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What a drag: The chilling impact of unemployment on real wages

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Abstract

Real wage growth in the UK labour market, since around 2003, has slowed down and stagnated. In this paper, we document the nature of real wage changes across the wage distribution over the last three decades, showing that the recent period of stagnant real wage growth represents a distinct break of trend that pre-dates the onset of recession. We explore whether unemployment has become a stronger moderating influence on real wage growth since the trend break and document, using aggregate economy-wide data and regional panel data, that real wage-unemployment sensitivities have become stronger in the period from 2003 onwards.

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Executive summary

In the years following the financial crash and economic downturn of 2008-09, the UK labour market has not responded as might have been expected. In contrast to recessions of the 1980s and 1990s, real wages have fallen rather than simply levelling off and, relative to the magnitude of the economic contraction, unemployment has risen by less than predicted. While wage trends are affected by a number of economic factors, these two surprising outcomes are likely to be connected. Indeed, however painful falling wages may be, it is important to note that they may have been instrumental in preventing a much larger increase in unemployment. But the factors driving these trends remain unclear and the extent to which they represent a genuine change in the relationship between unemployment and pay has important implications for wage growth during the period of economic recovery.

So soon after the event, it would clearly be foolhardy to assume that the relationship in place from 2008 represents some kind of 'new normal'. But there is some evidence to suggest that real wage growth entered a new phase earlier in the decade: long before the onset of recession.

A general picture of steady real wage growth dominated the UK labour market through the 1980s and 1990s. Though wage inequality rose rapidly in this period – through much faster growth in wages at the top (90th percentile) as compared to the middle (50th percentile), and in turn faster growth at the middle compared to the bottom (10th percentile) – this was (mostly) in the form of differential positive trends in real wage growth rather than through periods of real wage falls in any particular part of the distribution. As highlighted by earlier Resolution Foundation publications however, at some point in the early 2000s – beginning around 2003 – this model of rising real wages coupled with rising wage inequality ended. Instead, real wages stagnated across the majority of the wage distribution, with only those at the very top continuing to experience real pay growth.

With his in mind, this paper seeks to do three things:

- First we determine whether the period from around 2003 represents a genuine break in trend real wage growth;
- Having established that it does, we secondly consider whether unemployment has held back real wages from this point in a way that was either not present or was less marked in the period of real wage growth that came before; and
- Finally, in considering what this might mean during a period of economic recovery, we explore whether unemployment levels play a more important role in determining wage growth among low to middle earners than among higher earners, and the extent to which future falls in unemployment could therefore promote pay growth for such workers.

In order to boost our sample size, we look at both the national and regional level, identifying the same trends in both instances.

Documenting the nature of real wage changes across the wage distribution over the last three decades we confirm that the recent period of stagnant real wage growth represents a distinct break of trend that pre-dates the onset of recession. Between 1986 and 2003, real wage growth at the middle (the median) of the distribution rose by 1.6 per cent a year. Since 2003, median real wages fell by 0.3 per cent a year (flat-lining in the first part of this period and falling following the onset of recession). Overall, the rise in unemployment explains just under half of this slowdown. That is, of the overall 1.9 percentage point slowdown in median real wage growth (from +1.6 per cent to -0.3 per cent), increased unemployment accounted for around 0.8 percentage points.

Using regression analysis, we find that there has been an increased sensitivity of real wages to unemployment in the period from 2003. The increased correlation is strong: while a doubling of unemployment at any point in the period between 1986 and 2002 would have been expected to drive down median real wages by 7 per cent, it would have pushed typical pay down by 12 per cent between 2003 and 2010.

The real wage-unemployment sensitivity in the period from 2003 to 2010 is such that the increase in unemployment that took place between its low in 2005 (4.6 per cent) and its peak in late-2011 (8.3 per cent) would be associated with a reduction of around £2,100 in the annual earnings of someone working full-time at the median hourly rate of pay.[1] In the earlier period, however, the same magnitude of increase in unemployment would have reduced median earnings by just £1,300 (in 2011 prices). The increased sensitivity therefore equates to around an extra £800 a year wage loss in the more recent period compared to what would have occurred in earlier decades.[2]

This paper has not looked at the potential drivers for this increase in real wage-unemployment sensitivity, but it may, at least in part, be a consequence of the weakening of labour market institutions such as the coverage of trade unions. It may also reflect the impact of active welfare policies which have made the unemployed a closer substitute for those in work.

Looking across the earnings distribution we see an almost universal increase in sensitivity between the two periods. It is worth noting however, that in both the earlier and the later period, the impact of unemployment on real wages is more pronounced for low to middle earners (in the 20th to 50th percentiles of the distribution) than for those in the top half of the distribution.

Of course, these results do not prove that the sensitivity of real wages to unemployment changed in 2003 – the shift is likely to be more gradual and it is difficult to pin down the precise date at which it occurred. Nevertheless, it is clear that the relationship between unemployment and real wages looks different in the current period than it did coming out of previous recessions. This has several important implications going forward:

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[1] Median hourly pay among full-time and part-time employees was £11.14 an hour in 2011 (ONS, *Annual Survey of Hours and Earnings*).

[2] More straightforwardly, a hypothetical doubling of unemployment would reduce median earnings by £1,600 a year in the earlier period and by £2,600 a year in the later one, meaning that the increased sensitivity would produce an additional annual loss of £1,000.

- First, if the same real wage-unemployment relationship remain in place, higher paid workers are likely to continue to see a modest upward trend in real wage growth with flat unemployment, but real wage growth for low and middle earners will not return to significant positive territory until unemployment starts to fall significantly – probably below the levels (of between 4 and 6 per cent) recorded in the period from 1999 to 2007.

- Secondly, in contrast to the view that there has been a large degree of labour hoarding that can generate a productivity boost when growth returns, any economic recovery will need to feed through into jobs growth before it boosts wages. Higher pay will only be generated when and if unemployment falls significantly.

- Thirdly, while pay will respond if and when unemployment falls significantly, especially for low to middle paid workers, the kind of sustained real wage growth recorded through the 1980s and 1990s will not return if unemployment simply falls back to its pre-recession norm. This is likely to allow policy makers to keep interest rates lower than in the past for similar levels of unemployment without fear of an inflationary wage-price spiral.

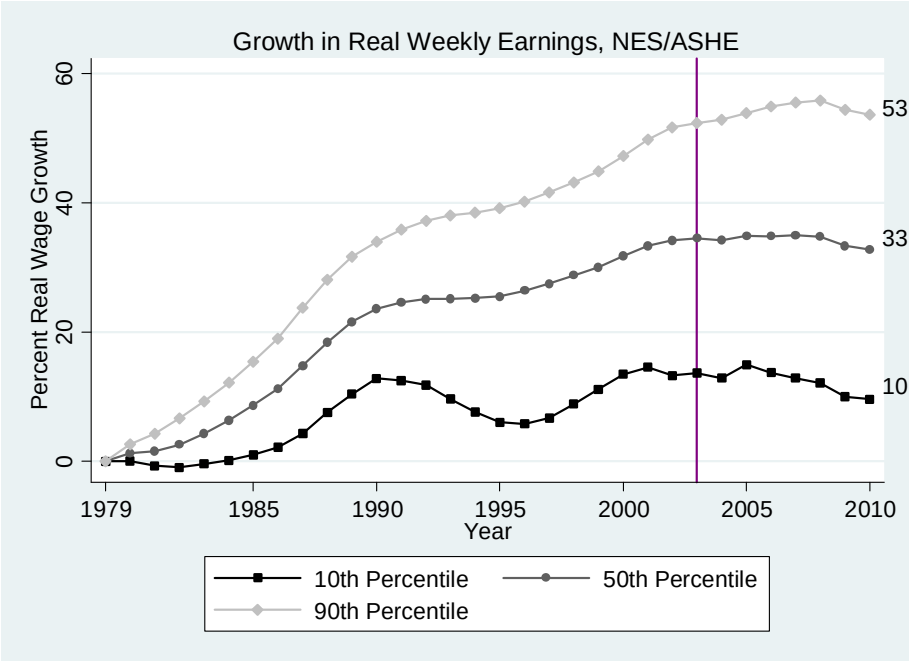
- Finally, if government wishes to boost the earnings of low and middle earners it must focus not just on policies that influence pay directly, but also on driving down levels of unemployment. The increased sensitivity of real wages to unemployment means that such a focus becomes even more important than it has been in previous years.

Introduction

At the heart of the work being undertaken by the Commission on Living Standards hosted by the Resolution Foundation is a recognition that, following a sustained period of almost continuous growth, the real wages of ordinary workers flat-lined towards the end of the last period of economic expansion, before falling during the recession. Between 2003 and 2008, real-terms pay stagnated for all parts of the earnings distribution outside of the very top. A range of research reports have sought to better understand the causes and implications of this trend in order to ensure that the benefits of future economic expansion are more evenly shared across society.[3]

This recent slowdown in wage growth is shown in Figure 1, which details real weekly wage growth from 1979 for all workers aged 16-60.[4]

Figure 1: Cumulative Growth at the 10th, 50th & 90th percentiles of the weekly real wage distribution: GB 1979-2010



Source: ONS, New Earnings Survey & Annual Survey of Hours and Earnings

[3] See for example, Holmes C & Mayhew K, *The changing shape of the UK job market and its implications for the bottom half of earners*, Resolution Foundation, March 2012; and Pessoa JP & J Van Reenen, Decoupling of Wage Growth and Productivity Growth? Myth and Reality, Resolution Foundation, February 2012.

[4] The data is drawn from the most reliable source of wage levels, the Annual Survey of Hours and Earnings (ASHE) and its predecessor the New Earnings Survey (NES). The data is reported by employers and covers around 1 per cent of the working population. An as of yet unresolved issue is that, while the much smaller samples in the Labour Force Survey do seem to show a slowdown in real wages relative to trends from earlier, this is less marked than in the NES/ASHE data.

It is evident from the chart that, in the middle of the distribution (the 50th percentile), the onset of the real wage slowdown pre-dated the recent deep recession. At some point in the early 2000s – beginning around 2003 – the picture of rising real wages coupled with rising wage inequality through faster real wage growth higher up the wage distribution, which had been the norm in earlier decades, ended. It is interesting that this shift took place during a period of economic growth, when the UK experienced its tightest labour market since the 1970s. That said, Figure 1 also makes the impact of the recent recession clear, with actual falls in real wages occurring across the wage distribution from 2009 onwards.

This paper offers a first exploratory look at the role played by the wage restraining effects of unemployment in this period. A key aspect in studying this is to consider whether, and how far, a tightening labour market (working through higher employment or lower unemployment) could in due course have scope to improve pay and therefore living standards, with a particular focus on low to middle earning workers. We also seek to understand the somewhat surprising performance of the labour market during the downturn, characterised by relatively stable employment and falling real wages.

We start in Section 1 by briefly considering the theoretical and empirical case for such a relationship between unemployment and real wages, before turning in Section 2 to the specifics of the recent UK context, focusing on economic performance, labour market outcomes and real wage trends. In Section 3, we report our findings on the sensitivity of real wages to unemployment and present empirical estimates studying whether there is evidence of changes through time. We offer some preliminary conclusions in Section 4.

By way of context, we discuss in Appendix 1 general changes in labour market performance in the UK in recent decades, with a focus on secular shifts that have occurred for different groups of workers. Throughout the paper, our analysis is based on data from the New Earnings Survey/Annual Survey of Hours and Earnings (NES/ASHE). Full details are provided in Appendix 2. Finally, we present an example of how to interpret the findings of our regression analysis in Appendix 3.

Section 1 - The theoretical and empirical link between wages and unemployment

The Phillips Curve and NAIRU

The recognition that unemployment can act to restrain wages dates back to the classical economists, (for example, Marx's discussion of the reserve army of labour). In modern economics, the Phillips Curve[5] suggested a stable relationship existed between unemployment levels and wage growth, with higher unemployment restraining nominal (not adjusted for inflation) wage changes. However, this relationship was primarily empirical, with little theoretical foundation.

In simple terms, we might expect higher unemployment to restrain wages in three potential ways.

- First, in times of high unemployment workers have a reduced scope to push for higher wages because of alternative better offers from another firm.
- Secondly, because workers fear job loss more when there are so many more people to compete against to get a replacement job, they may cede wages to hold on to a job.
- Finally, new job openings are flooded with applicants and firms can secure well qualified labour at lower wages than in better times.

However, evidence suggests that employed workers and the unemployed are *not* close competitors. Workers losing their jobs are disproportionately drawn from the ranks of the lower paid.[6] Even on their return to work, wages are substantially lower than prior to job loss,[7] especially among those enduring longer periods of unemployment, and part of these wage losses persist for very long periods. Those suffering from longer periods of unemployment also struggle to maintain stable employment, suffering further periods of unemployment even 15 or more years later.[8] Part of the permanent loss of earnings stems from this instability of later employment or repeat job loss. [9]

This all suggests that many unemployed struggle on the margins of the labour market rather than acting as close substitutes for those in stable work. The more concentrated unemployment is on individuals (via long-term unemployment), regions or skill groups, the more likely it is to reduce this competition effect and therefore the downward pressure on wages.[10] Hence the sensitivity of wages for workers already in employment has regularly been found to be low.

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[5] Phillips A, "The Relation Between Unemployment and the Rate of Change of Money Wages in the United Kingdom", 1861-1957, *Economica*, 1958, 25, 283-99

[6] Gregg P, Scutella R & Vittori C, *Earnings Mobility and Inequality: An Integrated Framework*, Centre for Market and Public Organisation, mimeo, July 2012

[7] Nickell S, Quintini G & Jones P, "A Picture of Job Insecurity Facing British Men", *Economic Journal*, 2002. 112, 1-27

[8] Gregg P, "The Impact of Youth Unemployment on Adult Unemployment in the NCDS", *Economic Journal*, 2001 111, F626-53

[9] Gregg P & Tominey E, "The Wage Scar From Male Youth Unemployment", *Labour Economics*, 2005, 12, 487-509

[10] Nickell S & Bell D, "The Collapse in Demand For the Unskilled and Unemployment Across the OECD", *Oxford Review of Economic Policy*, 1995, 11, 40-62

Indeed, the empirical relationship described by the Phillips Curve broke down in the period of high inflation in the 1970s. The theoretical and empirical evidence instead suggested that unemployment regulates the rate of *real* wage growth – the mark up of wage growth over inflation – rather than nominal wage changes. This meant that low unemployment was associated with not just higher wage growth but a situation where wage growth exceeded productivity; leading to a slow but steady upward wage-price spiral. This approach termed the level of unemployment that holds wage growth and inflation steady as the Non-accelerating Inflation Rate of Unemployment (NAIRU),[11] or the sustainable rate of unemployment by politicians.

Recent developments

More recently, this debate has been revisited with Gali suggesting that the Phillips Curve has re-emerged in the US at least.[12] That is, with wage setting rigidities, the contention that unemployment restrains nominal rather than real wage growth *does* have plausible theoretical underpinning.

Other empirical work has studied the relationship between the level of wages and *local* unemployment, via the existence of the so-called 'wage curve'.[13] Sargan noted that the steady state (long run) solution to the Phillips' curve specifies that the level of wages depends on the level of unemployment.[14] Moreover, in US work, Hines, Hoynes and Krueger argue that a relationship between the levels of unemployment and (real) wage levels both fits the data better and has a better justified theoretical justification to show how unemployment can restrain real wages.[15]

[11] Layard R, Nickell S & Jackman R, *Unemployment*, 1991, Oxford University Press

[12] Gali J, "The Return of the Wage Phillips Curve", *Journal of the European Economic Association*, 2011, 9, 436-61

[13] See Blanchflower D & Oswald A, *The Wage Curve*, 1994, MIT Press; Blanchflower D & Oswald A, "An Introduction to the Wage Curve", *Journal of Economic Perspectives*, 1995, 9, 153-67; and the meta-study of Nijkamp and Poot, 2005.

[14] Sargan D, "Wages and Prices in the United Kingdom: A Study in Econometric Methodology", in Hendry, D. and K. Wallis (eds.) *Econometrics and Quantitative Economics*, 1964, Basil Blackwell

[15] Hines J, Hoynes H & Krueger A, "Another Look at Whether a Rising Tide Lifts all Boats", in Krueger, A. and R. Solow (eds.) *The Roaring Nineties: Can Full Employment be Sustained*, 2001, Russell Sage Foundation

Section 2 - The recent UK context

In the US, the real wages of a typical worker have not risen over the last 30 years, apart from the period of very low unemployment in the mid- to late 1990s. By contrast, in the UK we have been used to steadily rising typical real wages, outside periods of recession, that have increased broadly in line with the productivity growth of the economy.

In periods of recession output falls, but employment has tended to fall to a similar or slightly greater degree, leaving productivity broadly stable and in turn real wages broadly stable. As unemployment then falls back during recovery, growth feeds into wages to a greater degree than employment. This is the normal pattern that we have got accustomed to. Hence in the UK, as in other developed countries, the cyclical volatility of unemployment has been large relative to that of real wages, which has long puzzled economists.[16]

These patterns have looked radically different in the last decade, however. The UK has endured a very severe recession, but unemployment has not increased by as much as might have been expected. In contrast, real wages appear to have been more negatively affected than during previous downturns, with sustained reductions across the earnings distribution. In this section we consider these three trends in turn.

Economy

By historical standards, Britain has been experiencing not just a severe recession, but what some commentators refer to as a second Great Depression. Indeed, the fall in economic output in the recent recession was almost as large as the 1930s, but the recovery has been markedly slower. Figure 2 shows that output still lies some 4 per cent below peak levels four years on from the start of the recession, by the same stage, the 1930s economy was in a sustained recovery.

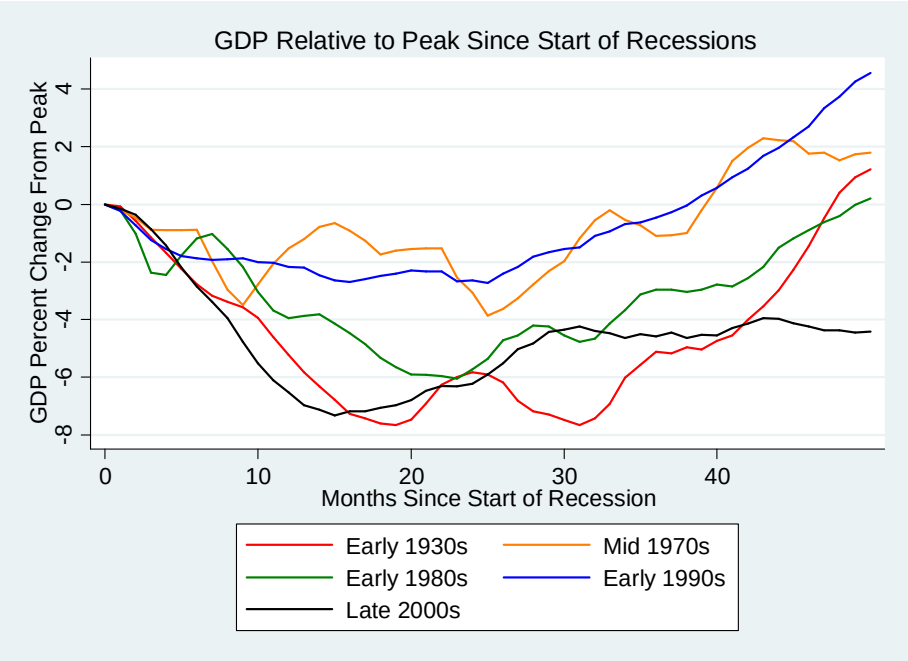
Employment

One possible reason why things may not feel like a Depression to some is that the loss of employment has been relatively modest. Figure 3 shows that just over 2 per cent of jobs have been lost in the current recession compared to around 6 per cent in the previous two recessions. Indeed, a jobs recovery started as soon as the economy showed some growth in late 2009 and has held up well in the long period of economic stagnation that started in the second half of 2010.

This means that productivity growth has stalled since the middle of 2006, which in historical terms is a remarkably sustained period. The UK thus has output about 6 per cent below that recorded in previous recessions and recoveries, but employment is 4 per cent higher – this 10 per cent productivity differential of producing less with more people is huge. Moreover, with cuts in employment resulting in 'productivity improvements' in the public sector, the gap appears to be entirely concentrated in the private sector.

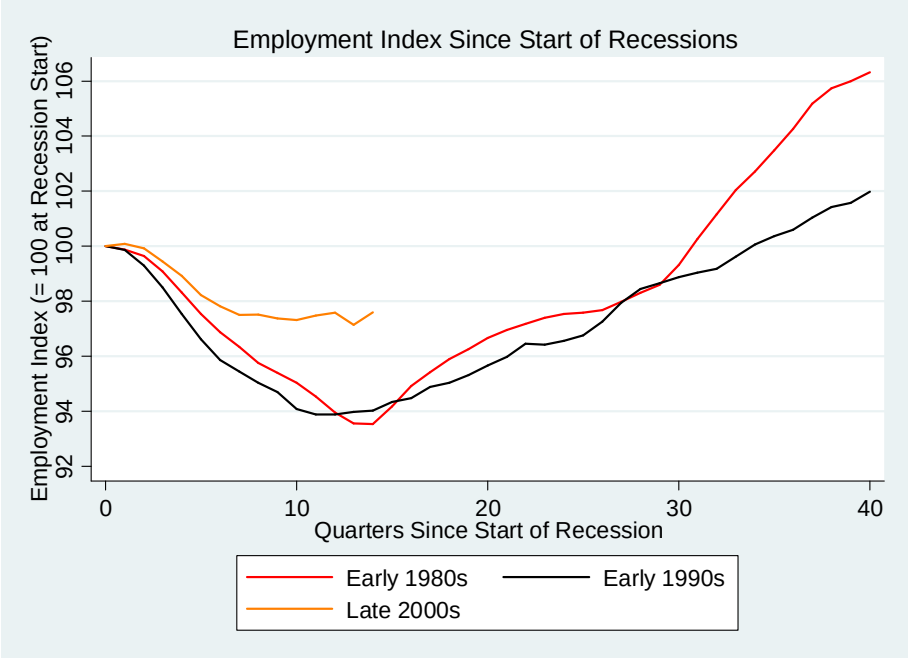
[16] See Pissarides C, "The Unemployment Volatility Puzzle: Is Wage Stickiness the Answer?", *Econometrica*, 2009, 77, 1339-69; and Kudlyak M, "Are Wages Rigid over the Business Cycle?", *Economic Quarterly, Federal Reserve Bank of Richmond*, issue 2Q, 2010, pages 179-199 for recent overviews

Figure 2: GDP relative to peak across selected recessions



Source: National Institute of Economic and Social Research

Figure 3: Employment levels from the start of the recession for 1980, 1990 and 2008/09 downturns



Source: National Institute of Economic and Social Research

Real wages

However, the story on real wages is different. There have been sustained real wage falls on a scale not seen since WWII, outside of the period of government imposed wage controls in the 1970s. The recessionary real wage falls have not just been associated with surge of price inflation in 2011 as both before and after the inflation push, real wage growth has been in negative territory. The latest data shows average weekly earnings rising by 1.6 percent while inflation measured by the RPI stands at 3.0 percent (average of three months to July 2012).

Furthermore, as was shown earlier in Figure 1, real wage growth stalled in the UK from somewhere around 2003, well before the onset of the recession, even though productivity growth still rose by over 6 per cent from then up to early 2008. Therefore, the UK has had a sustained period of flat followed by falling real wages, but employment levels have been sustained remarkably well through the recession.

Figure 1 is highly suggestive that a temporal break in real wage growth across the wage distribution occurred in the early 2000s. Indeed, as is shown in the left hand charts of Figure 4, if a linear trend is fit to the real wage growth trends over the full time period 1979-2010, it under-predicts up to 2003 and over-predicts afterwards. This is the case for the 10^{th}, 50^{th} and 90^{th} percentiles of the wage distribution, but is probably more marked for the 10^{th} percentile. If, however, a linear trend is fit to the real wage growth data only in the period up to 2003, as shown in the right hand charts of Figure 4, it fits the data much better (certainly in terms of the start and end points, although which side of the line 2002 falls is debatable).

This tends to suggest that real wage growth trended up positively, at a faster rate higher up the wage distribution thus raising wage inequality, up to 2003. After this, the labour market moves to a different pattern of real wage growth, where it has recently turned negative. The figure also suggests far greater cyclical variation of real wages among lower wage workers (i.e. at the 10^{th} percentile).

This pattern of growing wage inequality and a recent slowdown in wage growth is also shown in Table 1 where the greater magnitudes of the trends in the real wage growth distribution higher up the distribution can be seen. For the overall time period 1979 to 2010, the first column for each percentile shows that real wages grew on average by 0.45 per cent per annum for workers at the 10^{th} percentile of the wage distribution, 1.2 per cent per annum in the middle and 1.8 per cent per annum at the top. From 2003, however, a significant break in trend can be seen.

The second column specifications in each case allow the trend to differ between the 1979 to 2002 time periods and the period after 2003. Looking at each column, we see that for the earlier time period, real wage growth was 0.60 per cent a year at the 10^{th} percentile, 1.50 per cent at the 50^{th} and 2.17 percent at the 90^{th} percentile. The second row of the table suggests that post-2003 trend completely offset the previous growth for low paid (10^{th} percentile workers): that is, the negative 0.597 per year in 2003-10 is equal and opposite to what went before, leaving no real wage growth at all. Further up the earnings distribution sharp reductions in real wage growth rates are also observed, leading to very low net increases in real wages, at a quarter of one per cent a year for the 50^{th} percentile (i.e. 1.497 minus 1.245) and 0.8 per cent for the 90^{th} percentile (i.e. 2.172 minus 1.392).

Figure 4: Real wage trend predictions by percentile: GB 1979-2010 & 1979-2003

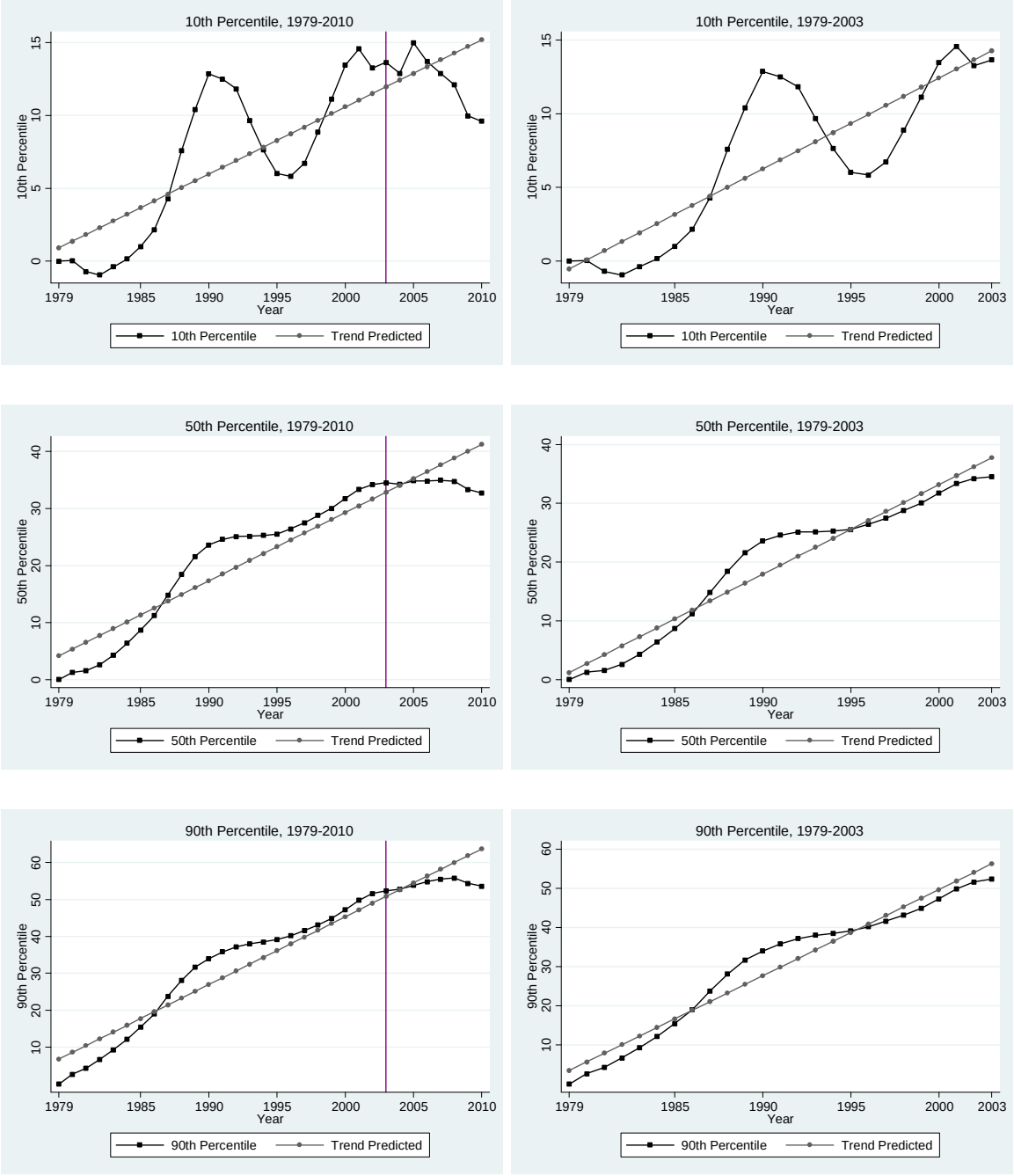


Table 1: Annualised per cent real wage growth trends: GB 1979-2010

	Real Wages					
	10th percentile		50th percentile		90th percentile	
Trend	0.450	0.597	1.191	1.497	1.829	2.172
	(0.073)	(0.106)	(0.081)	(0.100)	(0.094)	(0.118)
Year >=2003		-0.597		-1.245		-1.392
		(0.321)		(0.303)		(0.359)
Sample Size	32	32	32	32	32	32

Notes: Robust standard errors in parentheses.

Thus, from around 2003, the labour market experienced a shift away from positive real wage growth. In the next section, we move on to report some first results from estimating real wage-unemployment sensitivities from economy-wide and regional real wage equations between 1986 and 2010, investigating whether the empirical link between unemployment and real wage growth has changed in an important way.

Section 3 - Estimates of changing real wage-unemployment sensitivities

In Section 1 we summarised the theoretical debate about the relationship between unemployment and wages, describing changes in the empirical link over the last century or so. In Section 2 we considered the UK situation over the past decade, highlighting the fact that real wages have stagnated during a period of economic growth and fallen during the recent recession. In this Section, we investigate whether the UK experience has resulted from an increased sensitivity of wage setting to unemployment.

While it may well form part of the explanation for the trends we have observed from 2003, we cannot assume this to be the case: many other factors are likely to have affected wage growth over the same period.

It is possible, for instance, that it is the quite rapid wage growth among middle to high earners (and thus rising wage inequality) during the 1980s and 1990s, rather than the slowdown of the 2000s, which represents the break from the longer term trend. The pay restraints imposed by government in the 1970s are widely thought to have led to a build of wage pressure that was released after 1979, just as unemployment was rising and trade union influence was in decline (which is again widely thought to have led to reduced wage pressure, especially among low wage workers)[17] and a number of recent reports have also noted that an increasing share of GDP has flowed into profits rather than wages over the last decade.[18]

A further factor to consider in the last decade is the large scale migration from A8 countries from 2004, which may have placed extra downward pressure on wages. Note that such migration would be focused on areas of high job demand and hence low unemployment, so this would tend to dampen the sensitivity of wages to local variations in unemployment.[19]

So, wage pressure in an economy may increase or decrease without any particular sensitivity to unemployment levels or indeed may involve reduced sensitivity to local unemployment conditions. Thus, it is hard to assess whether the period of constrained wage growth from 2003 reflects an increased sensitivity to unemployment from looking purely at *aggregate* data. It may simply reflect an aggregate slowdown in wage pressure for reasons unconnected to prevailing levels of unemployment.

To explore whether wages have become more sensitive to unemployment we therefore look both at the *macroeconomic* picture and at UK *regions* over time. We assess the sensitivity of wages to local unemployment to study whether this relationship appears to have strengthened and thereby increased the importance of low unemployment for delivering real wage growth. We also consider whether such effects are more or less pronounced in different parts of the *wage distribution*. We therefore present our findings in four subsections below:

- Economy-wide sensitivities;

[17] Machin S, "Wage Inequality in the UK", *Oxford Review of Economic Policy*, 12(1), 1996, 47-64; and Machin S, "Changes in UK Wage Inequality Over the Last Forty Years", in P. Gregg and J. Wadsworth (eds.) *The Labour Market in Winter*, 2011, Oxford University Press

[18] See for example, Whittaker M & Savage L, *Missing Out: Why ordinary workers are experiencing growth without gain*, 2011, Resolution Foundation

[19] While potentially plausible it should be noted that this is not something that we currently have clear evidence on.

- ❖ Economy-wide sensitivities across the earnings distribution;
- ❖ Regional sensitivities; and
- ❖ Regional sensitivities across the earnings distribution.

Economy-wide real wage sensitivities

Table 2 shows real wage-unemployment sensitivities (or 'elasticities') estimated from an equation relating the (log of the median) real wage to the (log) unemployment rate one year earlier (dated t-1) and a linear trend that picks up the underlying longer term growth rate of real wages.[20] A detailed explanation of the various figures and labels is provided in Appendix 3. This should also help readers unfamiliar with regression analysis to interpret the results presented elsewhere in this report. Here we summarise the findings.

Table 2: Median real weekly wages and unemployment: GB 1986-2010

	Dependent variable: Log (Median real weekly wage)				
	(1)	(2)	(3)	(4)	
	1986-2010	1986-2010	1986-2002	2003-2010	Change 1986-2002 to 2003-2010
Log(Unemployment Rate[t-1])	-0.116	-0.116	-0.074	-0.119	-0.045
	(0.024)	(0.022)	(0.024)	(0.012)	(0.027)
Trend	0.005	0.007	0.009	0.003	-0.006
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Year>=2003		-0.005			
		(0.002)			
R-Squared	0.94	0.94	0.92	0.90	
Sample Size	24	24	16	8	

Notes: Robust standard errors in parentheses.

In column (1) the real wage growth trend covers the whole period, while in column (2) it is split for periods before and after 2003 (1986-2002 and 2003-2010).

In the specifications reported in both columns, the first thing to note is that there is a wage restraining impact of unemployment on median real wages (that is, the sensitivity is negative), and we estimate an elasticity for the full time period of -0.12 (0.116 in the table). This means that a doubling (100 per cent increase) in the unemployment rate, say from 4 to 8 per cent, reduces real wages by 12 per cent.

To consider the magnitudes of these estimates, it is worth noting that in the first year of our sample (1986) unemployment was high and nearly halved by 2002 (see Figure 6 in Appendix 1). Of course it has also risen sharply in the recent downturn.

[20] The relationship is specified in logarithms so we can interpret the estimated coefficients as 'elasticities' (i.e. we can talk about the impact of an x per cent increase in unemployment on real wages).

The column (2) estimates suggest that wages were growing at an underlying rate of 0.7 per cent a year before 2003. The halving of unemployment over the period produces an additional significant boost to pay. From 2003 onwards, real wages grew at an underlying rate of 0.2 per cent (from the difference in the trend coefficients, 0.007 minus 0.005), but the powerful wage dampening effects from rising unemployment that reached a low of 4.6 per cent in 2005, but rose rapidly from 5 to 8 per cent in the recession, meant that wage growth was overall flat or falling.

However, these first estimates do not explore whether there is variation in the real wage-unemployment sensitivity for the sub-periods 1986-2002 and 2003-2010. This is shown in columns (3) and (4), where we allow differential effects for both trend real wage growth and unemployment for each period.

The figures in the first row of columns (3) and (4) therefore detail the recorded elasticities in the two periods: between 1986 and 2002 we see that a doubling of unemployment would have been associated with a 7 per cent fall in real wages; while in the period from 2003 to 2010 the same unemployment effect would have reduced wages by 12 per cent. Hence, the wage dampening unemployment effect is bigger post-2003.

Economy-wide real wage sensitivities across the wage distribution

The statistical model in Table 2 was estimated for median real wages. We have also estimated real wage-unemployment sensitivities and real wage trend differences at different decile points in the earnings distribution (where our starting point is that we would expect to see larger unemployment effects towards the bottom of the distribution). The results are reported in Table 3.[21]

With the exception of the 10th percentile, which was no doubt affected by the introduction of the minimum wage in 1999 and large increases around 2002, we see a stronger impact of unemployment on real wages in the 2003-2010 period of real wage growth stagnation.

[21] Effectively, this table reproduces results for the column(3) and (4) specifications of Table 2 for each decile point.

Table 3: Real weekly wages and unemployment: GB 1986-2010

		Dependent variable: Log(i^{th} percentile real weekly wage)		
		1986-2002	2003-2010	Change between 1986-2002 and 2003-2010
10^{th} Percentile	Log(Unemployment Rate[t-1])	-0.202 (0.030)	-0.224 (0.041)	-0.022 (0.049)
	Trend	-0.004 (0.002)	0.004 (0.003)	0.008 (0.005)
20^{th} Percentile	Log(Unemployment Rate[t-1])	-0.123 (0.028)	-0.174 (0.012)	-0.051 (0.031)
	Trend	0.003 (0.002)	0.003 (0.001)	0.000 (0.002)
30^{th} Percentile	Log(Unemployment Rate[t-1])	-0.087 (0.026)	-0.140 (0.010)	-0.053 (0.028)
	Trend	0.007 (0.002)	0.002 (0.001)	-0.005 (0.002)
40^{th} Percentile	Log(Unemployment Rate[t-1])	-0.073 (0.022)	-0.124 (0.010)	-0.051 (0.025)
	Trend	0.008 (0.001)	0.002 (0.001)	-0.006 (0.002)
50^{th} Percentile	Log(Unemployment Rate[t-1])	-0.074 (0.024)	-0.119 (0.012)	-0.045 (0.027)
	Trend	0.009 (0.002)	0.003 (0.001)	-0.006 (0.002)
60^{th} Percentile	Log(Unemployment Rate[t-1])	-0.058 (0.026)	-0.114 (0.012)	-0.056 (0.029)
	Trend	0.010 (0.002)	0.003 (0.001)	-0.007 (0.002)
70^{th} Percentile	Log(Unemployment Rate[t-1])	-0.061 (0.027)	-0.114 (0.015)	-0.053 (0.031)
	Trend	0.011 (0.002)	0.004 (0.001)	-0.007 (0.002)
80^{th} Percentile	Log(Unemployment Rate[t-1])	-0.060 (0.029)	-0.114 (0.016)	-0.054 (0.034)
	Trend	0.013 (0.002)	0.005 (0.001)	-0.008 (0.002)
90^{th} Percentile	Log(Unemployment Rate[t-1])	-0.066 (0.026)	-0.144 (0.021)	-0.078 (0.033)
	Trend	0.014 (0.002)	0.009 (0.001)	-0.005 (0.002)

Notes: Robust standard errors in parentheses.

It is also worth noting that real wages are far more sensitive to unemployment in the lowest paid three deciles than for higher paid workers (with this finding holding both in the earlier period and the most recent decade). As discussed in Section 1, this reflects the fact that the unemployed are more often drawn from the less skilled, meaning that they are closer substitutes for lower paid workers.

Thus it seems from the macroeconomic time series estimates that real wages *are* sensitive to unemployment levels and, in the period when real wages ceased their trend growth, they have become *more sensitive* to unemployment. Note that we do not include the latest data when an increase in VAT and a surge in oil prices resulted in extremely rapid falls in real wages in 2011 that are continuing into 2012.

The small number of post-2003 observations also means we cannot distinguish between the non-recession (2003-08) and recession (2008-10) sub-periods, even though it is only in the latter period that we have observed rising unemployment.

Regional real wage sensitivities

The aggregate economy-wide data we have used so far has two potential drawbacks. First, the second post-2003 time period we consider constitutes only eight annual data points which is very short to precisely isolate an increase in the effect of unemployment on real wages. Secondly, the only measure of the economic cycle we have modelled is unemployment and anything else that is happening at the same time, such as changes in firm profitability or shifts in aggregate demand, will show up as an unemployment effect. To address these issues, we therefore also estimated results using the additional data points available from the regional panel on real wages and unemployment.

Table 4: Regional median real weekly wages and unemployment: GB 1986-2010

	Dependent variable: Log (Regional median real weekly wage), 11 Regions, 1986-2010				
	(1)	(2)	(3)	(4)	
	1986-2010	1986-2010	1986-2002	2003-2010	Change 1986-2002 to 2003-2010
A. Trend Specification					
Log(Regional Unemployment Rate[t-1])	-0.079	-0.070	-0.046	-0.087	-0.041
	(0.009)	(0.008)	(0.009)	(0.007)	-(0.011)
Trend	0.006	0.009	0.009	0.001	-0.009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year>=2003		-0.004			
		(0.001)			
R-Squared	0.97	0.94	0.97	0.99	
Sample Size	264	264	176	88	
B. Year Dummies Specification					
Log(Regional Unemployment Rate[t-1])	0.010		0.010	-0.049	-0.059
	(0.013)		(0.012)	(0.009)	(0.015)
Region Dummies	Yes		Yes	Yes	
Year Dummies	Yes		Yes	Yes	
R-Squared	0.98		0.99	0.99	
Sample Size	264		176	88	

Notes: Robust standard errors in parentheses.

Table 4 reports estimated elasticities of the regional median real weekly wage with respect to the regional unemployment rate from the previous year. The upper panel (A) reports results from the same model specification as for Table 2 and Table 3 (i.e. including log unemployment and a linear trend) but here the sensitivity of real wages to unemployment across regions is considered, greatly increasing the amount of information available.

The estimated sensitivity of wages to local unemployment is a little smaller that we saw before, which may reflect the fact that survey based estimates of regional unemployment are likely to be measured with more error, especially for smaller regions. This formulation combines aggregate cyclical effects at the macroeconomic level with localised ones at the regional level. But the key point remains, namely that the slowdown in underlying real wage growth and the increased sensitivity of regional wages to local unemployment are identified in the period from 2003 onwards.[22]

The specifications in the second panel (B) include a full set of year effects in place of the trend. This is a more general specification where any year-to-year movements in wages arising from any other source than unemployment will be captured, including the aggregate economic cycle. Thus, the estimated effect of regional unemployment only reflects the year-to-year movements in regional unemployment that differ from the national picture. This is a tough ask of the data as the general rise and fall in unemployment with the economic cycle is discounted. Interestingly, however, in terms of changes through time, we see the same pattern of results as for the economy-wide analysis. This reaffirms the picture of real wages becoming increasingly sensitive to movements in unemployment, whether economy wide or at the regional level.

The estimated regional real wage-unemployment sensitivities show no significant relationship in the 1986-2002 time period, which says that there was no independent regional effect above the economy-wide cycle but a significant negative relationship (i.e. of a 5 per cent fall in wages when unemployment doubles) in the recent 2003-10 time period. Thus, real wages became more sensitive to unemployment at the regional level in this latter period. The change is strongly significant in statistical terms and is close in magnitude to the change in the aggregate median real wage specification reported in Table 2. Overall, the regional results depict a general slowdown in real wage growth combined with growing sensitivity to local unemployment conditions.

Table 5 shows a number of robustness tests of the regional median real wage findings. Panel A uses full-time weekly earnings and so excludes part-time workers, Panel B considers hourly earnings and Panel C looks at the regional employment-population ratio rather than the regional unemployment rate. The estimates reported are comparable to the Table 4 models that include a full set of year effects.

The results in the three panels of the table confirm and strongly corroborate the Table 4 findings. The 2003-10 time period of stagnant real wage growth is one where unemployment/employment is more strongly correlated with median real wages than the period of positive real wage growth that preceded it.

[22] The wage equations include regional fixed effects and so the estimated elasticities can be interpreted in terms of changes.

Table 5: Robustness of regional wage results

	Dependent variable: Log (Regional median real wage), 11 Regions, 1986-2010		
	1986-2002	2003-2010	Change between 1986-2002 and 2003-2010
A. Full-Time Weekly Wage			
Log(Regional Unemployment Rate[t-1])	0.023	-0.030	-0.053
	(0.011)	(0.011)	(0.016)
Region Dummies	Yes	Yes	
Year Dummies	Yes	Yes	
Sample Size	176	88	
B. Hourly Wage			
Log(Regional Unemployment Rate[t-1])	0.016	-0.059	-0.074
	(0.011)	(0.030)	(0.032)
Region Dummies	Yes	Yes	
Year Dummies	Yes	Yes	
Sample Size	176	88	
C. Weekly Wage, Employment/Population Ratio			
Log(Regional Employment/Population Ratio[t-1])	-0.191	0.286	0.478
	(0.090)	(0.107)	(0.138)
Region Dummies	Yes	Yes	
Year Dummies	Yes	Yes	
Sample Size	176	88	

Notes: Robust standard errors in parentheses.

Regional real wage sensitivities across the wage distribution

The final empirical exercise we consider looks at different percentiles of the wage distribution in the regional panel. Estimates of decile specific real wage-unemployment elasticities for 1986-2002 and 2003-10 are reported in Table 6, along with the change in these elasticities across the two sub-periods.

As we saw before, wages are far more sensitive to unemployment for the lower paid and at almost all deciles – the 10th percentile being the exception – the real wage-unemployment elasticities became larger (in absolute magnitude) in the second time period. The different behaviour at the 10th percentile is most likely because the minimum wage propped up wages in the 2000s after its introduction in 1999. In the regional context, this will be likely to have boosted wages most in low wage and mostly high unemployment areas, thus lowering the relationship between wages and local unemployment.

However, for the rest of the distribution, one sees unemployment restraining real wages by more in the 2003-10 time period. For higher wage workers the picture that is important for wage setting is more the national than the regional one and hence when we take out the economy-wide cycle the sensitivity to just local conditions is low.

Table 6: Regional real wages and unemployment across the wage distribution: GB 1986-2010

	Real wage-unemployment sensitivity, 1986-2002	Real wage-unemployment sensitivity, 2003-10	Change
10th Percentile	-0.154	-0.058	0.096
	(0.034)	(0.027)	(0.043)
20th Percentile	-0.041	-0.060	-0.019
	(0.017)	(0.018)	(0.025)
30th Percentile	-0.012	-0.057	-0.045
	(0.011)	(0.013)	(0.017)
40th Percentile	0.004	-0.052	-0.056
	(0.011)	(0.011)	(0.015)
50th Percentile	0.010	-0.049	-0.059
	(0.012)	(0.009)	(0.015)
60th Percentile	0.019	-0.033	-0.052
	(0.012)	(0.011)	(0.016)
70th Percentile	0.017	-0.027	-0.045
	(0.011)	(0.010)	(0.015)
80th Percentile	0.008	-0.020	-0.028
	(0.011)	(0.011)	(0.015)
90th Percentile	0.020	-0.024	-0.044
	(0.015)	(0.012)	(0.019)

Notes: Estimates comparable to Table 4. Robust standard errors in parentheses.

Section 4 - Conclusions

In this exploratory paper, we study the fact that real wage growth has stagnated in the UK from around 2003 and ask whether this can be related to a return of unemployment holding back real wages that was either not present or was less marked in the period of real wage growth that came before. We highlight the period of slow real wage growth that has characterised the UK since 2003, showing that there have been recent real wage falls across the distribution. We also explore whether unemployment levels are more important for low and middle earners and the extent to which falls in unemployment could promote earnings growth for these workers.

From analysis of economy-wide data and of regional panel on real wages and unemployment, we find the same pattern of results. We document the nature of real wage changes across the wage distribution over the last three decades, showing that the recent period of stagnant real wage growth represents a distinct break of trend that pre-dates the onset of recession.

Our statistical analysis that shows that an increased sensitivity of real wages to unemployment appears to have been an important factor in this slowdown of real wage growth, with real wage-unemployment sensitivities becoming more marked in the period of poor real wage growth. This is strongly the case, with a doubling of unemployment driving down real wages by 5 per cent more than would have been the case in the 1980s and 1990s recessions.

Thinking about what this means in monetary terms, we find that the increase in unemployment that took place between its low in 2005 (4.6 per cent) and its peak in late-2011 (8.3 per cent) would be associated with a reduction of around £2,100 in the annual earnings of someone working full-time at the median hourly rate of pay[23] in the period from 2003 to 2010, compared with a reduction of just £1,300 in the earlier period. The increased sensitivity therefore equates to around an extra £800 a year wage loss in the more recent period compared to what would have occurred in earlier decades.

On the one hand, this increased sensitivity has moderated real wage growth and reduced real wage levels compared to what would otherwise have been the case. On the other, this may well have limited the extent of job losses in the recent deep recession. Of course, while we show that unemployment has been a factor, it is not the only variable driving real wage stagnation and reduction. Moreover, we remain less clear on why the unemployment sensitivity has increased. This paper has not looked at potential drivers, but it may, at least in part, be a consequence of the weakening of labour market institutions such as the coverage of trade unions. It may also reflect the impact of active welfare policies which have made the unemployed a closer substitute for those in work.

Moreover, the sensitivity of wages to unemployment is also larger for low to middle wage workers (in the 20th to 50th percentiles) than for higher wage workers, although the recent *increase* in sensitivity is broadly the same across most of the distribution. In the most recent period, this means that the reduction in real wages associated with a doubling of unemployment would be 3 to 5 per cent bigger for low and middle earners compared to workers higher up the wage distribution.

Several implications follow from this analysis.

[23] Median hourly pay among full-time and part-time employees was £11.14 an hour in 2011.

- First, if the same real wage-unemployment relationship remain in place, higher paid workers are likely to continue to see a modest upward trend in real wage growth with flat unemployment, but real wage growth for low and middle earners will not return to significant positive territory until unemployment starts to fall significantly – probably below the levels (of between 4 and 6 per cent) recorded in the period from 1999 to 2007.

- Secondly, in contrast to the view that there has been a large degree of labour hoarding that can generate a productivity boost when growth returns, any economic recovery will need to feed through into jobs growth before it boosts wages. Higher pay will only be generated when and if unemployment falls significantly.

- Thirdly, while pay will respond if and when unemployment falls significantly, especially for low to middle paid workers, the kind of sustained real wage growth recorded through the 1980s and 1990s will not return if unemployment simply falls back to its pre-recession norm. This is likely to allow policy makers to keep interest rates lower than in the past for similar levels of unemployment without fear of an inflationary wage-price spiral.

- Finally, if government wishes to boost the earnings of low and middle earners it must focus not just on policies that influence pay directly, but also on driving down levels of unemployment. The increased sensitivity of real wages to unemployment means that such a focus becomes even more important than it has been in previous years.

Finally, the subject matter of this paper, focusing on the real wage slowdown and connections to patterns of changing unemployment, remains relatively unexplored to date. There are a number of relevant research questions that need to be studied in more detail.

The first is to compare changing patterns of real wage growth with other data sources. The second is to start to try and understand what have been the proximate causes of the real wage slowdown, and why the level of unemployment is more strongly related to real wages in this recent period of poor real wage growth performance than it was before. A third is to consider the potential importance of differences across regions.

Hopefully, research in these areas will enable us to gain a better understanding of why real wage stagnation has occurred and the extent to which the consequent nominal and real wage moderation have played a role in employment falls being relatively modest over the recession.

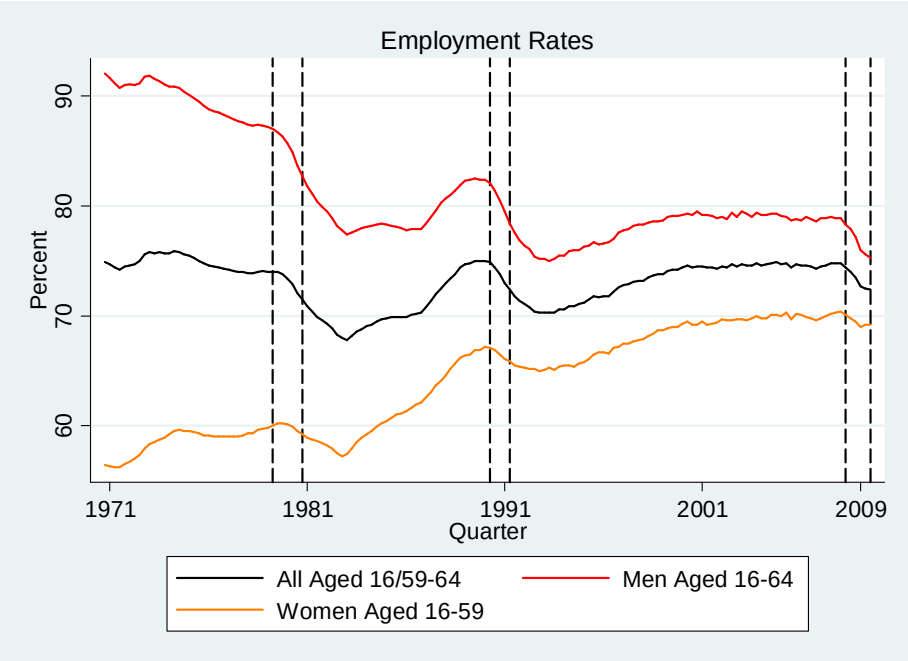
Appendix 1 - Labour market performance

By way of context for the discussion in the main paper about the relationship between unemployment and wages, we set out here the labour market trends evident in recent decades, and the adjustments associated with the recent downturn in particular.

Employment, inactivity and unemployment rates

Peak level aggregate UK employment levels have altered little over the last half century, with around three-quarters of the working-age population during periods of economic expansion. This was true in the late 1960s, most of the 1970s, briefly in the late 1980s at the end of the 'Lawson boom' and for a sustained period from the late 1990s to the onset of the most recent recession. This aggregate feature of the UK labour market is shown by the black (middle) line in Figure 5, which details the aggregate employment rate for all working age individuals between 1971 and 2008.

Figure 5: Employment rates for working-age individuals by sex: UK 1971-2009



Notes: *Quarterly data. Vertical dashed lines show recession quarters.*

Source: *ONS database, provided by Andrew Damant.*

However, this aggregate pattern hides the huge shift (also shown in Figure 5) in employment from men to women that occurred over this period. While in the 1970s around 90 per cent of men were in work as compared to around 60 per cent of women, by the late 1980s this 30 percentage point difference had shrunk to 15 percentage points (with employment rates in the low 80 per cents for men and high 60 per cents for women). By 2000, it had shrunk further still to just a ten percentage point difference (with 80 per cent of men and 70 per cent of women in work).

Figure 6 shows the ILO unemployment rate between 1979 and 2011. It shows very clearly how much unemployment came down before the early 2000s, dropping from 10.6 per cent in 1993 to 5 per cent by 2003. The sharp increase in the late 2000s recession, with a rise from around 5 to 8 per cent is also evident.

Figure 6: ILO unemployment rate: UK 1979-2011

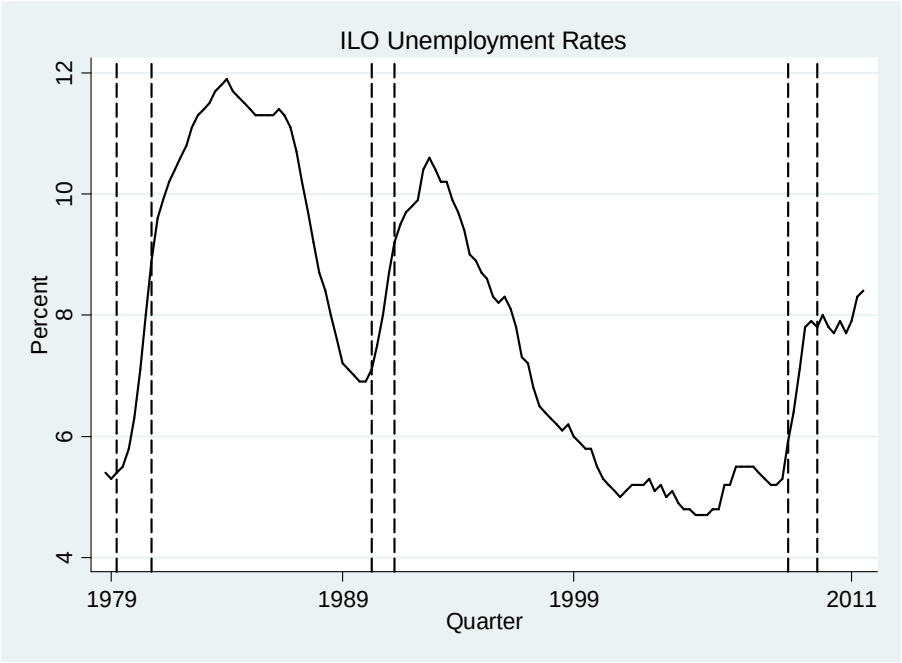


Figure 7 shows rates of economic inactivity in the population.[24] Apart from brief periods in the early and late 1980s, this has stayed relatively constant at about 23-24 per cent of the working-age (16-64) population. If anything, there is a slow, but not very marked decline after 1993. However, Figure 7 also plots the inactivity rate excluding full-time students from 1993 onwards. When the full-time students are removed, it becomes evident that economic inactivity has indeed fallen sharply over the past 20 years.

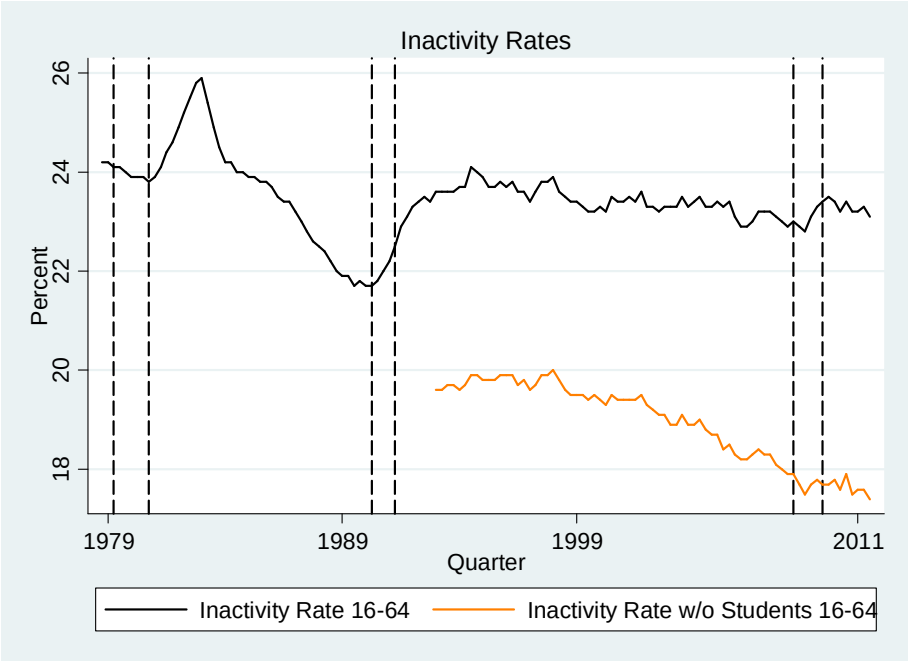
There are compositional changes within these shifts in employment, unemployment and inactivity shown in Figure 5 to Figure 7. For example, the fall in male employment in the 1980s was focused on older and less educated men, while the growth for women has been primarily among better educated mothers with younger children.

More generally and more recently, there have been increases in employment among the over-50s, where cohorts of people who in earlier times would have retired early or gone onto disability benefits are now staying economically active, increasingly even beyond the state retirement age. At the aggregate level this delayed exit relative to the 1980s and 1990s[25] has been offset by growth in delayed entry into work associated with increases in the numbers of full-time students.

[24] That is, the proportion of the working-age population not in work or looking for work (i.e. not including the unemployed).

[25] It should be noted that much of this delay in retirement represents a return to pre-1979 patterns for men.

Figure 7: Economic inactivity including and excluding full-time students: UK 1979-2011



Notes: *Quarterly data. Vertical dashed lines show recession quarters.*

Source: *ONS database, provided by Andrew Damant.*

Therefore, since the end of the last recession in 1993, the employment rate of those aged 50 to 64 has risen by 10 percentage points (somewhat more for women than men) to 65 per cent. On the other hand, for 16-17 year olds the employment rate has fallen from 40 to 20 per cent and for 18-24 year olds from 64 to 57 per cent. These trends are very much likely to continue, especially the extension of working lives toward the age of 70, in part because of recent pension system changes.

Absolute employment levels

The initial picture of a constant 75 per cent of adults being in work also masks the fact that the total population has grown rapidly. Maintaining constancy therefore requires a huge increase in *absolute* employment. In 1979, 75 per cent of adults in work translated into about 25 million workers. Prior to the onset of the current recession, the comparable number was 31 million workers.

The UK labour market has therefore shown a powerful capability to increase employment to match increases in population. These have been driven both by domestic changes – with births having been a little above the replacement rate over the period (particularly so during the 1960s baby boom[26]) – and by net international migration.

Low employment groups

The picture for groups who generally have below average employment rates has been mixed in the recent period. Raising employment among the least educated and in deprived parts of Britain was not substantively achieved during the strong employment performance of the 2000s, and other groups (like the disabled, lone parents, ethnic minorities and older and younger workers) still report large amounts of economic inactivity.

[26] There has also been an upsurge in births since 2000 but this has not yet fed into the labour force.

Nevertheless, employment among lone parents surged from the end of the previous recession, rising from around 40 per cent (1993) to 57 per cent (2011). Similarly, those from ethnic minorities and disabled people experienced steady progress in terms of employment through the 2000s (though their employment rates peaked at 62 and 52 per cent respectively, well below the 74 per cent average). By contrast, employment rates among the least educated and those living the most deprived areas of Britain stabilised at 60 per cent and 67 per cent respectively before the crash in 2008.

Since the onset of recession, these last two groups have experienced larger than average falls in employment, as has the migrant population,[27] while the other groups mentioned above have fared better than for the population as a whole (with lone parents not recording any reduction in employment for instance).

Future employment expectations

Looking forward, the reforms to pension systems that are extending the normal expected retirement age, increasing the penalty associated with early retirement more, and shifts to defined contribution rather than defined benefit pension schemes are likely to result in significant increases in economic activity among those in their 60s over the next decade. In addition, the government is looking to get around 1 million disabled benefit claimants back into work, through classifying them either as being job ready (and therefore on Job Seekers Allowance) or as being eligible for the new Work Related Activity Group in Employment Support Allowance (ESA). It is also continuing efforts to increase employment among parents to tackle child poverty.

The expectation is thus that the potential increase in employment in Britain over the next decade could easily be above 5 million: roughly 1 million who were openly unemployed above previous norms, 2 million from the over 60s, 1 million disabled and others and 1 million to absorb likely population growth that is currently running at 100,000 per year.

Furthermore, with a rapidly ageing population the UK needs this employment to fund demands on the pension system, health and social care services. A sizable portion of the increase in employment is likely to come from these same sectors because of increased employer demand.

[27] We can measure immigrant status by not being a British citizen or by being born outside the UK. On either metric, migrants have lower employment rates than the domestic population by around 6 percentage points. Through the recession, the share of UK born people in work has fallen 2.2 percentage points, while the comparable number for the non-UK born is a fall of 2.9 percentage points.

Appendix 2 - Data sources

As discussed in the main report, our data source throughout the paper is employer-reported wages data from the New Earnings Survey/Annual Survey of Hours and Earnings (NES/ASHE).28

For most of our analysis, we consider weekly wages (in 2011 prices, deflating by the retail price index) at different decile points of the wage distribution. Our initial analysis considers log real wages at the median, or 50th percentile, of the distribution (i.e. for the worker exactly halfway up - or down - the wage distribution).

We also study wages at different points in the overall distribution, looking at workers at intervals for each tenth of the working population (the 10th, 20th…… up to the 90th percentiles of the distribution).

We have put together a regional panel of data on wages from the NES/ASHE data and unemployment rates from the Labour Force Survey for the standard regions of Britain: North East; North West; Yorkshire and Humberside; East Midlands; West Midlands; East Anglia; London; South East; South West; Wales; and Scotland. The sample we use covers these eleven regions for the years 1986 through 2010.[29]

[28] This work contains statistical data from ONS which is Crown Copyright. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

[29] The start year is dictated to us as it is the first year when we can use the ILO definition of unemployment from the Labour Force Survey.

Appendix 3 - Interpreting regression results

The estimation of the sensitivity of real wage growth to unemployment presented in this paper is based on a standard regression analysis. By looking at the relationship between log unemployment and log real wages, we are able to determine the proportional change in pay that is associated with a 1 per cent change in unemployment: that is, the *elasticity* of real wages to unemployment.

For those unfamiliar with such regression analysis, the outputs can be difficult to follow. Below we re-present Table 2 from the main report, with annotations to describe in detail what the various figures and labels are referring to. Consideration of these notes should aid the reader in interpreting the results in all of the other tables in the report.

This is the elasticity, calculated by comparing log median real wages with log unemployment data. It shows the proportional change in median real wages associated with a 1 per cent change in unemployment

In both columns, the elasticity, R-squared and sample size figures are the ones that relate to the entire period. The underlying growth rate for real median wages is split in column (2) though, into the period before and after 2003

In these columns, the various figures are those that are recorded in the two separate time periods. It therefore shows how the elasticity in the latter period compares with the earlier one

The elasticity for the entire period is -0.116. This means that a 1 per cent increase in unemployment is associated with a 0.116 per cent *decrease* in median real wages. The underlying real wage growth in the period is 0.5 per cent a year. This figure is pulled down during periods of rising unemployment, and pushed up during periods of falling unemployment

Table 2: Median real weekly wages and unemployment: GB 1986-2010

	Dependent variable: Log (Median real weekly wage)				
	(1)	(2)	(3)	(4)	
	1986-2010	1986-2010	1986-2002	2003-2010	Change 1986-2002 to 2003-2010
Log(Unemployment Rate[t-1])	-0.116	-0.116	-0.074	-0.119	-0.045
	(0.024)	(0.022)	(0.024)	(0.012)	(0.027)
Trend	0.005	0.007	0.009	0.003	-0.006
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Year>=2003		-0.005			
		(0.002)			
R-Squared	0.94	0.94	0.92	0.90	
Sample Size	24	24	16	8	

Notes: Robust standard errors in parentheses

This is the *underlying* rate of annual growth in real median wages: that is, the growth we would expect during periods of steady unemployment. Column (2) splits the trend before and after 2003

Here the elasticity figure is unchanged, because it still refers to the entire period. The 0.5 per cent a year underlying growth rate of real median wages is split though. Prior to 2003, we record a rate of 0.7 per cent a year; after this point, the figure is reduced by 0.5 per cent, leaving us with trend growth of 0.2 per cent a year. Rising unemployment from 2008 will subsequently wipe out this underlying wage growth

This is the coefficient of determination and provides a measure of how well the model fits the real world data. The closer to 1 the figure is, the better

The recorded standard errors are 'robust' because the dataset is large enough to provide accurate hypothesis tests. The smaller the number, the more 'significant' are our findings

Here we specify the elasticity recorded in the two periods. Between 1986 and 2002, a 1 per cent increase in unemployment pulls real wages down by 0.074 per cent; from 2003 it has a dampening effect of 0.119 per cent. Alternatively, a doubling of unemployment (100 per cent increase), reduced pay by 7 per cent and 12 per cent respectively

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