

Looking through the hourglass

*Hollowing out of the UK jobs market
pre- and post-crisis*

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A polarising crisis, a polarising recovery?

Assessing the UK's changing job structure

- A large and growing body of research details **the 'hollowing out' of developed labour markets** (the relative decline of mid-skilled jobs and expansion of low- and high-skilled jobs) from the 1970s to the 2008-09 recession
- Previous Resolution Foundation research (Plunkett & Pessoa, 2013) confirmed that **these trends continued in the UK in the early years of the crisis**
- This analysis updates the picture to 2014, and places UK trends in the context of broader debates on polarisation. In particular we:
 - Describe **patterns of occupational polarisation in the UK since the early 1990s**
 - Summarise current debates on **the potential drivers of hollowing out**, including our own initial analysis of the role of technological change
 - Explore **the significance of these trends** – why do they matter?

1. Patterns of occupational polarisation in the UK

Since the early 1990s, mid-skilled occupations have experienced falling employment shares

Change in share of employment: **1993-2014**



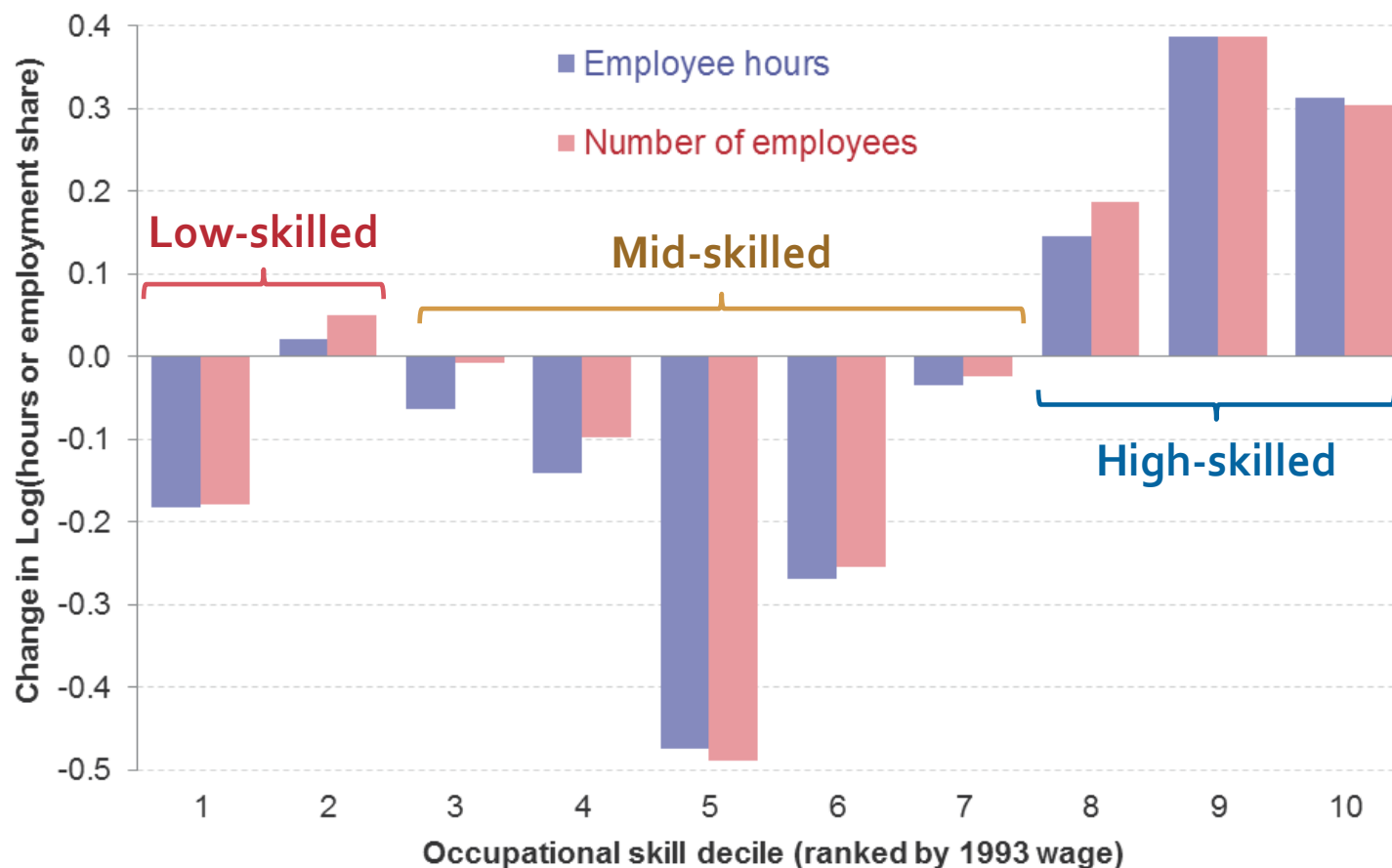
Using initial wages as a proxy for skill levels, mid-skilled occupations have declined 1993-2014 and high-skilled occupations have grown, with smaller changes in low-skilled occupations. This leads to a 'U-shaped' graph

The picture is similar when looking at hours or headcount – in the remainder of this analysis we focus on aggregate working hours

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Relative growth in high-skilled jobs has exceeded growth at the bottom

Change in share of employment: **1993-2014**



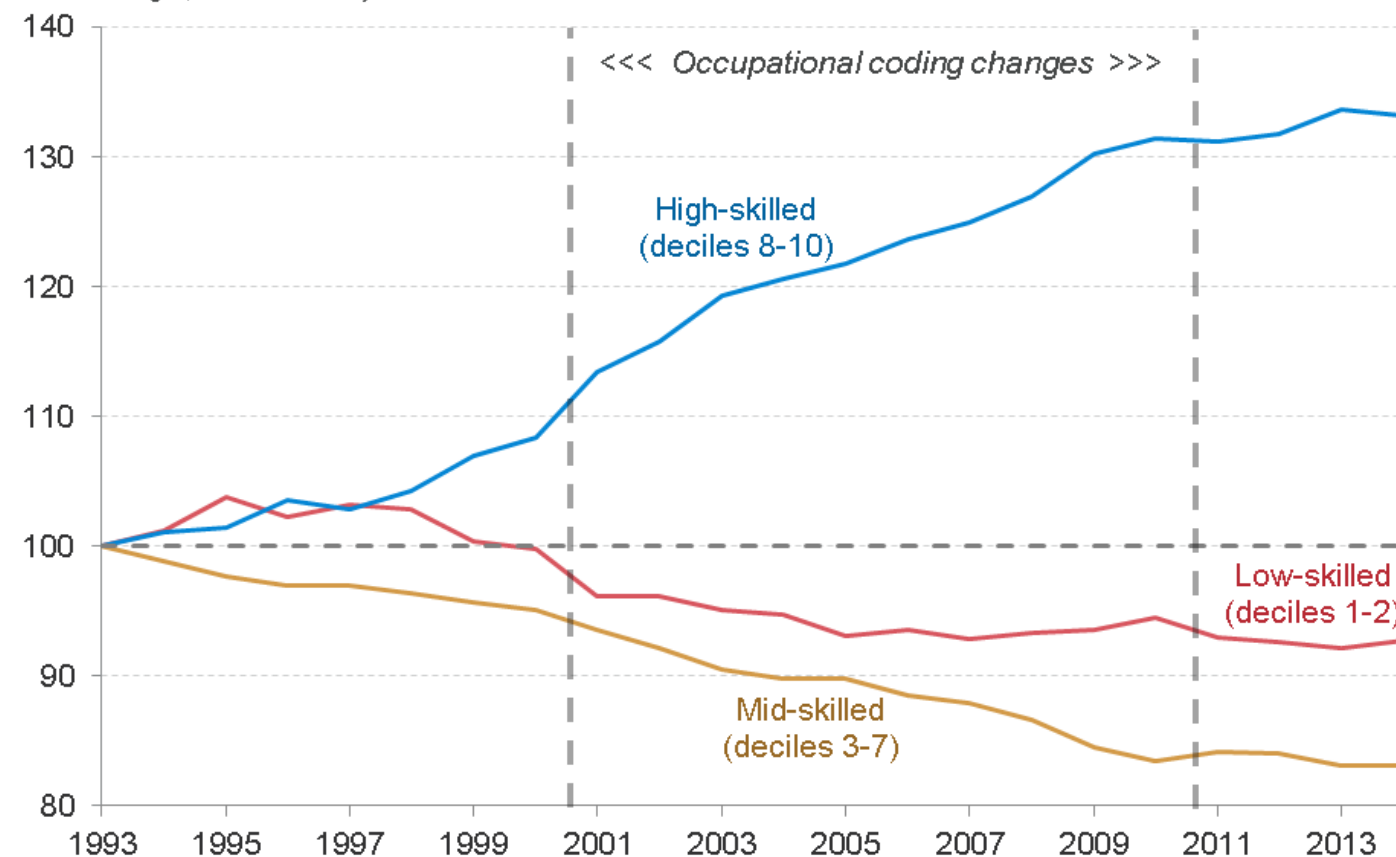
Because of stronger relative growth at the top, the 'U-shape' is much more lopsided than the 'hollowing-out-of-the-middle' narrative implies

In this analysis we summarise the trends in different parts of the occupational skill distribution by grouping together skill deciles 1 and 2 (low-skilled), 3 to 7 (mid-skilled), and 8 to 10 (high-skilled)

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Low-skilled occupations were growing in share in the mid-1990s, but then declined

Change in share of total employee hours in occupational skill deciles (skill deciles based on 1993 wage, 1993=100)



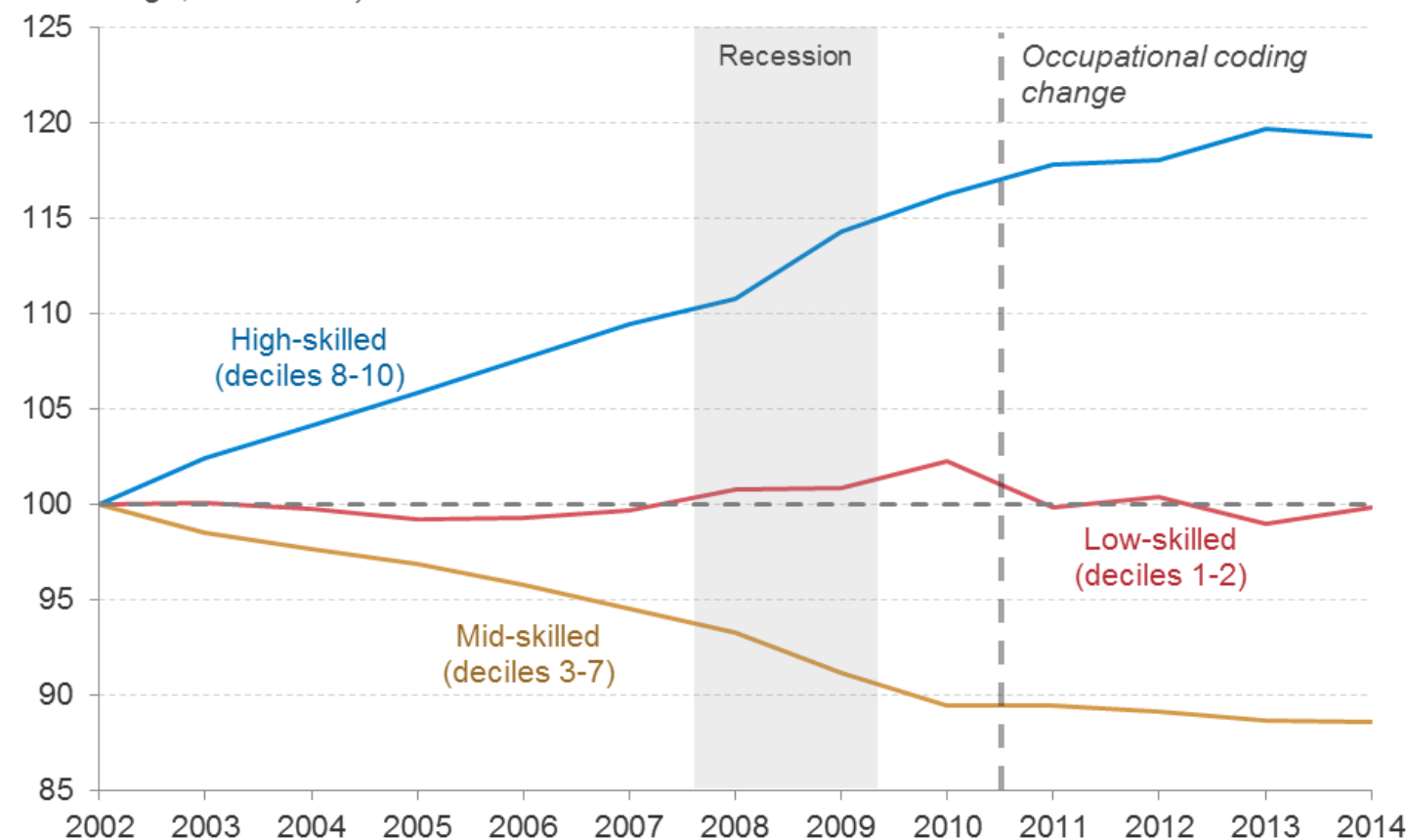
Notes: The first quarter of 2001 and the final quarter of 2014 are not included due to missing variables or because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Low-skilled jobs declined in share through the late-1990s and early 2000s, and have been broadly flat since

Changes to the way we classify occupations make analysis over time harder, but the 'matching' process we use provides a seemingly consistent picture – particularly for the latest coding change in 2011

The downturn may have 'amplified' polarising trends

Change in share of total employee hours in occupational skill deciles (skill deciles based on 2002 wage, 2002=100)



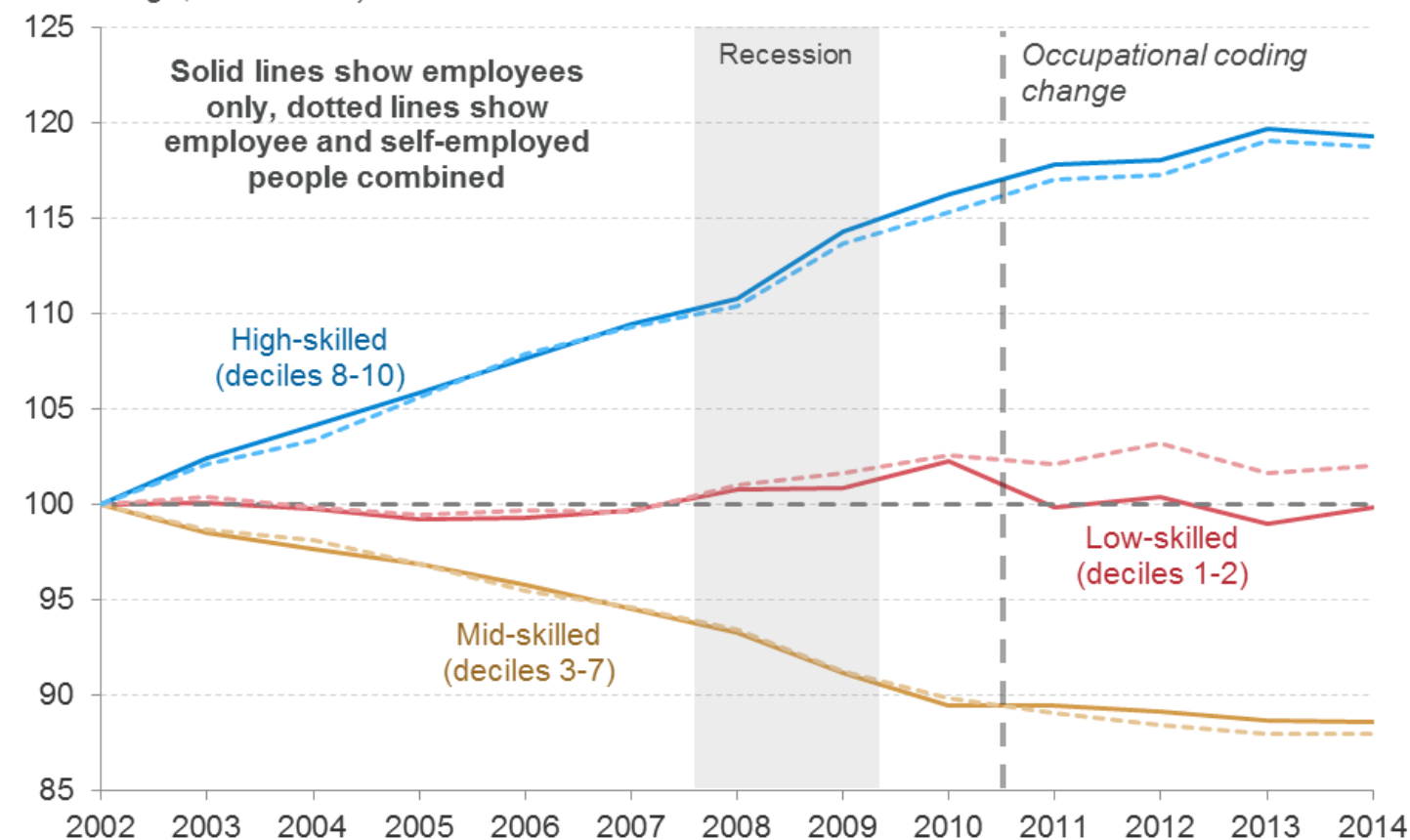
Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Updating our starting point to 2002 (to remove the effects of one coding change, and reflect a decade of changes to the occupational wage structure) gives a similar picture

The crisis shows a potential return to the trends of the mid-1990s, with growth high-skilled jobs, slight growth in low-skilled jobs, and sharper relative decline in mid-skilled ones. These trends then slow

The self-employed skew the picture slightly towards low-skilled jobs

Change in share of total working hours in occupational skill deciles (skill deciles based on 2002 wage, 2002=100)



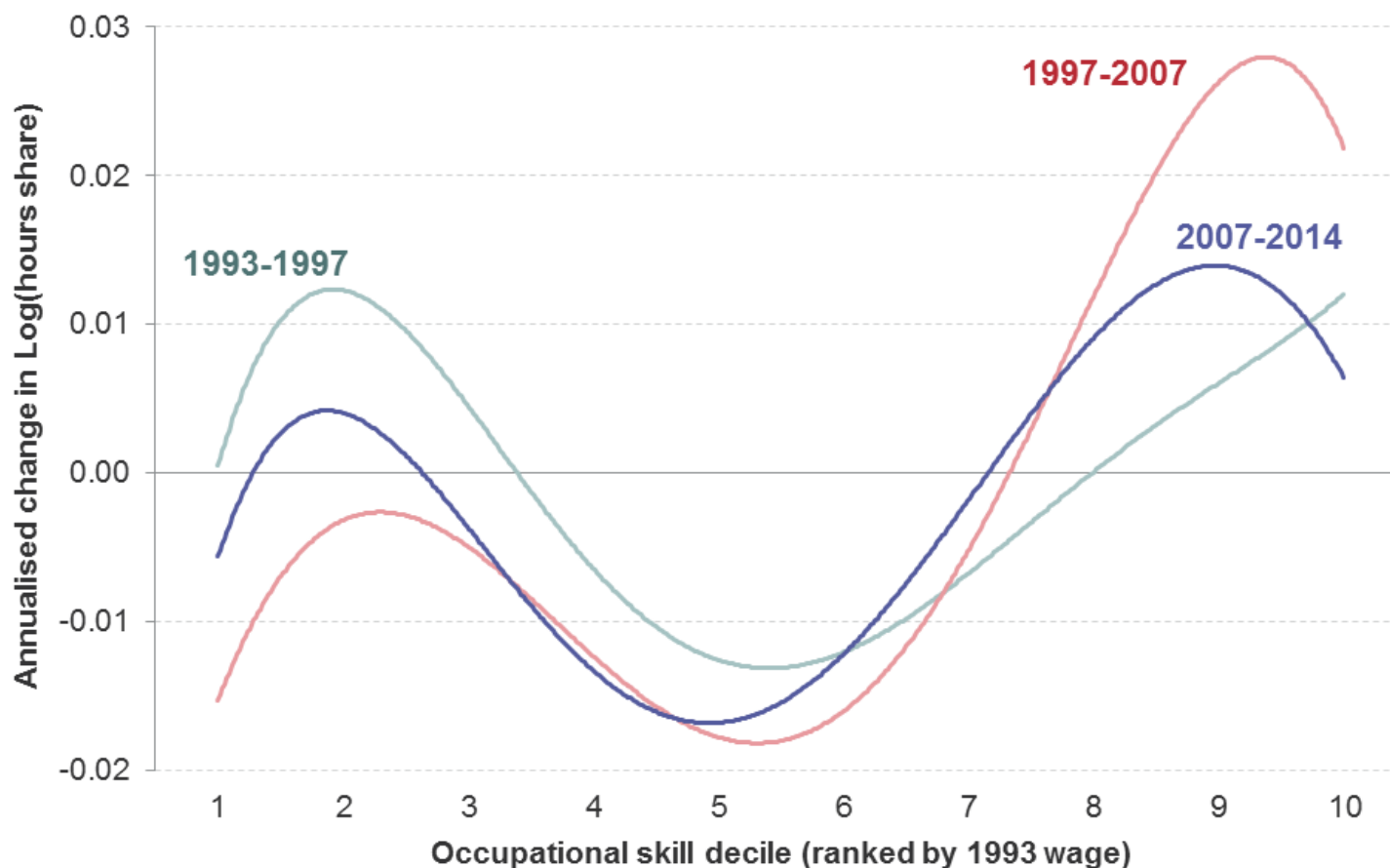
Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

When including the self-employed (by assuming they have the same wage structure as employees), we find that low-skilled jobs expanded slightly, and high-skilled jobs grew slightly more slowly, between 2002 and 2014

In this analysis we mainly focus on employees, as occupational changes for the self-employed are likely to have a different set of drivers

Recent employment changes may signal a shift back towards traditional 'hollowing out' patterns

Annual change in share of total employee hours



The trends shown in the previous figures for the period during and since the crisis can also be seen in a partial return to a 'U-shape' reminiscent of the mid-1990s

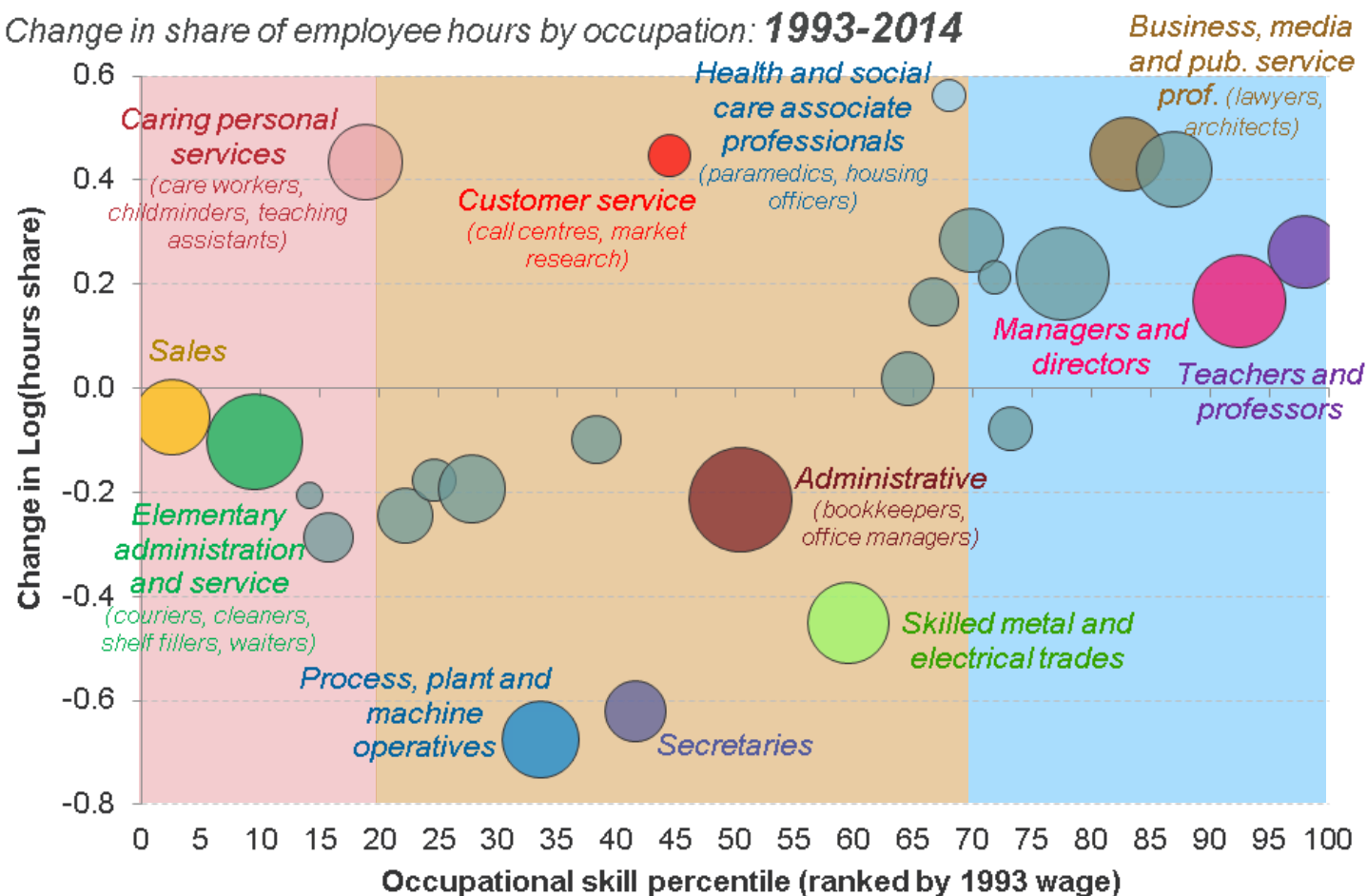
The pattern of occupational change in the decade before the crisis looks the most positive – with strong growth in high-skilled jobs and declining employment shares across lower-skilled deciles

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. Trends are smoothed using five-order polynomial curves. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

So what are these declining mid-skilled jobs?

manual trades and mid-skilled office workers...

Change in share of employee hours by occupation: **1993-2014**



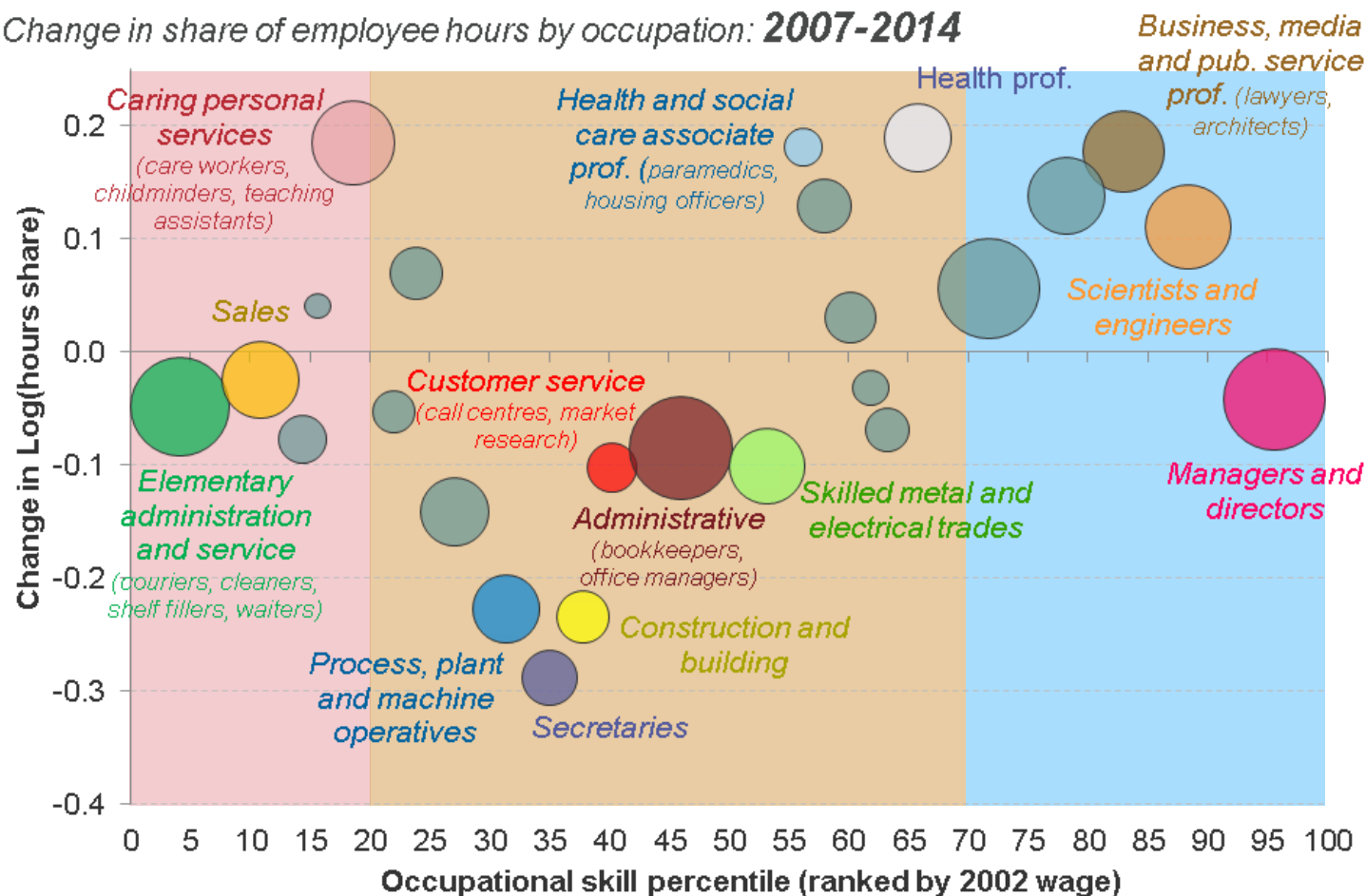
The two occupations experiencing the largest decline in their share of employment since 1993 are 'process, plant and machine operatives' and 'secretaries'

There has been strong growth in caring and service occupations across the occupational wage distribution, some of which may reflect demographic changes

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. Bubble size reflects the average labour share between 1993 and 2014. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

With similar trends enduring during the crisis and recovery

Change in share of employee hours by occupation: **2007-2014**



Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. Bubble size reflects the average labour share between 2002 and 2014. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Once again we update our starting point to 2002 in this figure, to eliminate some coding changes and update the initial wage profile. However, the picture is similar to the longer-run view

The employment share of construction occupations declined sharply since 2007 (in contrast to the longer-run view), likely reflecting the collapse in demand for these skills during the crisis

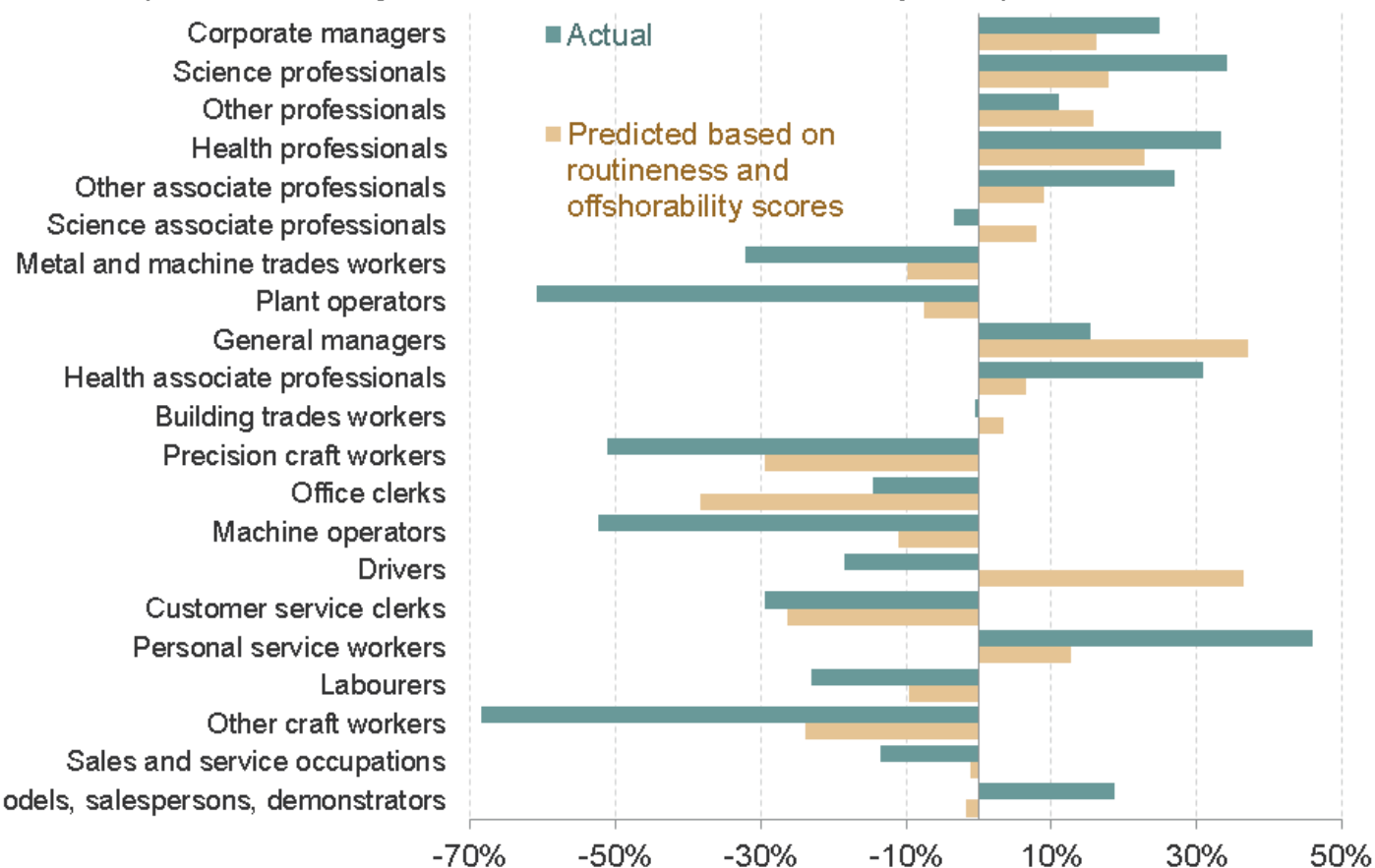
2. The potential drivers of hollowing out

Technology and the automation of routine tasks is frequently cited as a key driver

- Much analysis of job polarisation in developed economies has explored the '**routine-biased technological change**' (RBTC) hypothesis: the idea that declining, mid-skilled occupations are those that are most 'routine' and therefore easily replaced by computers (Autor et al, 2003; Goos & Manning, 2007; Goos et al, 2014)
- Recent research has shown that the 'routineness' of jobs is a good explanation for changing employment structures in 16 Western European countries between 1993 and 2010, with the 'offshorability' of jobs (how easily they can be moved abroad) also tested but much less important (Goos et al, 2014)
- We have replicated this analysis for the UK in isolation, and through to 2014...

A strong link between changes in the UK's occupational structure and computerisation

Actual and predicted changes in the share of hours worked by occupation, UK, **1993-2014**



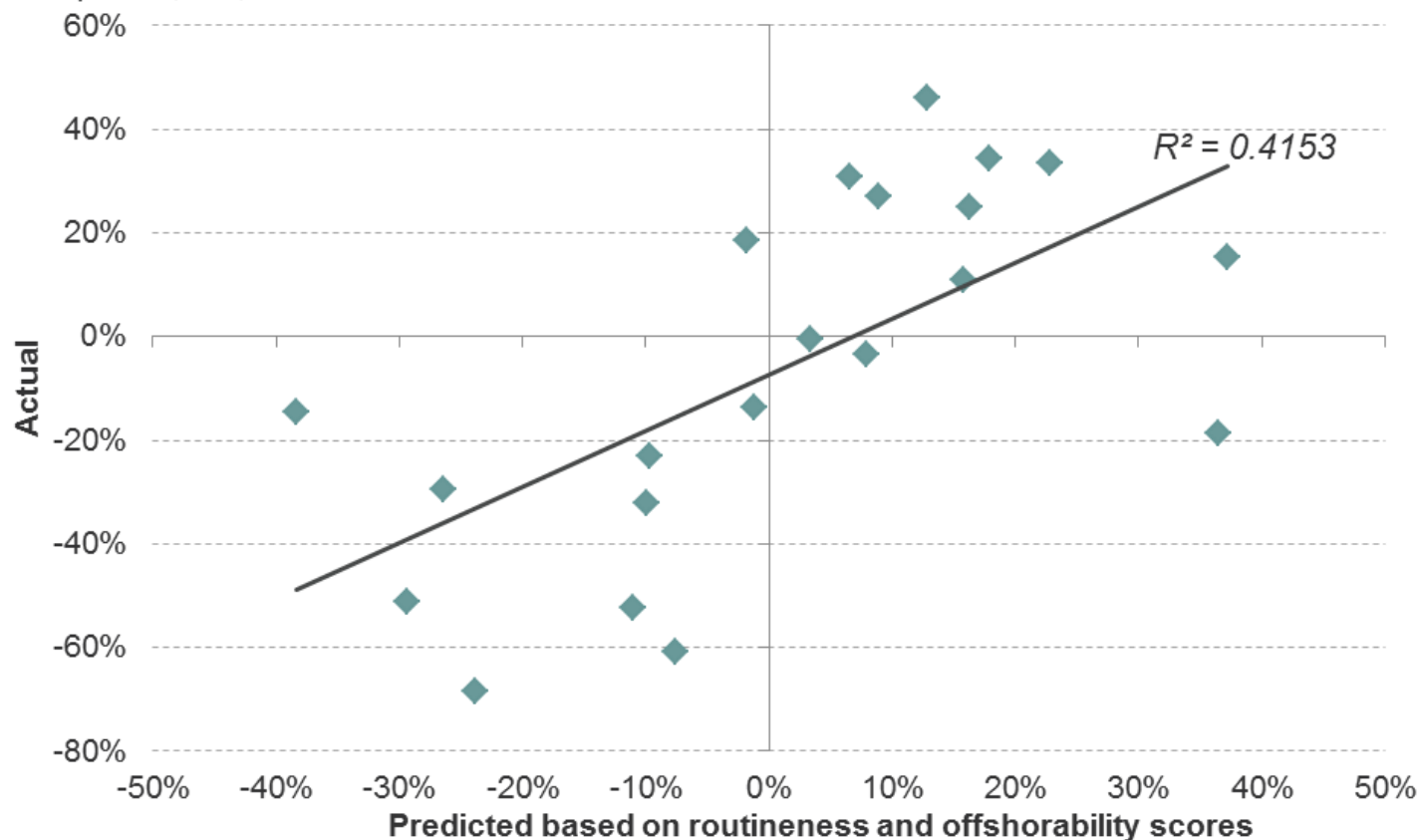
We assign external 'routineness' and 'offshorability' scores to occupations, and explore the relationship between these metrics and employment shifts

Our model has slightly stronger predictive capability than Goos et al's (which referred to 16 countries, up to 2010), with 'routineness' a far stronger predictor than 'offshorability'

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

A strong link between changes in the UK's occupational structure and computerisation

Relationship between actual and predicted changes in the share of hours worked by occupation, UK, **1993-2014**



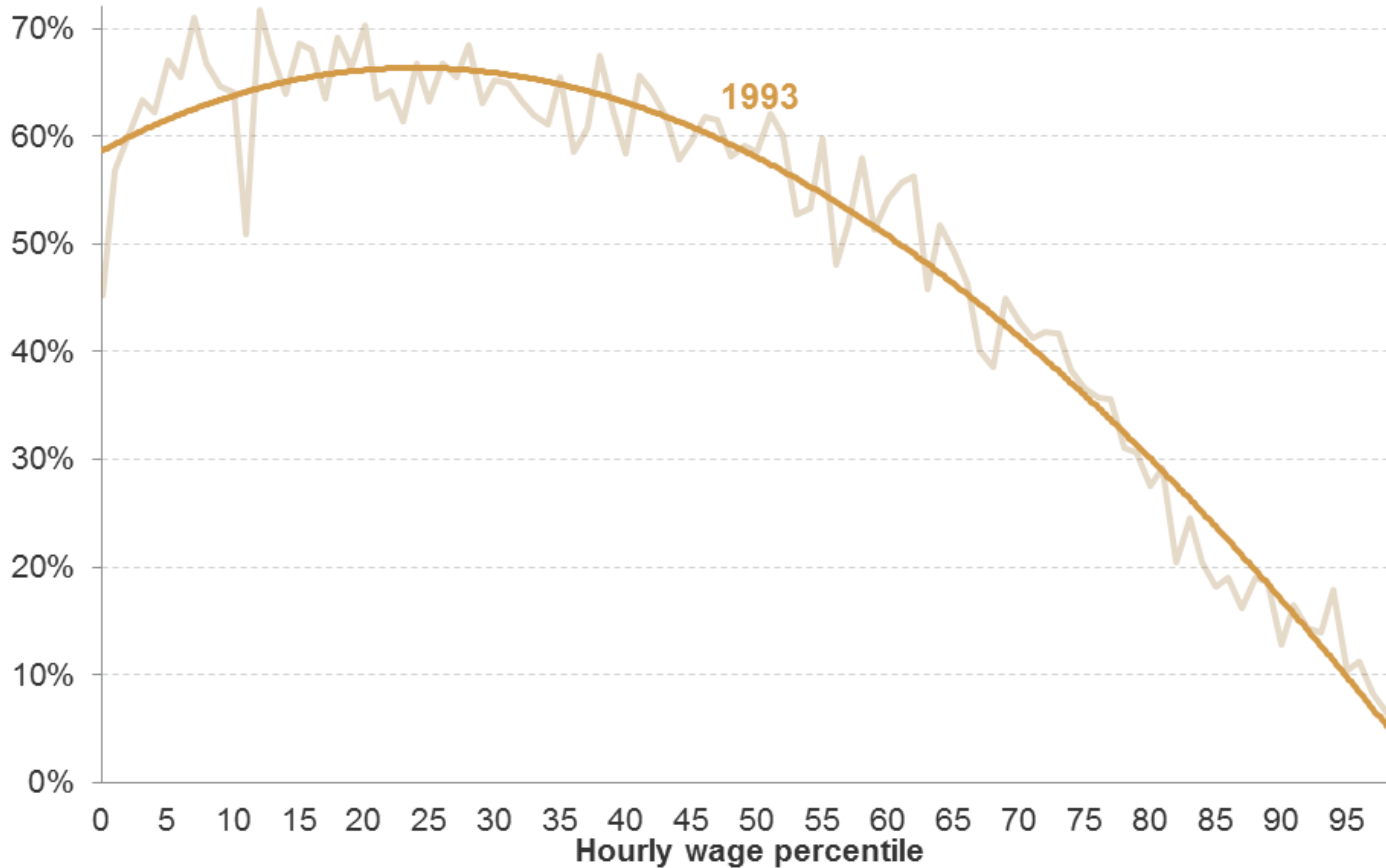
This suggests that technological change has played an important role in the UK's changing job structure over the past two decades

The strongest relative declines in manual trades and more routine office jobs shown in previous figures attest to this – these are the roles most at threat from computerisation

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

But how do 'routineness' and hollowing out relate?

% of jobs that are 'routine', by wage percentile

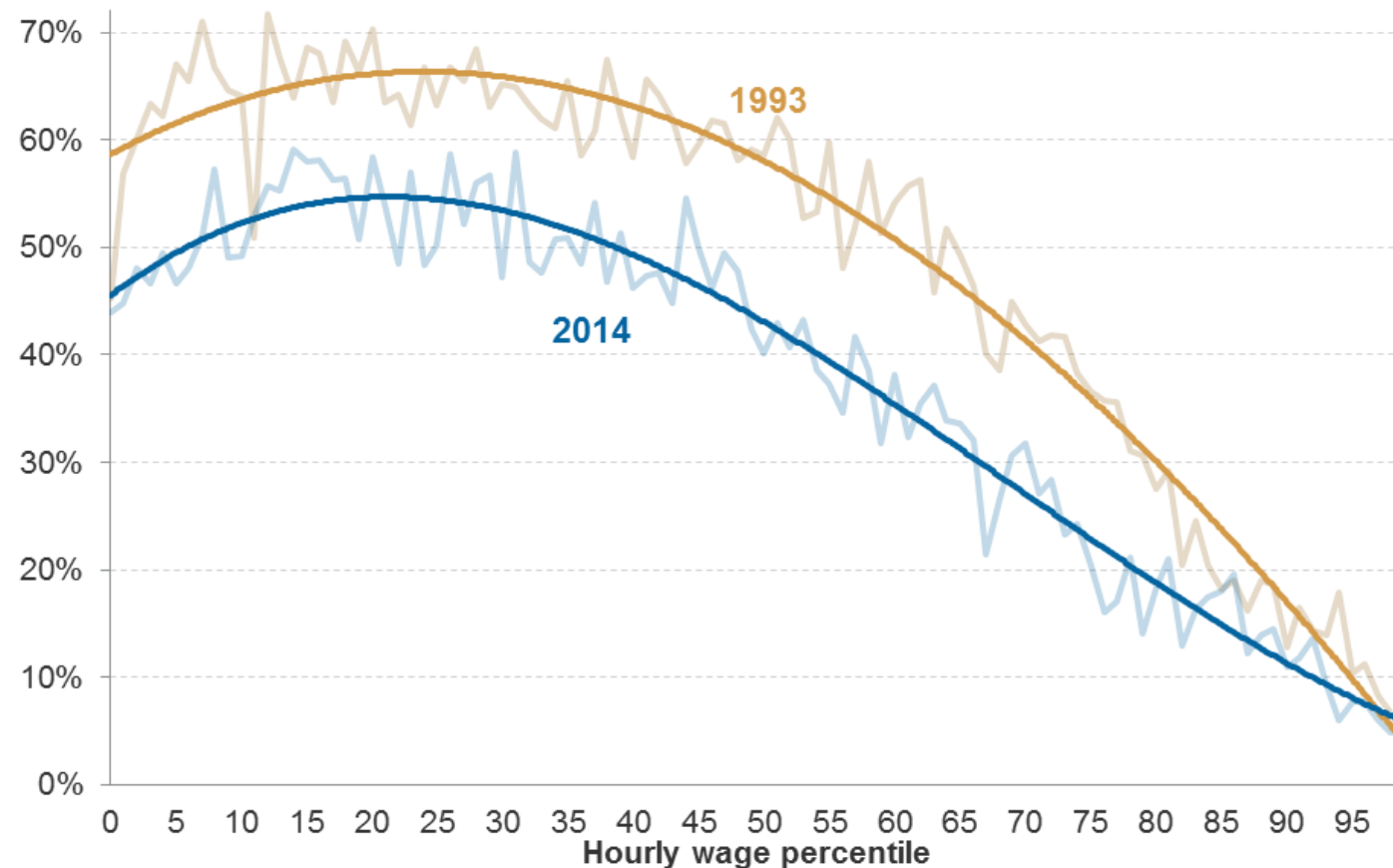


As a mirror image of falling employment shares, jobs of above-average 'routineness' are concentrated in the middle and bottom of the pay distribution

Notes: See annex for methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

But how do 'routineness' and hollowing out relate?

% of jobs that are 'routine', by wage percentile

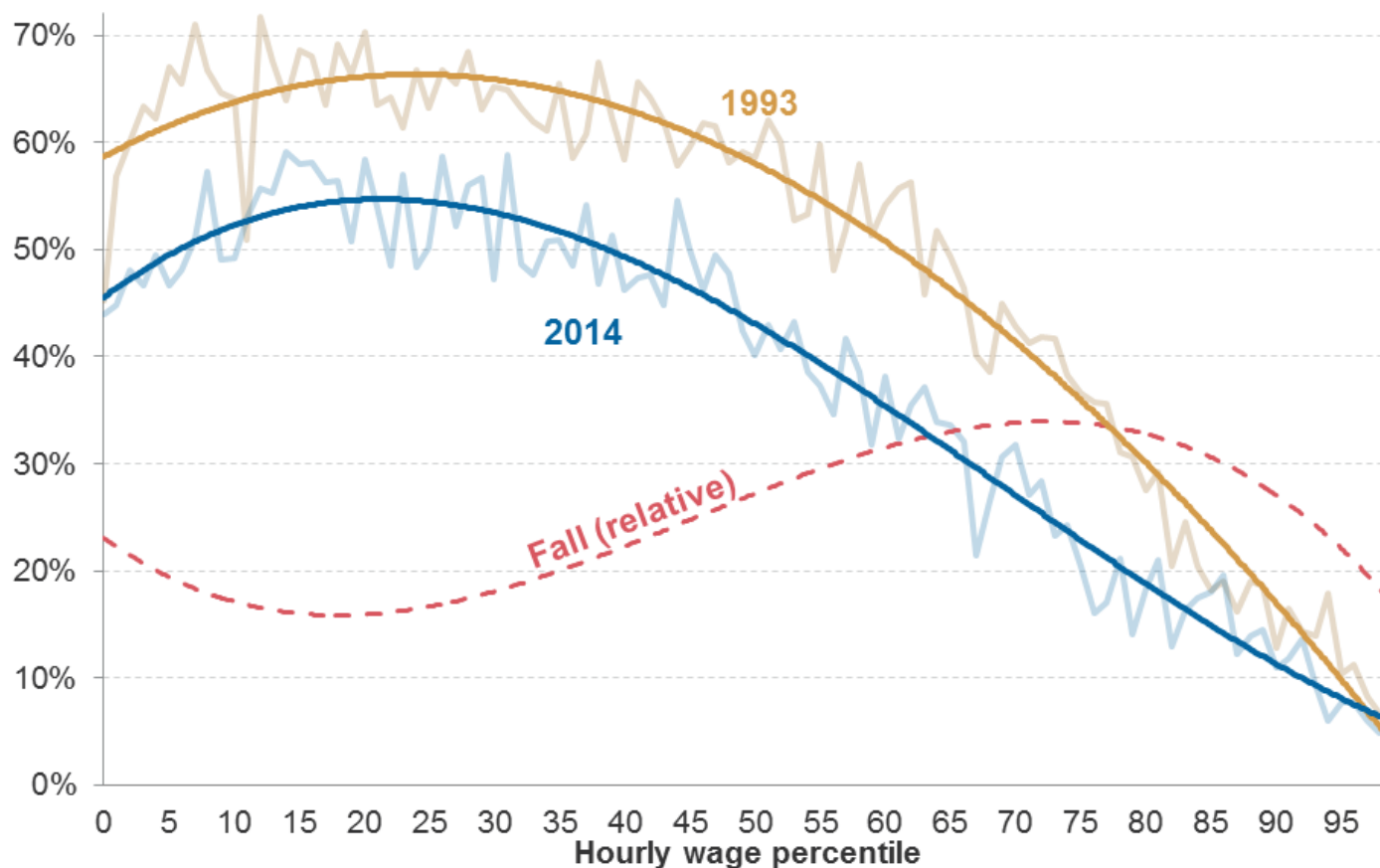


And the employment share of these routine jobs has fallen over time, with the largest absolute falls in the middle, helping explain the earlier 'U-shape'

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

But how do 'routineness' and hollowing out relate?

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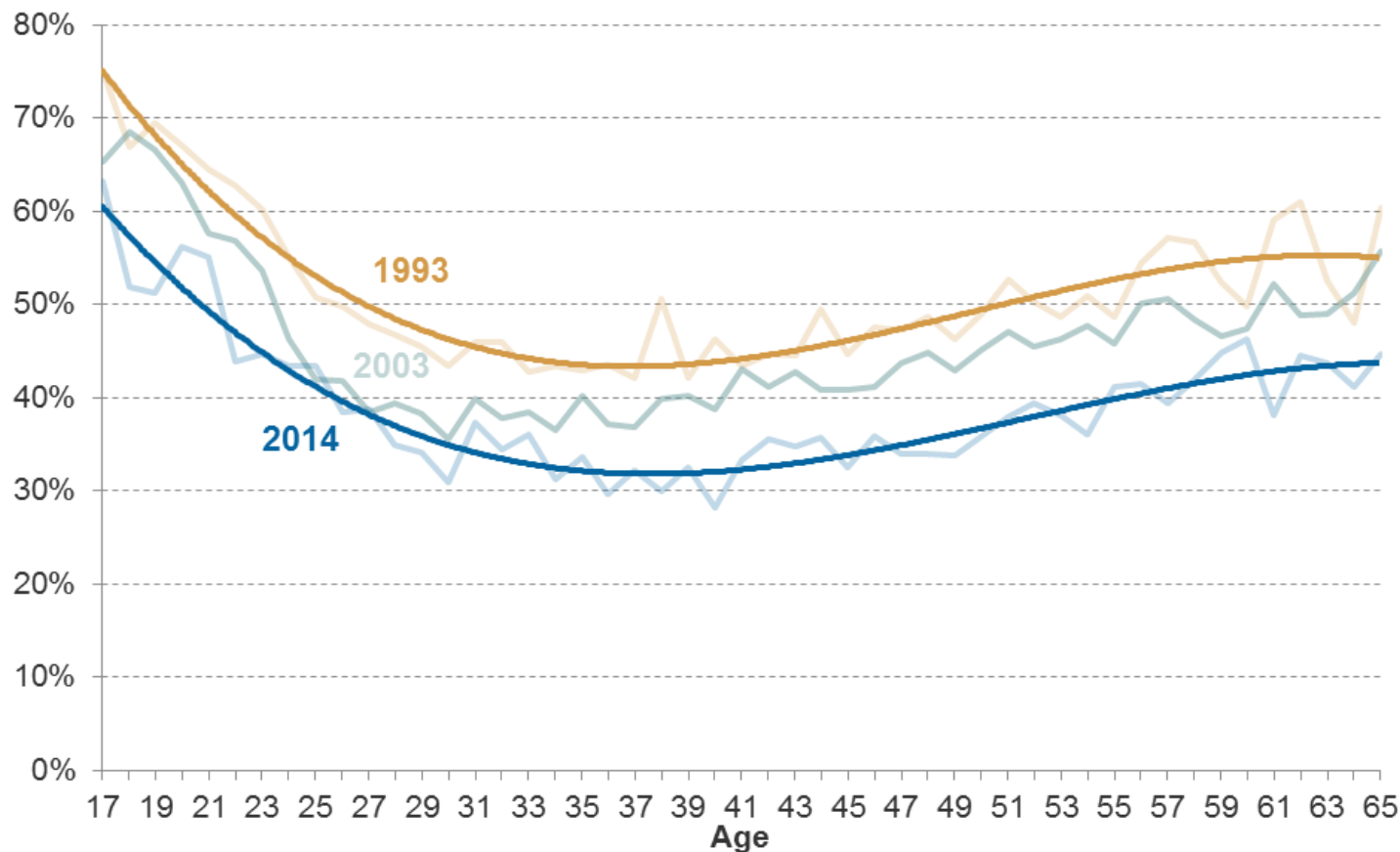
But there is some very tentative evidence that mid- to high-paying routine jobs are most at risk

This may be because low-paying routine jobs will – all else equal – be less profitable to automate (Feng & Graetz, 2015), though this theory requires further empirical exploration

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

And what can this tell us about the prospects of current (and future) cohorts?

% of employees in 'routine' jobs, by age



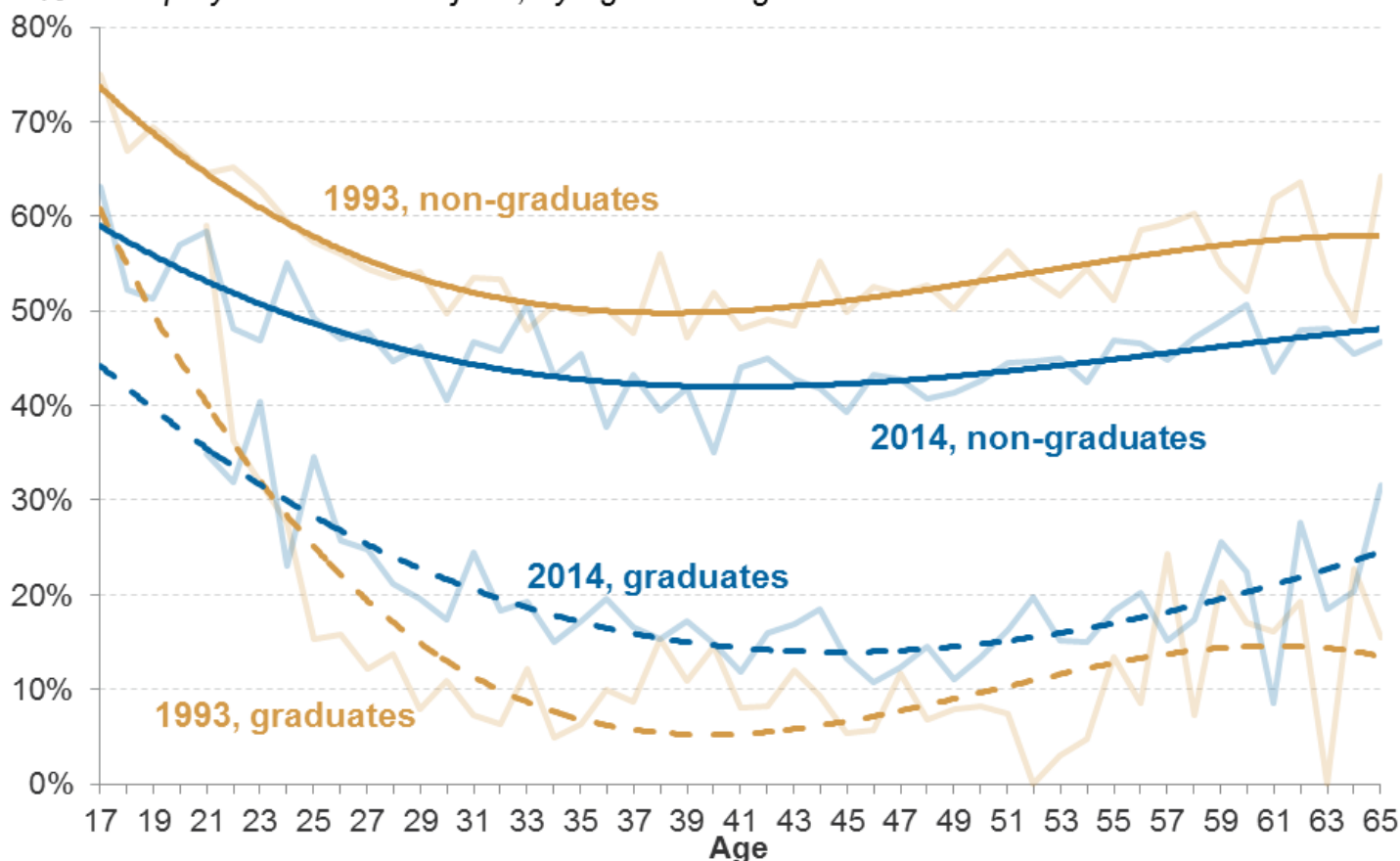
If 'routineness' is a good predictor of future employment shifts (Frey & Osborne, 2014), what might be the implications and who might be most affected?

One way to look at this is by age. Young people (stripping out students) are most likely to be in routine jobs, and this appears to hold over time

Notes: Full-time students excluded. The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

And what can this tell us about the prospects of current (and future) cohorts?

% of employees in 'routine' jobs, by age and degree status



And while the number of routine jobs has fallen overall at every age, this isn't true for graduates

Graduates are far less likely to be in routine occupations, but this gap has shrunk as graduate numbers have grown

Notes: Full-time students excluded. The final quarter of 2014 is not included because data was not available at the time of analysis. See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

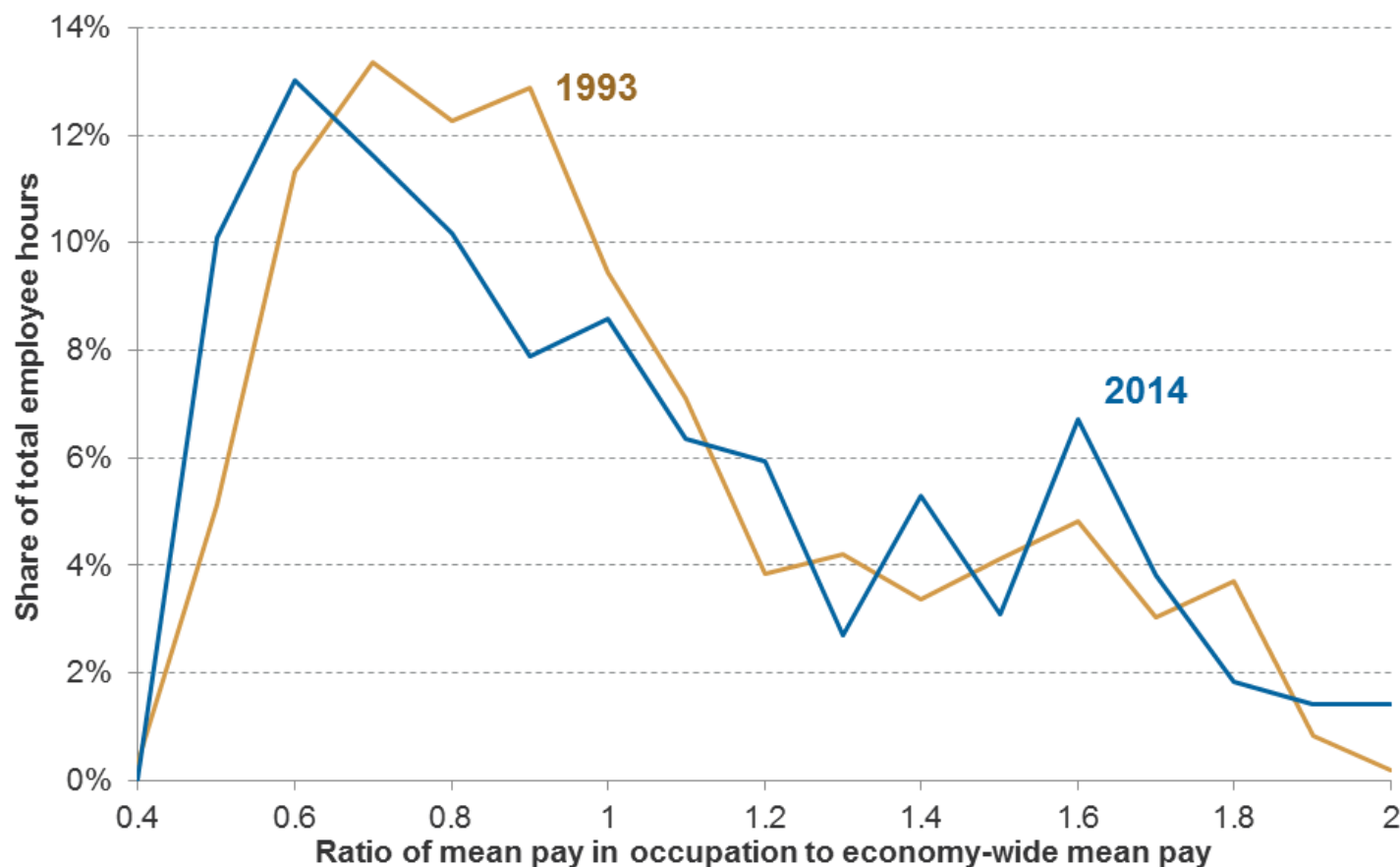
Don't just blame the robots – technology is not the only factor in occupational polarisation

- Many have highlighted that **occupational polarisation has not led to corresponding wage polarisation** (wages changing in line with employment shares) – which we would expect if demand-side factors like RBTC were the only driver of changing employment structures (Holmes, 2010; McIntosh, 2013; Mishel et al, 2013).
- Major proponents of the RBTC theory have themselves been vocal in emphasising its limitations and uncertainties (see Konczal, 2015)
- **Supply-side factors are also likely to be important** – including upskilling of the workforce, female labour market participation, immigration and welfare reform (McIntosh, 2013; Salvatori, 2015)
- And other more localised factors – such as **demographic changes and the cyclical collapse in the construction industry** – will have had an impact on occupational changes, as previous figures have indicated

3. The significance of these trends: does polarisation matter?

There is some, but limited, evidence of job polarisation driving wage polarisation

Occupational pay distribution: distribution of employment by average pay in occupation



Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. 1993 analysis based on SOC 1990 (3-digit); 2014 analysis based on SOC 2010 (4-digit). See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

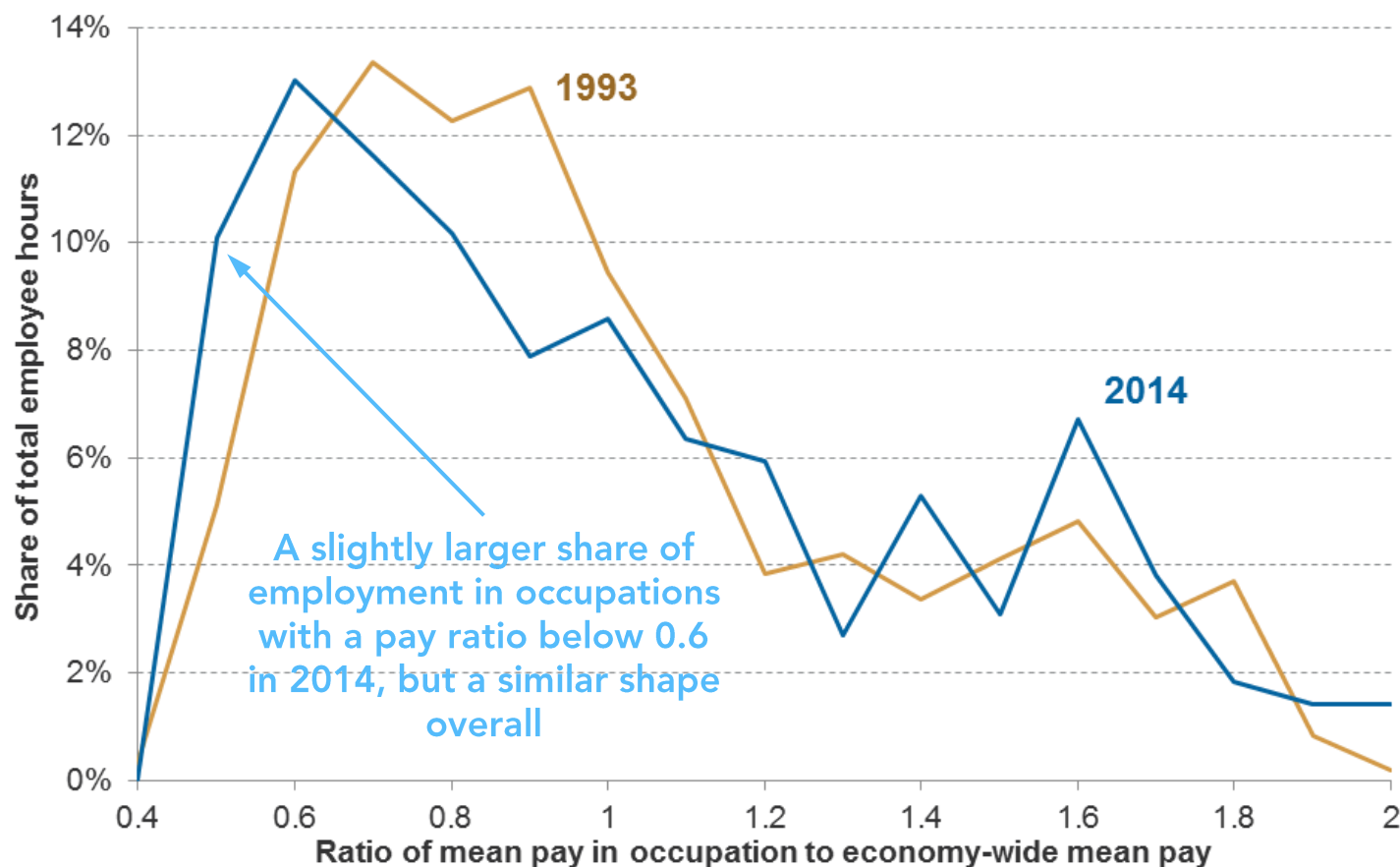
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It is often assumed that a polarising labour market has been the main driver of rising wage inequality – with more low- and high-paid occupations increasing the gulf between the two

However, research has demonstrated that while a shift in the UK's job structure has played a role in lower wage growth for low- and middle-earners, this is only one part of the story (Holmes & Mayhew, 2012)

There is some, but limited, evidence of job polarisation driving wage polarisation

Occupational pay distribution: distribution of employment by average pay in occupation



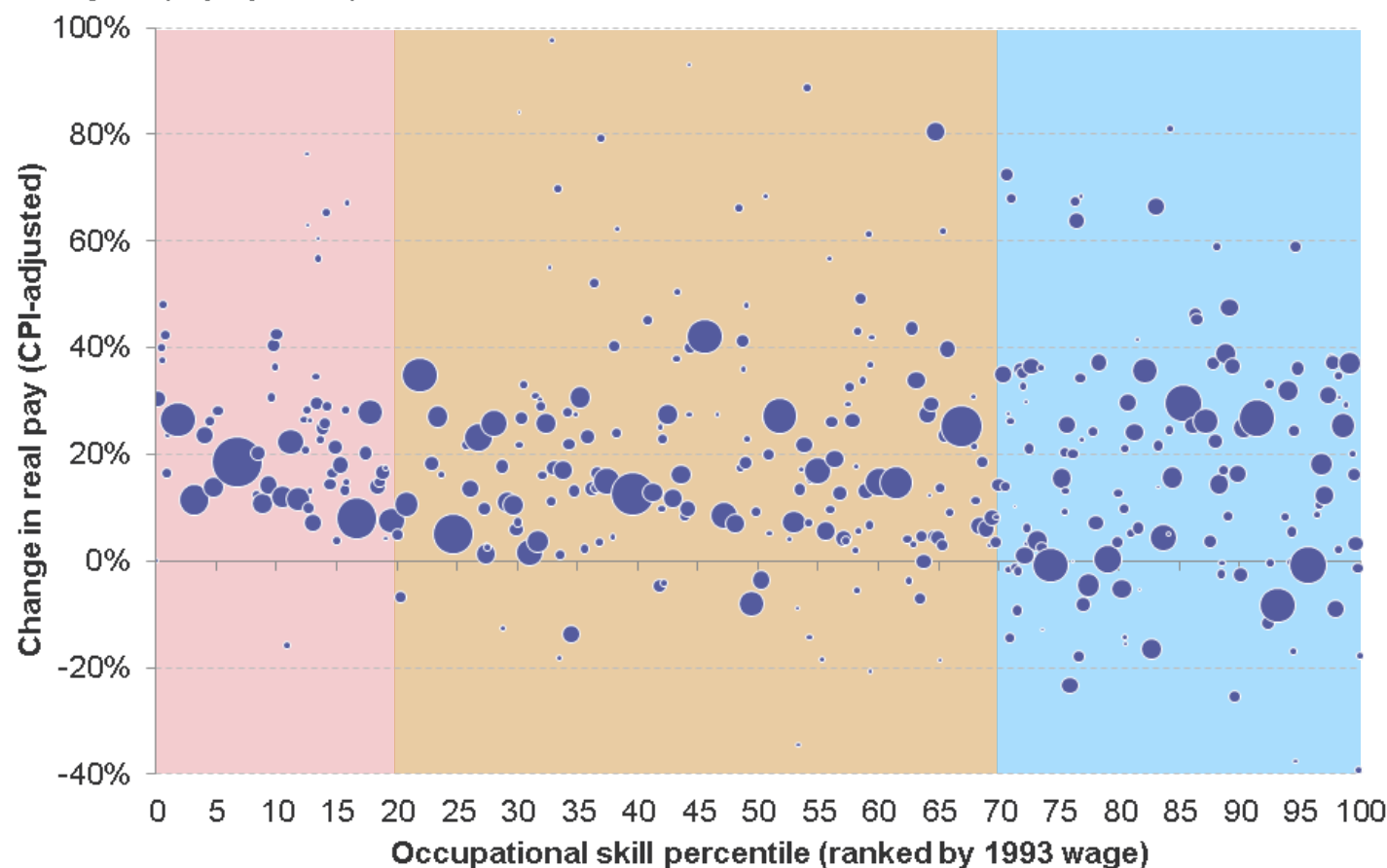
In line with other research, we find some 'skewing' of pay across occupations, but not much

The fact that job polarisation hasn't driven significant wage polarisation will reflect the changing wage structure of jobs over time: other occupations can move into the middle as initially mid-skilled jobs decline, or completely new jobs can be created (e.g. to support emergent technologies)

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. 1993 analysis based on SOC 1990 (3-digit); 2014 analysis based on SOC 2010 (4-digit). See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

With low-, mid- and high-skilled occupations experiencing similar wage growth

Change in pay by occupation: **1993-2014**



*This doesn't mean that wage inequality hasn't increased over the past two decades, but that much of the growth has been **within** occupations (e.g. between age groups, regions, or sectors) rather than **across** them (Mishel et al, 2013)*

Therefore occupational employment trends provide only partial insights into overall wage trends

Notes: The final quarter of 2014 is not included because data was not available at the time of analysis. Other studies have found differential wage growth by skill level in some periods (McIntosh, 2013). See annex for other methodological details. Source: Resolution Foundation analysis of Labour Force Survey, ONS

Nonetheless, hollowing out may offer insights for worker mobility and skills policy

- Technological advancement is predicted to continue to drive occupational change (Frey & Osborne, 2014): what are **the long-term career prospects for those workers, particularly young people, currently entering 'routine' jobs?**
 - What happens to those workers that are displaced?
- Has the decline of traditional, mid-skilled jobs affected **progression from entry-level jobs in certain sectors?** (McIntosh, 2013)
- How can our **education and skills system adapt to the UK's changing jobs structure?**

Annexes

Methodology: *calculating changing occupational employment shares*

Our approach to calculating changing occupational employment shares draws on established methods, and is very similar to that of previous Resolution Foundation analysis (Plunkett & Pessoa, 2013 – see this report for a more detailed account of our methods). In particular:

- We focus on changes in working hours within occupations in the main, rather than changes in worker numbers, as a more granular measure of overall employment shifts. We show *relative* changes in employment (i.e. scaled to the average growth across all jobs), meaning that some occupations or deciles with declining hours shares may still have experienced growth in absolute terms.
- We use wages (in either 1993 or 2002) as a proxy for an occupation's skill level, ranking occupations on a spectrum from low- to high-skilled on this basis. We apply the total share of working hours in each occupation in order to distribute occupations across skill deciles (or percentiles). This means that each decile shown in our figures represents 10 per cent of the labour share (in either 1993 or 2002). For consistency and ease of comparison, we only show results based on 1993 / 2002 wage and labour share profiles. However, we have tested the use of different 'base' years to generate skill deciles, producing very similar results.
- The data we use (the Labour Force Survey) contains three different occupational classification systems – switching from SOC 90 to SOC 2000 at the beginning of 2001, and SOC 2000 to SOC 2010 at the beginning of 2011. To measure shifting occupational employment shares over time, we used 'probabilistic matching' code shared by the Office for National Statistics, casting *backwards* from SOC 2010. This matching code is generated from dual-classified data and captures the likelihood of an occupation in one classification system corresponding with an occupation in another. Matching in this way suffers from a degree of error, however it is the best option available to us in the absence of consistently-coded data, and does not appear to substantially affect polarisation findings at the summary level (see Salvatori, 2015, for more details).

Methodology: *capturing the 'routineness' and 'offshorability' of occupations*

In exploring the links between job polarisation and the 'routineness' and 'offshorability' of different occupations, we use the method set out by Goos et al (2014):

- The less significant 'offshorability' measure is replicated from Blinder & Krueger (2013). The measure of 'routineness' is the Routine Task Intensity (RTI) index favoured by Autor & Dorn (2013).
- The RTI index is based on assessments of the routine, manual and abstract task content of different occupations in an international classification index (ISCO 1988). One again, we use a 'probabilistic matching' process to relate this classification system to UK classifications.
- We use the scores calculated by Goos et al for 21 high-level occupational classes. These scores are normalised to have a mean of zero. For example, office clerks have the highest RTI score in their data, at 2.24, while managers of small enterprises ('general managers') have a score of -1.52.
- Where we classify jobs as either routine or non-routine, we use a definition of 'RTI score greater than zero', which encompasses 10 of the 21 occupational classes.

Methodology: *modelling the importance of 'routineness' in explaining job polarisation*

Our model of the relationship between an occupation's 'routineness' and 'offshorability' and its changing labour share exactly replicates a model previously constructed by Goos et al (2014) which was applied to 16 Western European countries over the period between 1993 and 2010. Their paper, and the data and programme files they have generously made publicly available, provide further details on this model.

We replicate the model summarised in Table 3 (Column 1) of the paper, for the UK only and applying to the period 1993-2014. A summary of our model is as follows:

Estimating labour demand, 1993-2014, UK	Dependent variable: Log(hours worked/1000)
Linear time trend interacted with:	
RTI ('routineness') score	-1.01*** (0.229)
Offshorability score	-0.008 (0.260)
Observations	4,124
R-squared	0.970
R2_adj	0.966

Notes: Point estimates (and standard errors in parentheses) have been multiplied by 100. Includes occupation-industry and industry-year fixed effects. Standard errors are clustered by occupation-industry. *** p<0.01, ** p<0.05, * p<0.1. Source: Resolution Foundation analysis of Labour Force Survey, ONS

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