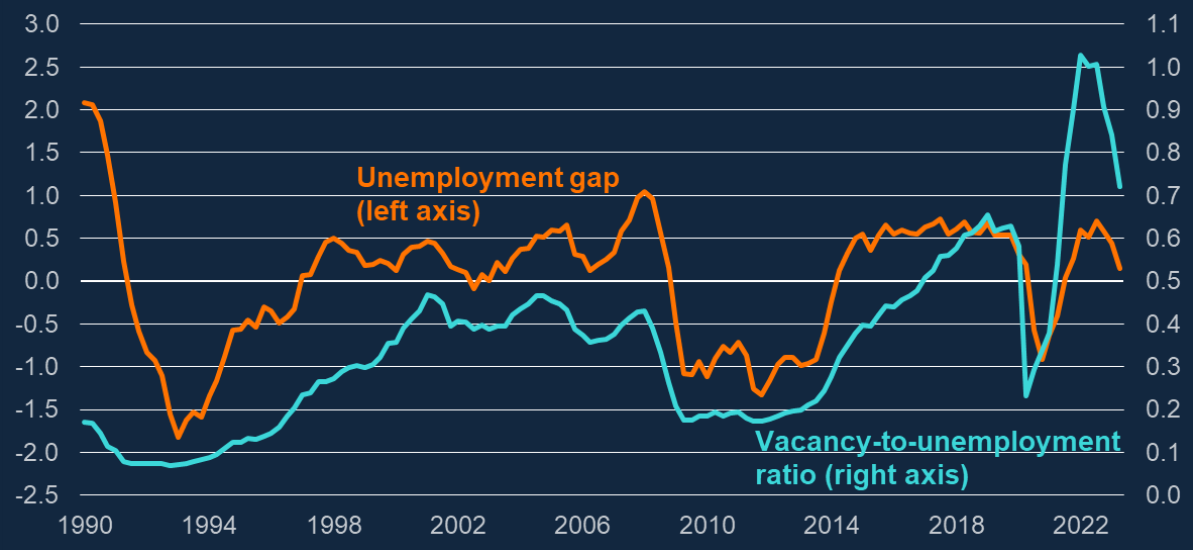
Appendix to Implications of current wage inflation – speech by Jonathan Haskel

Vacancies to unemployed ratio and the unemployment gap

Chart A1: Vacancy to unemployment ratio and unemployment gap
Quarterly, 1990 Q1 to 2023 Q2 (a)



Source: ONS – **Vacancies Survey**, author's calculations.
(a) Notes: Unemployment gap as in Chart 3, and described in text and in Appendix. Vacancy-to-unemployment (V/U) ratio uses published ONS estimates of vacancies and unemployment. Unemployment gap plotted against left-hand axis, and V/U ratio against right-hand axis. Latest data point 2023 Q2.

Wage equation specification

$$\Delta w = \Delta w_{t-4} + ugap_{t:t-3} + \Delta prod + \pi^{e}_{t:t-3} + a$$

where:

Δw is annual wage growth

Δw_{t-4} is annual wage growth from four quarters before

$ugap_{t:t-3}$ is the average level of the unemployment gap between the current quarter and three quarters ago (i.e. a rolling annual average)

$\Delta prod$ is trend annual productivity growth

$\pi^{e}_{t:t-3}$ is the average level of the one-year ahead expected inflation between the current quarter and three quarters ago (i.e. a rolling annual average)

a is a constant

Table B: Estimated wage equation [(a)]

	Dependent variable: Δw
Δw_{t-4}	0.2780*** (0.0506)
$ugap_{t:t-3}$	-1.1374*** (0.1027)
$\Delta prod$	1.0362*** (0.1348)
$\pi^{e}_{t:t-3}$	0.7489*** (0.1103)
a	-0.5014* (0.2683)
Observations	120 (1990 Q1 – 2019 Q4)
R^2	0.8513

Source: ONS, Bank of England, author's calculations.

Data sources for wage equation

Our wage series is the Average Weekly Earnings (AWE), as **published by ONS**, with some modifications. We prefer to use the "regular pay" series (which excludes bonus pay and arrears) for the private sector, since this is the measure most relevant for monetary policy and inflationary pressure, and is least likely to be distorted by unusual factors.

Private sector regular pay AWE is available on the ONS website from the start of 2000 until the present. For periods before 2000, the ONS has published a historic series based on a VAR model and the now discontinued Average Earnings Index (AEI) (see **Crane and Elliott, 2013**, for details). However, this is for total pay rather than regular pay, and is not

seasonally adjusted.[1] Bank of England staff have created a modelled backseries for AWE private sector regular pay, which is broadly consistent with the ONS measure for total pay, which extends to 1987. We use the Bank staff's version for consistency across the time series.

During the pandemic, we use the Bank staff's assessment of "underlying" AWE, which attempts to adjust for compositional effects and the effects of furlough, and the interaction between these two effects (see **Monetary Policy Report February 2022**, section 3). This is challenging and uncertain, and the pay growth during this period should be interpreted with caution. However, we judge that it is preferable to use an "underlying" measures here, since the official AWE measure is clearly distorted by furlough payments. Annual growth rates are affected by this "underlying" adjustment up to 2022 Q3 inclusive (since furlough was still active in 2021 Q3), but from 2022 Q4 onwards we revert to the annual growth rates implied by the official estimates (since 2021 Q4 was free of furlough effects).

Since the AWE wage measure is a "per job" measure, the appropriate productivity measure to use in the equation is also a "per job" measure. We use the **ONS whole economy output per job series**. A private sector or market sector measure would be preferable, but such a measure does not exist on a consistent quarterly basis back to 1990. Productivity, and productivity growth, is measured at all times with error, and so annual growth rates can be volatile. However, the relevant concept for wage growth is surely something more like trend productivity growth. To avoid imparting undesirable volatility into the model, and to better reflect the likely wage-setting process, we construct a trend productivity measure by running a Hodrick-Prescott (HP) filter through the annual productivity growth series (with a smoothing parameter of 8000), and extracting the trend component. Given challenges measuring productivity over the pandemic (due to furlough and composition effects, largely analogous to the discussion on wages) we hold trend productivity growth constant from 2019 Q4 onwards – productivity growth is thus estimated to contribute to wage growth by the same amount (roughly three-quarters of a percentage point) from 2019 Q4 to 2023 Q2.

For the unemployment rate, we use the measure published by ONS covering all people aged 16 and over. This is available since 1971, so we simply use the published series here.

For our estimate of U* (the "underlying" rate of unemployment), we run a Hodrick-Prescott (HP) filter through the unemployment rate, with a smoothing parameter of 8000, and extract the trend component. We found that such a smoothing parameter produced a sensible degree of variation in U*, which should usually be a relatively slow-moving concept, broadly consistent with more sophisticated measures such as those in **Inflation Report February 2018**, Box 4). Given the discussion in this speech, we hold U* constant

[1] Available in **dataset EARN02**.

at its 2019 Q4 level, which is broadly consistent with the MPC's view before the pandemic that U* was "just above 4%" (**Inflation Report February 2018**, Box 4). The unemployment gap is then the difference between U and our estimate of U*.

Our series of inflation expectations is a composite measure of one-year ahead inflation expectations taken from the Bank of England's Millennium of Macroeconomic Data dataset[2], which runs to the end of 2016. The Millennium series is a composite measure covering household, professional and market-implied expectations. The wedge between average expectations and actually inflation is adjusted for, since households appear to persistently over-estimate inflation, and market rates contain risk premia. From 2016 onwards, we extend the Millennium series by the median expected inflation 12-months ahead form the Bank of England's Inflation Attitudes Survey (IAS)[3]. By extending the past level, this implicitly also adjusts the level of the IAS results. As such, our measure of inflation expectations peaks at 4.0% in 2022 Q3, compared with 4.9% reported on the IAS. This is the highest point on our series since 1993 Q2, and compares to an average over 2014-2019 of 2.2%.

Details about the construction of the Average Weekly Earnings (AWE)

The Monthly Wages and Salaries Survey

The AWE is constructed using a monthly survey called the Monthly Wages and Salaries Survey (MWSS). The MWSS asks around 9,000 businesses every month what their total pay bill was for the month prior, with and without arrears and bonus payments. It also asks for their current number of employees. The business' average total pay per employee is then their total pay bill divided by their number of employees; for regular pay, bonuses and arrears are first subtracted from total pay, then divided by the number of employees. This is repeated for all the responding businesses and combined. Since this data comes from a survey, and it isn't feasible to ask every business every month, sample weights are applied to gross up the figures to represent the total business population (and, by extension, all employees). These sample weights reflect the number of businesses of different sizes and in different industries across the economy, and response rates.

Once selected for the survey, businesses stay in the sample for 5 years, meaning that the samples of adjacent months are largely overlapping – this ensures the data are of a high quality.[4] Estimates for businesses that don't respond in a given month are "imputed" based on their previous response for up to 5 months. After 6 months without response, the

[2] Available from **https://www.bankofengland.co.uk/statistics/research-datasets**. Many thanks to Ryland Thomas for help with these data.
[3] Available from **https://www.bankofengland.co.uk/statistics/research-datasets**.
[4] While this does impart a fairly large burden on respondents, this information is vital to help us set monetary policy, so we are grateful to all the responding businesses.

previous response is judged to no longer be appropriate, and other responses are scaled up to compensate for the missing respondent.

The MWSS only samples businesses with 20 or more employees. Out of approximately 2.7m businesses in the UK, only about 5% (about 140,000) have 20 or more employees (based on **data from the Inter-Departmental Business Register**).[5] However, these larger businesses represent around 80% of total employment (based on data from the **Business Population Estimates**).[6] So, through the MWSS we are getting data that is representative of a small minority of businesses, but a large majority of employees.

Adjusting the MWSS

To account for the smaller businesses, which are not sent the survey, the ONS makes an adjustment based on the difference between the average pay of large businesses and the average pay of small businesses (see **ONS, 2015**, for a worked example). That adjustment is calculated from the Annual Survey of Hours and Earnings (ASHE), another ONS survey that collects data on pay, covering employees in businesses of all sizes. However, ASHE is only conducted annually, so this cannot feed into the AWE every month. Instead, ONS calculates an adjustment using past ASHE surveys, and holds constant the adjustment until they get the next set of ASHE data. The adjustments are applied at a detailed industry level (SIC 2007 industry divisions), and the resultant estimates aggregated for publication. Updating AWE estimates with new small firm adjustment factors (using new ASHE data) has historically had very little effect on aggregate AWE growth estimates (for instance, in **2015**, **2017** and **2019**).

The survey collects data on total payments and number of employees for weekly- and monthly-paid employees, where a month may be either a calendar month, a 4-week period, or a 5-week period, since those are the frequencies on which most businesses make payments.[7] ONS then converts all of these to weekly figures by dividing by the relevant number of weeks. In the case of monthly pay, ONS divides by approximately 4.348 – the average number of weeks in a month.

[5] Strictly, this is “enterprises”, some of which are government organisations. Of approximately 2.6m non-government enterprises on the IDBR, around 125,000 have 20 or more employees, still about 5% of the total.
[6] An **ONS article from 2015** describes the process to adjust for firms with less than 20 employees, and reports that 79% of employment is in firms with 20 or more employees.
[7] Some businesses pay in 4-4-5 week patterns, which then aligns neatly with calendar quarters of 13 weeks. Months, inconveniently, are not equally divisible into weeks. It would be more difficult for many businesses to report weekly pay directly.

Calculating growth rates of the Average Weekly Earnings index

Putting all of that together gives an estimate of the average level of weekly wages in a given month[8], across all employees. Finally, ONS seasonally adjusts the estimated average earnings index, to strip out predictable seasonal patterns. For instance, most annual pay rises happen in April, causing an increase in the level of average pay in April in most years. To avoid this predictable pattern distorting growth rates, seasonal adjustment is used to strip out those effects. That still means that if April pay rises are bigger than usual, then seasonally-adjusted pay growth will increase in April.

How then do we get to 8%? ONS calculates the annual growth rate in each month, which, for August 2023 vs August 2022 was 7.8%. However, to mitigate the effect of any volatility (notably sample variability) in single-month estimates, the headline measure is the average of AWE in a three month period, compared with the same three month period the year before. For instance, the three months ending August 2023 (June-August 2023) vs the three months ending August 2022 (June-August 2022) – that growth rate is 8.0%.

Regular pay vs total pay

Recall that we are looking at the regular pay series. What exactly does that mean? Regular pay is calculated as total pay, minus bonuses and arrears. That is, responding businesses are asked for their total wage bill, their bonuses payments, and their arrears payments. Regular pay is then the total pay bill minus the bonuses and arrears.

What counts as a bonus? According to the **MWSS survey form**: “Bonuses, commissions, performance pay (e.g. productivity bonuses), annual profit from profit related pay schemes (PRP), long service awards, appearance money (sporting professions)”. Anything that is not listed there, and which is not an arrear of pay, should therefore be in “regular pay”. That will include, for instance, basic pay, and overtime and shift allowance payments. The **AWE Quality and Methodology Information (QMI)** also states that “employer National Insurance contributions and contributions to pension schemes, benefits in kind, expenses, redundancy payments, signing-on fees, [and] stock options not paid through the payroll” are excluded entirely from collection in MWSS (and thus from AWE).

Explanations for the recent increase in AWE growth

The speech reviews some possible reasons that growth in AWE private sector regular pay appears to have increased while other pay measures have not. This Appendix expands on some of these points.

[8] To be clear, it is weekly wages, on a monthly basis. In the case of monthly-reported data, it is the effective average weekly figure. For weekly-reported data, it is the final week of the month, or a representative week within the month.

Regular pay might include so-called “cost of living payments” – one-off pay awards given to staff (especially low-paid staff) to help with the cost of living. It isn’t clear how these are recorded on the MWSS and hence in AWE – they could feasibly be recorded by businesses as regular pay, bonuses or arrears. However, most evidence suggests that these payments were made around the end of 2022 and start of 2023, when energy prices and inflation were at their peak (see main text for more). As we have seen, wage growth is a three-month average. These payments could only be artificially inflating regular pay growth over June-August 2023 if they were being paid at that time, which seems unlikely.

One possibility is that something in the way the ONS constructs the data is causing measured AWE growth to be higher than ‘true’ wage growth. A possible reason could be the adjustment for businesses with less than 20 employees. Recall that ONS accounts for these using an adjustment factor which changes infrequently, only when new data come along. In the period since the latest ASHE data (in the “statistical tail”) it is implicitly assumed that there is a level difference between average pay of small and large firms within an industry, but not a difference in growth rates. Put another way, in AWE, it is only large firms which determine wage growth in the “tail” (through the MWSS), while small firms also factor into wage growth in the past and the wage level at all times.[9]

If small firms are more susceptible to a slowing economy than larger firms, then small firms might be reducing wage growth relative to larger firms. This could show up in other indicators of wage growth which do not make adjustments for small firms. In AWE, the divergence in wage growth between small and large firms would not be accounted for.

While this is plausible, it is likely to be a small effect. Given that small firms account for only about 20% of employment (see above), the divergence in pay trends would have to be quite large to make a substantive effect on the headline AWE growth. For instance, for the AWE to be over-predicting true wage growth by 0.5pp from this effect, then small business wage growth would have to be around 2.5pp less than that of larger businesses (5.5%, rather than the 8.0% for larger businesses). And to explain the apparent acceleration of wage growth in AWE (against an assumed truth of no acceleration), the gap between wage growth of small and large businesses would have to be increasing. While this is plausible, it seems unlikely to be the only driver.

Another possibility is that this is being driven by a few outliers. Since AWE is essentially a mean average across employees (i.e. an estimate of total pay of all employees, divided by an estimate of the total number of employees), a few very high paying businesses (or

[9] To see this, consider the following: MWSS estimates the average weekly wage (of large firms) is, say, £500. The small firm adjustment is that the level is lower by say 10%, which applies to say 20% of employees. Then the AWE estimate is £500*80%+£500*90%*20% = £490. The next period, MWSS estimates 5% growth to £525. The same small firms adjustment is made, and so the new AWE estimate is £525*80%+£525*90%*20% = £514.5, which is 5% more than the previous AWE estimate. Thus, a constant adjustment to the level of AWE on account of a lower level of pay in small firms does not affect the estimated growth rate of wages.

highly paid individuals) could be skewing the results. Again, while plausible, this effect would have to be very large. For instance, the total pay of Premier League footballers (excluding bonus payments) is in the region of £30m per week[10], which accounts for around 0.2% of total pay in the UK, which isn't enough to make a material impact on the aggregate growth rates.

Labour demand equation specification

$$n_{c,t} = \alpha_1 n_{c,t-1} + \alpha_2 w_{c,t} + \alpha_3 TRADE * w_{c,t} + \alpha_2 r_{c,t} + Z_{c,t}$$

Where *c* is country and *t* is time, *n* is log employment, *w* log wages, *TRADE* an openness indicator, *r* log capital rental prices and *Z* are a series of other controls, namely changes in all terms and controls for demand in the form of exchange rates. Estimates on market sector data, 11 economies, 1999-2019, using the EUKLEMS-INTANProd data set (**https://euklems-intanprod-llee.luiss.it/**).

[10] Data from **https://www.spotrac.com/epl/rankings/weekly/**, calculated by summing "weekly salary" for the 2023/24 season across all players. This is intended to be illustrative only, and I do not make any claims as to the veracity of the data.