** (0.017)		0.053*** (0.014)
Minimum wage (ln)		−0.123*** (0.030)		−0.009 (0.037)
No minimum wage dummy variable		−0.204*** (0.041)		−0.046 (0.040)
1990s dummy variable			0.061*** (0.010)	0.062*** (0.013)
2000s dummy variable			0.093*** (0.020)	0.080*** (0.015)
2010s dummy variable			0.087*** (0.033)	0.066*** (0.022)
Sample size	40	40	40	40
R-squared	0.17	0.60	0.56	0.72

Note: The table reports coefficient estimates of time-series model (2), relating the relative weekly earnings of university-educated versus high-school-educated workers to shifts in the relative demand and supply for skills, measured – respectively – by a time trend and the ratio of university-educated to high-school-educated workers. The dependent variable corresponds to the composition-adjusted (age, gender, London) log relative full-time weekly earnings of graduates versus non-graduates. The relative supply variable is the log relative number of graduates versus non-graduates. Heteroskedasticity-robust standard errors are shown in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

Source: General Household Survey data between 1980 and 1992; Labour Force Survey data from 1993 to 2019.

B3.   Estimation of 'old-school' models of skill-biased technical change à la Berman, Bound and Griliches (1994)

Stated in its simplest form, the skill-biased technical change (SBTC) hypothesis says that new technologies lead to higher productivity, but only some (more skilled) workers possess the necessary skills to operate them. Therefore, in response to introducing these kinds of technologies into their workplace, employers raise demand and/or wages for highly skilled workers who are complements with the new technologies. A typical approach adopted to test this notion (first used in the pioneering paper by Berman, Bound and Griliches (1994)) comes from estimating statistical models that relate the skilled wage bill share (to capture relative demand shifts that occur through rising relative wages and/or relative employment of skilled workers) to observable measures of technical change. Equation 3 provides an example of such models:

$$\Delta_5 S_{it} = \alpha + \beta \left(\frac{R\&D}{Y} \right)_{it-5} + \gamma \Delta_5 \ln K_{it} + \delta \Delta_5 \ln Y_{it} + \varepsilon_{it} \tag{3}$$

where $\Delta_5 S_{it}$ is the five-year change in the graduate wage bill share, or the graduate hours share; $\frac{R\&D}{Y}$ is the ratio of R&D expenditure to GDP (Y); and K is capital.

Many studies from many settings reported evidence in line with SBTC, usually using data on workplaces or industries. And, despite not being causal in the modern sense, the approach is still useful to understand whether more technologically advanced workplaces or industries experienced faster skill demand shifts. Table B3 shows updated evidence for the UK, suggesting that SBTC remains an important phenomenon in the 2000s and 2010s. This new evidence complements a set of earlier studies that used data from periods of fast-rising wage inequality (Machin, 1996; Machin and Van Reenen, 1998).

Table B3. 'Old school' skill demand equations up to 2015

	Graduate wage bill shares			Graduate hours shares		
	2015, 34 industries	2015, 23 industries	2000, 2005, 2010, 2015, 23 industries	2015, 34 industries	2015, 23 industries	2000, 2005, 2010, 2015, 23 industries
$\frac{R\&D}{Y}$	0.191*** (0.071)	0.198*** (0.063)	0.117* (0.065)	0.130* (0.077)	0.148** (0.058)	0.108* (0.056)
$\Delta \ln K$	0.068 (0.080)	0.103 (0.074)	0.079** (0.039)	0.099 (0.111)	0.157* (0.086)	0.066** (0.033)
$\Delta \ln Y$	−0.062 (0.041)	−0.059 (0.043)	−0.017 (0.026)	−0.059 (0.042)	−0.078*** (0.029)	−0.005 (0.026)
Sample size	34	23	92	34	23	92

Note: Graduate wage bill and hours shares computed from Labour Force Survey data and specified in five-year differences (1995–2000, 2000–05, 2005–10 and 2010–15). Data on R&D/Y, K and Y from OECD ANBERD and STAN data. Heteroskedasticity-robust standard errors are shown in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

Source: Labour Force Survey and OECD.

Appendix C. Minimum wage setting in the UK

C1. Institutional details

The UK introduced a National Minimum Wage (NMW) in April 1999. Prior to that, there used to be industry-level wage floors – set by the Wage Councils – that were in force between 1909 and 1993, but that covered only approximately 12% of the workforce at the time of their repeal. In the 1997 elections, the Labour government committed to introducing a national minimum wage and established the Low Pay Commission. The Low Pay Commission was originally set up in 1997 on a non-statutory basis to make recommendations about how the national minimum wage should be introduced. Its statutory position was set out in the 1998 National Minimum Wage Act, and in June 2001 the government announced that it would have a permanent monitoring role.

The Low Pay Commission advises the government about the National Minimum Wage. Its nine members are appointed by the Secretary of State for Business, Innovation & Skills. Of the nine members, three are representatives of business organisations, three of employees and three of social partners (these include the Chair and two academics). They all serve in their personal capacity. As such, social partners are not directly involved in the setting and updating of the minimum wage. The Commission's responsibilities include: conducting extensive research and consultation; commissioning research projects; analysing relevant data and liaising with the Office for National Statistics to establish better estimates of the incidence of low pay; surveying firms in low-paying sectors; consulting with employers, workers and their representatives; taking written and oral evidence from a wide range of organisations; undertaking fact-finding visits throughout the UK; monitoring and evaluating the impact of the National Minimum Wage; and reviewing the different rates and making recommendations for change.

When making recommendations, the Commission must consider the impact on the economy of the United Kingdom, competitiveness and any other factors the Secretary of State asks them to consider. The Commission reports back to the Secretary of State and the Prime Minister at the same time. The reports are published and laid before both Houses of Parliament. The formal decision to update the minimum wage is taken by the government, based on the recommendation of the independent Low Pay Commission. If any recommendations made in a report are not accepted, or are only partly accepted, the Secretary of State must explain the reasons why this is the case in Parliament.

In April 1999, a minimum hourly wage of £3.60 for workers aged 22 and over, and a lower rate of £3.00 for workers aged between 18 and 21, were established. Additional rates have been introduced for workers aged 16–17 in 2004 and for apprentices in 2010. Additionally, in 2010 the adult wage group was expanded to workers aged 21. As of October 2015, the National Minimum Wage rates were as follows: an adult minimum rate of £6.70 for workers aged 21 and over, a youth development rate of £5.30 for those aged 18–20, a youth minimum of £3.87 for 16- to 17-year-olds and an apprentice rate of £3.30.

After winning the May 2015 election, the new Conservative government called an emergency Budget on 8 July 2015, in which Chancellor George Osborne announced the introduction of the National Living Wage. This changed the structure of minimum wages by introducing a new minimum wage rate of £7.20 an hour for workers aged 25 or above. There are currently five national minimum wage rates, as follows:

- the National Living Wage for workers aged 25 and over;
- the National Minimum Wage for workers aged 21–24;
- the youth development rate for workers aged 18–20;
- the young worker rate for workers aged 16–17;
- the apprentice rate.[18]

C2. International comparisons

Figure C1 shows the ratio of minimum wages to median earnings (Kaitz index) of full-time employees across OECD countries for 2019. If we consider European and North American countries, the UK is close to the international frontier in terms of minimum wage bite, with a Kaitz index of approximately 55%.

Figure C1. Minimum wage as % of median earnings of full-time employees, 2019

Minimum wage over median earnings of full-time employees
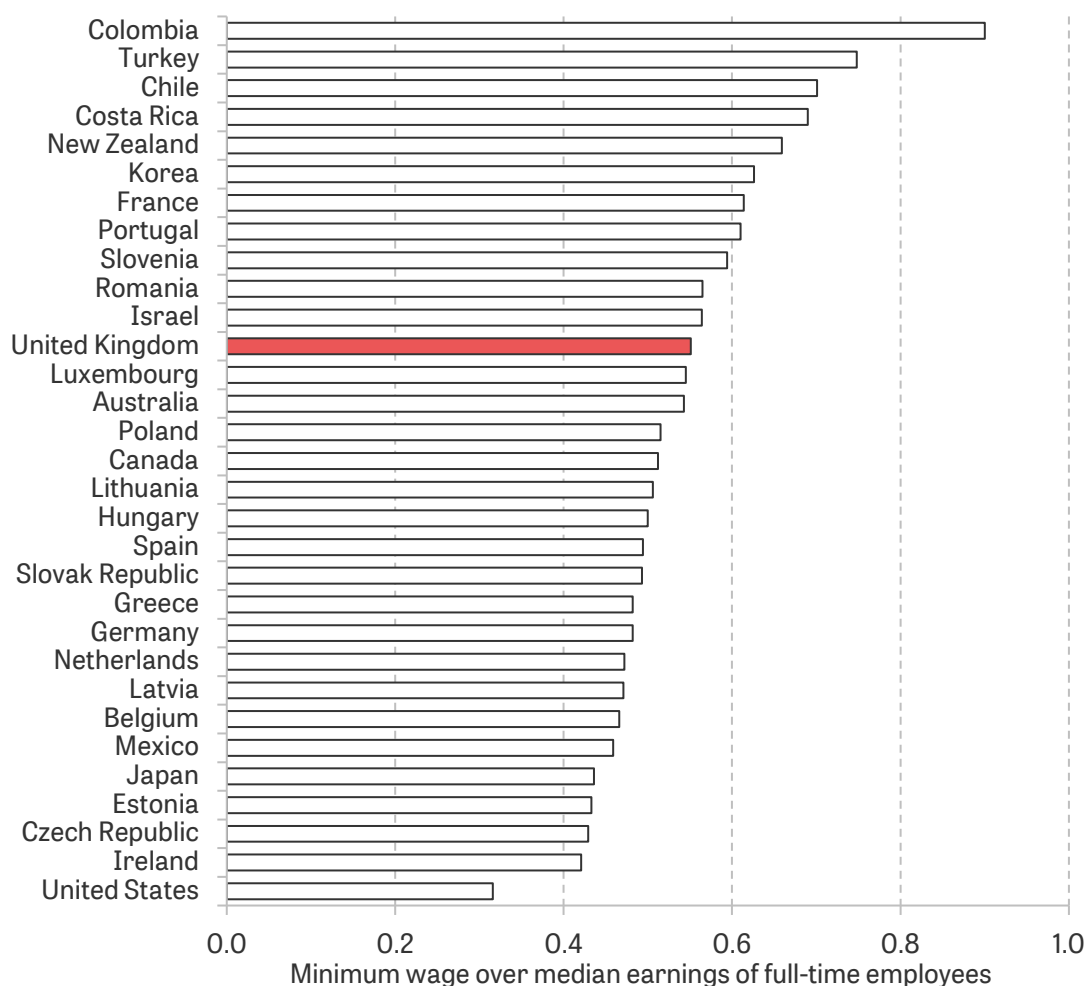
Note: The figure reports the value of the minimum wage as a share of median earnings of full-time employees across OECD countries in 2019.
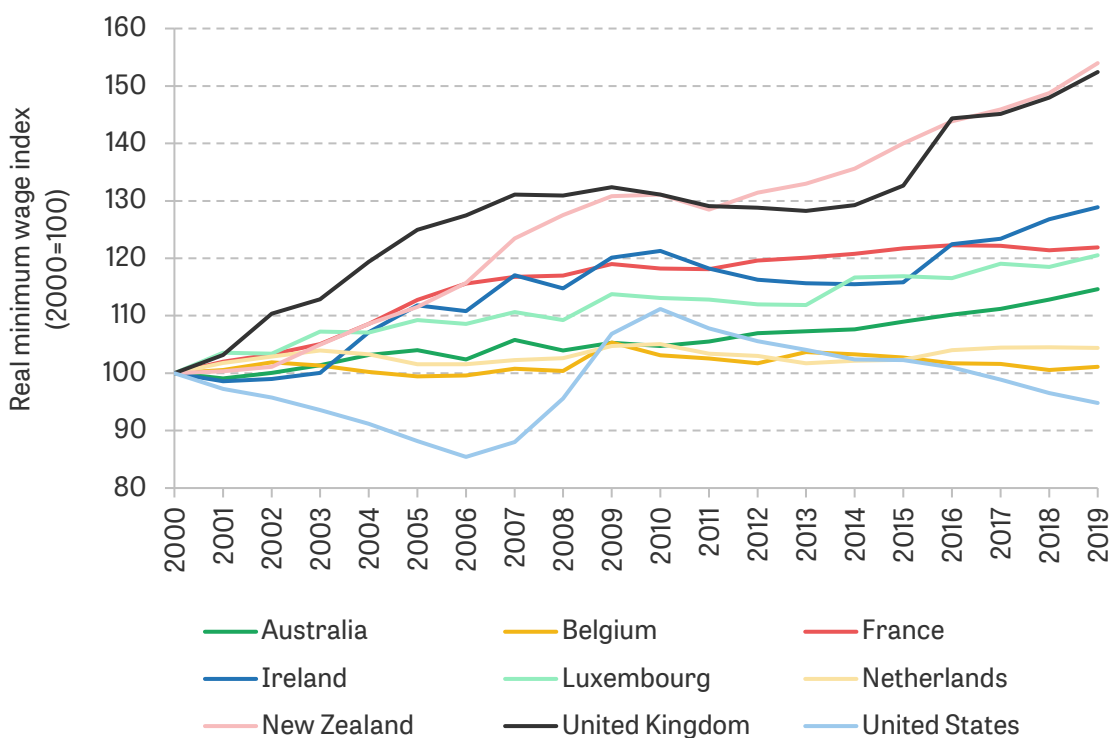
Source: OECD.

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[18] The rate that applies to each worker depends on their age at the start of a pay reference period. When a worker becomes 18, 21 or 25, their rate will increase from the pay reference period on or after their birthday. Apprentices are entitled to the apprentice rate if they are either aged under 19, or aged 19 or over and in the first year of their apprenticeship. They are otherwise entitled to the minimum wage for their age.

Figure C2. Change in minimum wages in OECD countries, 2000–19

Panel A. Nominal wages
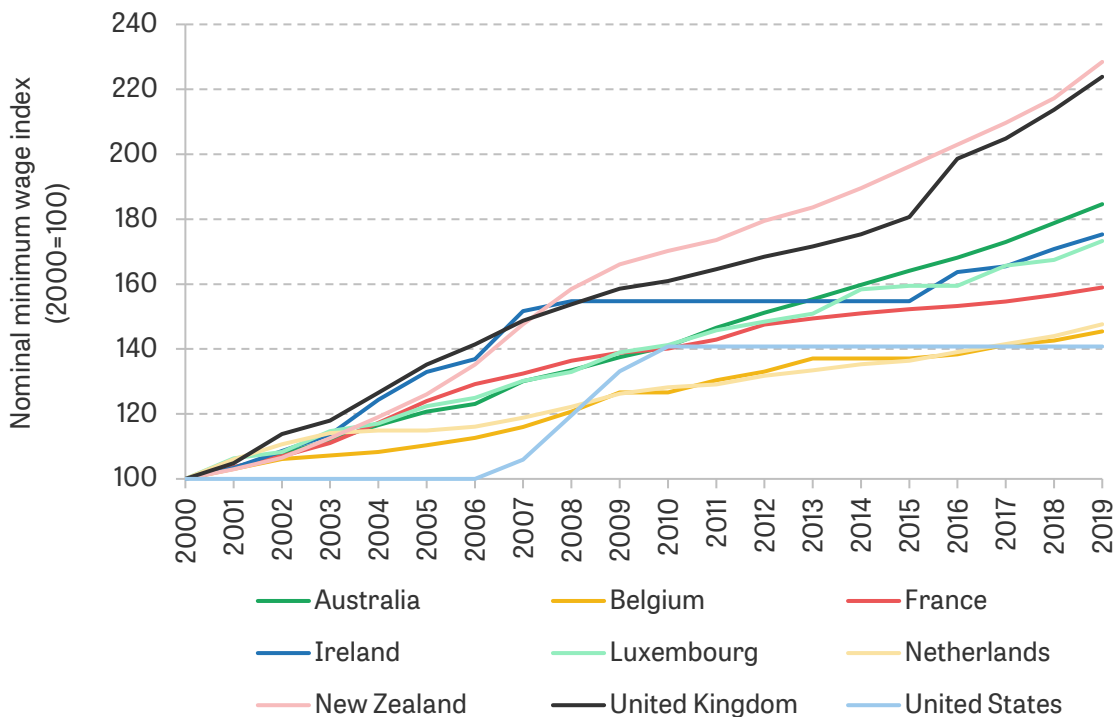
Panel B. Real wages

Note: The figure shows the evolution of nominal (panel A) and real (panel B) minimum wages across countries over the period 2000–19, relative to 2000.

Source: OECD.

Over its 20 years, in both nominal (panel A of Figure C2) and real terms (panel B of Figure C2), the UK's minimum wage has grown faster than those in all comparable OECD countries except for New Zealand. When the minimum wage was first introduced, the UK was in the middle of the OECD's real minimum wage rankings. Thanks to an ambitious minimum wage policy, the UK is now in the group of high minimum wage countries. Recent large increases, especially since the introduction of the National Living Wage in 2016, have been among the fastest in both nominal and real terms.