The Extent of Downward Nominal Wage Rigidity: New Evidence from Payroll Data

Online Appendix

Daniel Schaefer Carl Singleton[†]

Appendix A. Further Description of the Data

In what follows, we provide further details on the datasets used. All the relevant documentation and variable descriptions are publicly available from the UK Data Service. The ONS has also published various documents concerning the quality and consistency of the ASHE.

For each year in the period 2004-2018, the ASHE should in principle be a random sample of all UK employees, irrespective of occupation, size of employer, etc. Given the legal obligation of employers to respond using their payrolls, it has a high response rate and is generally considered to be very accurate. Conditional on a hundred percent response and success in locating employees and employers, the ASHE should be a true one percent random sample of UK employees in each year: all those with an administrative life-long National Insurance number which has a numerical part ending in two specific digits are included in the sampling frame every year, making it a worker-level panel dataset. However, there are two major sources of systematic under-sampling of employees, both occurring if individuals do not have a current tax record when they are looked up in January each year. This could happen for some individuals who have recently moved jobs, or for those who earn too little (mostly part-time) to pay income tax or National Insurance. From 2004, the ASHE, after it replaced its predecessor the New Earnings Survey, aimed to sample some of those employees which were likely under-represented before. It added supplementary responses for those without income-tax payments, and also attempted to track employees whose jobs changed between the determination of the sampling frame in January and the reference period in April. There is no cumulative attrition from the panel, as any individual not included in the ASHE in any year, for whatever reason, remains in the sampling frame the following year. One exception to this occurs where individuals have been assigned temporary National Insurance numbers, typically in the case of non-UK nationals. Following ONS recommendations, we drop all person observations where there are inconsistencies in age or sex within the National Insurance number-based ASHE longitudinal person identifier variable, *piden*.

The ASHE data contain information on the legal status of a firm, obtained from the administrative Inter-Departmental Business Register (IDBR). We classify private companies, sole proprietors, and partnerships as belonging to the private sector, while state-owned enterprises, nationalised industries, central government, local authorities, and non-profit organisations form the non-private sector in our analysis. The measure of firm size is also taken from the IDBR and refers to the total number of employees in the enterprise. An employee is working full-time hours when she works at least thirty hours per week. Some businesses have an arrangement with the ONS to provide their data electronically, which seems to be the case for very large enterprises in particular. Employees of such enterprises tend to have lower basic wages. Whenever it is reported that an employee's basic wage is

[†]email: daniel.schaefer@jku.at; corresponding author. This work is based on the Annual Survey of Hours and Earnings Dataset (Crown copyright 2019), having been funded, collected, and deposited by the Office for National Statistics (ONS) under secure access conditions with the UK Data Service (SN:6689). Neither the ONS nor the Data Service bear any responsibility for the analysis and discussion of the results in this paper.

set with reference to an agreement affecting more than one worker, e.g., pay agreed by a trade union or a workers' committee, we classify this employee's wage as affected by a collective agreement.

From 2005, a new questionnaire was introduced to the ASHE, which was intended to reduce the latitude for respondents' own interpretations of what was being asked of them. Prior to 2005, job stayers were identified by asking whether the job title and the description were the same as in the last reference period. From 2005 onward, the question became more specific, asking whether the employee had worked in the same job and role for more than a year. This relates to the ASHE identifier variable for job stayers, *sjd*, which we use to define job stayers for our analysis. For a very small number of job stayers, apparent inconsistencies can arise in the dataset: a worker can be marked as being in the same job, but the enterprise reference number can change. This is probably because of a change in a firm's ownership structure (e.g., a merger or a succession), which would result in a new administrative enterprise reference number being assigned, while the ASHE questionnaire explicitly tells the respondent to ignore such changes when answering whether an employee is working in the same job. We also ensure that each job stayer in our analysis features consecutive year-to-year job and wage records.

To avoid any potential errors, we also drop any worker observations for years with multiple job holdings, because in these cases it is not clear to which job the same-job marker refers to in the following year. Although the ASHE dataset is available from 2004 onward, we use only data starting from 2006 because some questionnaire changes in 2005 and 2006 introduced inconsistencies between these earlier years. Specifically, new instructions were included on how firms should report employees' hours worked. Before applying any further sample selection, the 2006-2018 ASHE panel dataset contains 2,096,927 worker-year observations. From this, we keep only observations where an employee is aged 16-64, and which have not been marked as having incurred a loss of pay in a reference period through absence, employment starting in the period, or short-time working, and which are marked as being on an adult rate of pay, dropping trainees and apprenticeships. This is practically the same filter applied by the ONS in their published results on UK "Patterns of Pay" using the ASHE. We drop observations with missing basic hours or earnings variables. We drop observations with over a hundred or less than one basic hour worked, as these could reflect measurement error or the inclusion of overtime. Applying these steps leaves 1,924,873 worker-year observations. To further address some potential for measurement error, we drop a further 3,571 observations whose derived hourly rates of pay, excluding overtime, are less than 80 percent of the applicable National Minimum Wage (NMW) each April, with allowance for the different age-dependent rates of the NMW over time. We set the threshold lower to avoid dropping observations where employers have rounded figures about the NMW, where the degree of rounding could vary with the actual value of the NMW, a behaviour which has been hypothesized by the ONS. Note, any such rounding for pay measures, conditional on accurate hours records, would tend to bias upwards the incidence of nominal wage rigidity. The ASHE has introduced some earnings imputations, using similar matched 'donor' observations where responses were, for example, missing an entry of basic hours but had recorded basic pay. Hourly pay rates were never imputed. We exclude from our main results the approximate one percent of the remaining observations where imputations were made to hours or basic pay, in the period they can be identified of 2013-2018. By focusing on this period, we were able to confirm that not dropping these observations did not meaningfully alter any of our results. Finally, before focusing on job stayers, we trim the

dataset by sequentially dropping the top and bottom 1% of basic wage observations. We trim twice as there are a tiny number of observations where there are clear coding errors for basic wage changes, such as £9.34 per hour in one year but £934 in the next year for a job stayer.

We use the following pay variables from the ASHE, summarised in Table A1. Basic pay is a worker's regular pay before adding anything extra. The dataset contains two measures of labour input: basic hours and overtime, whereby the former also includes hours worked at a shift premium. If an employer calculates an employee's basic pay by multiplying their basic hours worked by a pay rate, then the employer is also required to report this rate. The employer also reports the pay period, which is most often either weekly, fortnightly, four-weekly or a calendar month. We do not observe the reported totals for these periods, but instead the ONS derives weekly averages of variables.

TABLE A1: Overview of pay variables

		Description
	ASHE variables	
1.	Basic pay	All basic pay, excluding any extra payment
2.	Basic hours	Hours relating to basic pay (incl. hours paid at shift premium)
3.	Hourly pay rate	Reported hourly rate of pay where applicable (see text)
4.	Overtime pay	Total overtime pay in reference period
5.	Shift premium pay	Premium payments for shift work, night or weekend work
6.	Incentive pay	Incentive pay received for work carried out in the pay period
7.	Other pay	Pay received for other reasons, e.g., travel allowances
8.	Gross pay	Total pay received
9.	Annual gross pay	Annual gross earnings paid for the preceding tax year
10.	Annual incentive pay	Component of annual gross pay from incentive payments
	Derived variables	
11.	Basic wage	Basic pay divided by basic hours
12.	Earnings per hour, excl. overtime	Gross pay, excluding overtime pay, divided by basic hours
13.	Gross earnings per hour	Gross pay divided by the sum of basic and overtime hours

The key earnings variables that we analyse are the answers to the following questions in the ASHE questionnaire, whereby monetary values are measured in Pound sterling (GBP), including pence, and time variables are reported in hours and minutes:

BPAY: "How much basic pay, before deductions, did the employee receive in the pay period?
Include: all basic pay, relating to the pay period, before deductions for PAYE, National Insurance, pension schemes, student loan repayments and voluntary deductions. Include paid leave (holiday pay), maternity/paternity pay, sick pay and area allowances (e.g., London).
Exclude: pay for a different pay period, shift premium pay, bonus or incentive pay, overtime pay, expenses and the value of salary sacrifice schemes and benefits in kind."

BHR: "How many basic hours does [basic pay] relate to?
If your pay period is calendar month and hours are weekly, multiply the weekly hours by 4.348 to get calendar month hours. If the employee uses a decimal clock, please convert to hours and minutes. For example, 4.3 hours should be 4 hours and (0.3 multiplied by 60) minutes = 4 hours 18 minutes.

Include: any hours paid at shift premium and paid hours even if not worked.
Exclude: any hours paid as overtime."

HPAY: "[W]as the employee's basic pay in the pay period calculated by multiplying the number of hours they worked by an hourly rate of pay? [If yes,] what was the employee's hourly rate of pay in the pay period?"

OVPAY: "How much overtime pay did the employee receive for work carried out in the pay period?
Exclude: any basic, shift premium and bonus or incentive pay in this period, as well as overtime pay from the previous pay period."

SPPAY: "How much shift premium pay did the employee receive in the pay period?
Include: the element of shift premium pay. For example, for a 35 hour pay period, if the basic rate is £10 per hour and the premium rate is £12 per hour, multiply the difference of £2 by the hours worked (i.e. 35 multiplied by 2). The shift premium pay reported would therefore be £70.
Exclude: any basic, overtime and bonus or incentive pay."

IPAYIN: "How much [bonus or incentive payments did the employee receive,] related to work carried out in the pay period?
For example, if [an annual bonus was paid], the value should be divided by 12 if the employee was paid on a calendar month basis.
Include: profit sharing, productivity, performance and other bonus or incentive pay, piecework and commission.
Exclude: basic, overtime and shift premium pay."

OTHPAY: "How much pay did the employee receive for other reasons in the pay period?
Include: for example, car allowances paid through the payroll, on call and standby allowances, clothing, first aider or fire fighter allowances.
Exclude: paid leave (holiday pay), basic, overtime, shift premium, maternity/paternity, sick, bonus or incentive pay, redundancy, arrears of pay, tax credits, profit share and expenses."

GPAY: "How much gross pay, before deductions, did the employee receive for work carried out in the pay period?
Include: pay before deductions for PAYE, National Insurance, pension schemes, student loan repayments and voluntary deductions. Include basic, overtime, shift premium, bonus or incentive pay and any other pay.
Exclude: expenses and the value of salary sacrifice schemes."

AGP: "How much annual gross pay did the employee receive in their current job?
Include: pay before deductions for PAYE, National Insurance, pension schemes and voluntary deductions. Include basic, overtime, shift premium, profit sharing, productivity performance and bonus or incentive pay.
Exclude: any payments for expenses or previous employment."

ANIPAY: "How much of [AGP] is related to bonus or incentive payments for their current job?
Include: profit sharing, productivity performance and other bonus or incentive pay, piecework

and commission.

Exclude: basic, overtime and shift premium pay."

One take-away from these questions is that basic pay excludes shift premium pay, while basic hours include shift premium hours. Therefore, if the shift pattern of a worker changes between years, basic hours might change while basic pay remains unchanged, all else equal.

For reference, Table A2 display the distribution of observation over industries, separately for salaried and hourly-paid job stayers.

TABLE A2: Distribution of job stayers over industry sectors

Industry (SIC2003)	Hourly-paid (I)	Salaried (II)
A-F: Agric., Mining, Manuf., Energy, Constr. etc.	0.20	0.15
G-H: Wholesale & Retail Trade, Hotels & Restaurants	0.32	0.13
M-N: Education & Health	0.27	0.30
I-L, O: Other Services	0.22	0.42

Notes: Statistics use the later period for each job-stayer observation. Classification according to the ONS Standard Industrial Classification 2003. We convert ONS Standard Industrial Classification (SIC) 2007 to 2003, using files made available by the UK Data Service. This conversion uses the 2008 Annual Respondents Dataset, where both classifications were applied, and where any 2007 code mapping to multiple 2003 codes is decided using whichever of the two bore a greater share of economic output.

Appendix B. Further Details on the Composition of Pay

This section provides more details on the extra pay components besides basic wages, combined for hourly-paid and salaried job stayers.

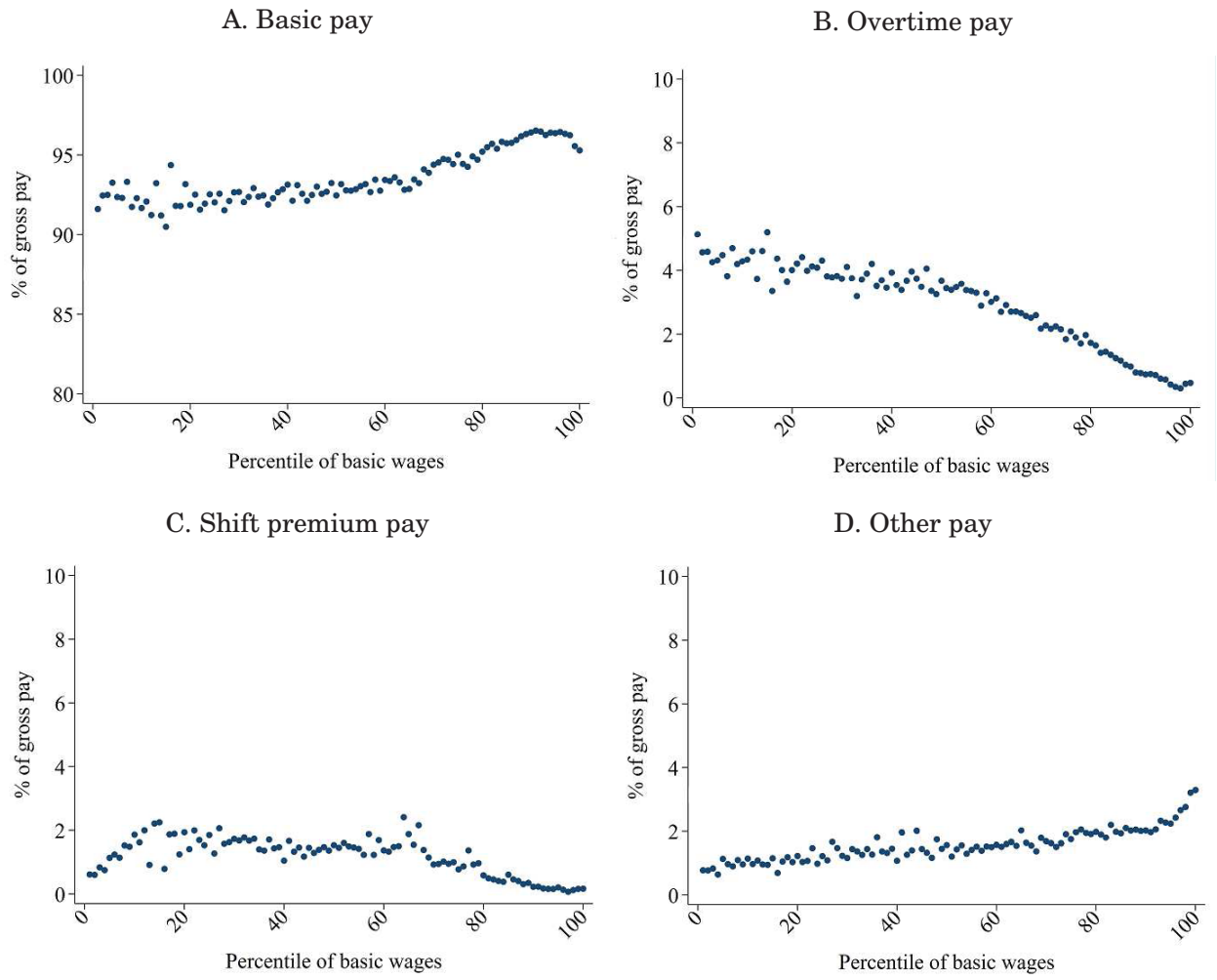

FIGURE B1: Non-incentive pay along the basic wage distribution

Notes: Average shares of pay component within the corresponding percentile of the basic wage distribution. Data pooled across all years.

The importance of paid overtime for job stayers declines with the basic wage (Figure B1B). While overtime accounts for almost 5 percent of total earnings in the bottom percentile and around 3 percent at the median, its share in total earnings is less than 1 percent in the highest decile. Shift premiums typically contribute less than 2 percent of total earnings, and are negligible in the top percentiles of basic wages (Figure B1C). A high basic wage is associated with a high share of total earnings from other pay, such as travel allowances (Figure B1D). Generally, overtime, shift premiums, and incentive pay all contribute relatively little to the level of total earnings in the top percentiles.

Benefits-in-kind, such as employer-sponsored health insurance, are not captured by the ASHE. According to Gu, Prasad, and Moehrle (2020), the value of not-legally required benefits in the US is substantial, accounting for about 21 percent of the total compensation of US employees on average over 1982-2018. The largest benefit is employer-provided health insurance, which accounts for over

8 percent of total compensation in the US. Benefits are also pervasive in the US labour market: Grigsby, Hurst, and Yildirmaz (2021) find that over 75 percent of job stayers in their payroll dataset receive benefits, again largely accounted for by employer-provided health insurance. To better understand the importance of benefits-in-kind in the UK, we use public aggregate data from the Benefits in Kind Statistics Table 4.2 and Table 4.5 from HM Revenue & Customs.[3] The two main categories of benefits-in-kind are private health and dental insurance, and company-provided car, which together account for almost all benefits-in-kind (other benefits include beneficial loans and provided accommodation). For each year, we separately compute the shares of employees who receive a positive amount of any form of benefit, private health insurance, and company-provided car. Figure B2 shows that the share of employees who received any type of benefit declined from over 13 percent in 2006 to 11 percent in 2018. The share of employees who received private health insurance was roughly constant at almost 8 percent. The share of employees who had a company car declined from 4 percent in 2006 to only 2 percent in 2018. Figure B3 shows the value of benefits-in-kind relative to annual gross pay for the tax year April 2016 to April 2017, as reported by firms to HM Revenue & Customs. The results for other years are very similar. The data allow us to analyse bands of annual gross pay, as indicated on the horizontal axis. The largest share of benefits is around 5 percent of annual gross pay, which is received by employees who earn between 40,000 to 50,000 GBP per year (the lower bound corresponds to the 79th percentile of the UK annual gross pay distribution, and the upper bound to the 88th percentile). Benefits-in-kind account for less than 3 percent of pay among employees with annual gross pay above 100,000 (97th percentile of the annual gross pay distribution).

[3]Data are from Table 4.2 - Total expenses and benefits for directors and employees by range of total income, and Table 4.5 - Time series of recipients and amounts of taxable benefits, available at https://www.gov.uk/government/statistics/total-expenses-and-benefits-for-directors-and-employees-by-range-of-total-income and https://www.gov.uk/government/statistics/number-of-recipients-and-amounts-of-taxable-benefits-by-type-of-benefit, respectively.

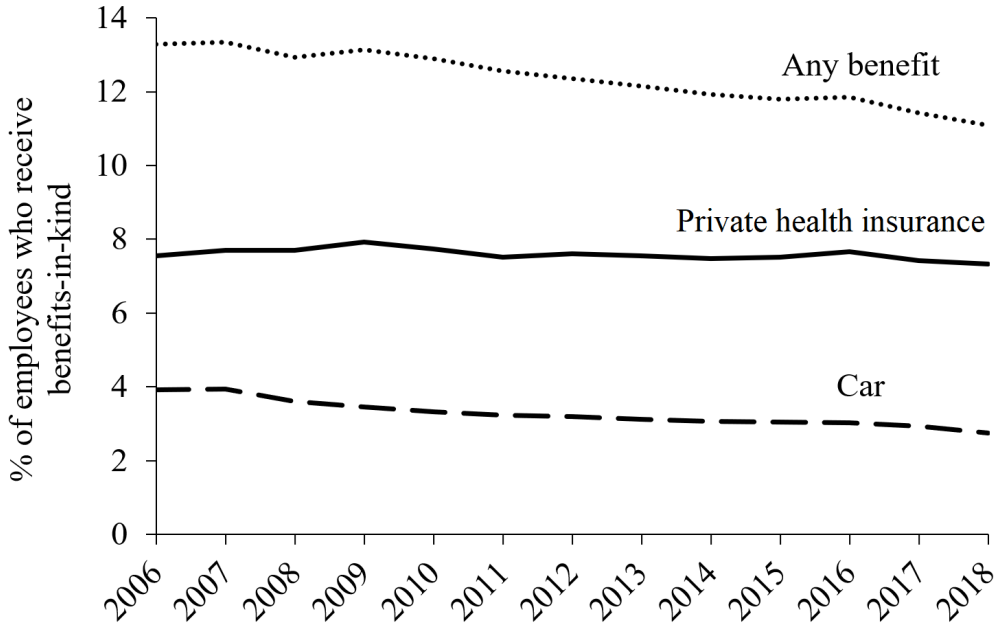

FIGURE B2: Share of all employees who receive benefits-in-kind, 2006-18

Notes: 'Private health insurance' shows the share of employees who receive at least some amount of taxable benefits-in-kind in the form of a private health insurance. 'Car' shows the share of employees who have a company car. 'Any benefit' is the sum of the two above categories plus a residual term that contains, e.g., beneficial loans or provided accommodation.
Sources: Number of employees from UK National Accounts, the Blue Book time series, ID: MGRZ; receipt of benefits-in-kind: Taxable benefits in kind and expenses payments statistics, HM Revenue & Customs.

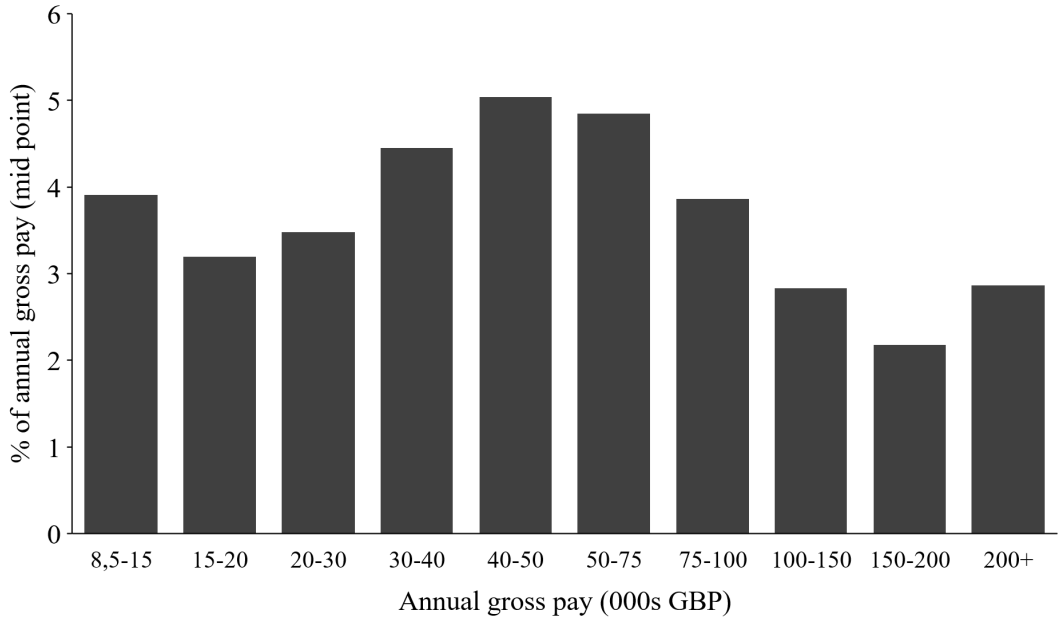

FIGURE B3: Taxable value of benefits-in-kind as share of annual gross pay in the tax year 2016-17, all employees

Notes: The share in annual gross pay is computed using the mid point of the displayed range of each category as the denominator, except for the last category which uses 200,000 as the denominator.
Sources: Taxable benefits in kind and expenses payments statistics, HM Revenue & Customs.

Appendix C. The Persistence of Pay Components

To assess the persistence of the different components of pay, we ask two questions about the extensive and intensive margin of extra pay. First, how likely is it that a job stayer receives some form of extra pay, conditional on her having received the same component last year? Second, conditional on receiving extra pay in consecutive years, how is the pay amount changing? To answer the first question, we estimate a linear probability model for the propensity to receive extra pay components:

$$D_{ijt} = \gamma D_{ijt-1} + u_{ijt} \tag{3}$$

where D_{ijt} equals one if worker i in job j in year t receives a particular extra pay component. We restrict the estimation sample to year-to-year job stayers. The results are reported in Table C1. Columns (I)-(IV) show that the propensity to receive non-basic pay in year t, conditional on having received the same extra pay in year $t-1$, is positive and significant. For example, salaried job stayers who received a positive amount of overtime pay last year, have a 52.3 percent likelihood of being paid for overtime in the current year, on average.

TABLE C1: Estimated year-to-year persistence of receiving extra pay components for job stayers

	Overtime (I)	Incentive pay (II)	Shift premium pay (III)	Other pay (IV)
Salaried	0.523***	0.481***	0.523***	0.614***
	(0.002)	(0.003)	(0.002)	(0.002)
Hourly-paid	0.546***	0.539***	0.546***	0.522***
	(0.002)	(0.004)	(0.002)	(0.002)

Notes: Least squares coefficient estimates of γ in Equation (3).
*** indicates significance from zero at the 0.1% level, two-sided tests, and standard errors in parentheses are robust to clustering within match.
Sample sizes: 691,521 salaried job-stayers and 416,497 hourly-paid job-stayers

For a better understanding of the persistence of individual pay components and, therefore, their likely impacts on the present value of labour costs, we follow Grigsby, Hurst, and Yildirmaz (2021) and estimate first-order autocorrelation coefficients at the intensive margin of each component, conditional on the receipt of the extra pay component in consecutive periods. For our sample of job stayers, we estimate the following regression, using least squares:

$$\log(\overline{w}_{ijt}) = \theta_{ij} + \rho \log(\overline{w}_{ijt-1}) + \overline{\mathbf{x}}'_{it}\overline{\boldsymbol{\delta}} + v_{ijt} \tag{4}$$

where $\overline{w}_{ijt}$ is the wage of worker i, in job j, and in year t; θ_{ij} is a fixed effect for an employer-employee match; ρ measures the first-order autocorrelation; and v_{ijt} is a random error term. The vector $\overline{\mathbf{x}}_{it}$ includes time-varying controls for firm size, age, age squared, and tenure squared.

Table C2 shows the autocorrelation estimates, computed separately for salaried and hourly-paid job stayers. The first column shows that basic wages are significantly positively autocorrelated. If basic wages are high in the current year, relative to the within-match average, then firms and workers

can expect that basic wages will also be relatively high in the next year. This implies a strong impact of basic wage changes on the present value of the labour cost: for example, not only are the current basic wages high, they are also expected to exceed their average value in the match in subsequent years, conditional on the age of the employee and length of the match. The extra pay components affect the present value of labour costs less. For example, conditional on receiving overtime pay in two consecutive years, column (II) of Table C2 shows that the amount of overtime pay is significantly negatively autocorrelated across years within a match. This means that higher overtime pay than normal in one year is followed by lower overtime pay than normal in the next year, on average. This would serve as a strong offsetting force on the effect of overtime on the present value of labour costs. Similar results hold for incentive pay and shift premium pay (columns (III)-(IV)). However, for salaried job stayers, the autocorrelation of shift premium pay and other pay is not significantly different from zero at the 5 percent level, suggesting that, within a match, the amounts of these components are i.i.d., conditional on receipt. For hourly-paid job stayers, shift premium pay and other pay are significantly negatively autocorrelated. Taken together, these results suggest that basic wages are considerably more important for the present value of labour costs than extra pay components; the estimates here point to the allocative wage for job stayers in the ASHE being most closely approximated by basic wages.

TABLE C2: Estimated persistence of basic wages and non-basic pay components, job stayers

	Basic wages (I)	Overtime (II)	Incentive pay (III)	Shift premium pay (IV)	Other pay (V)
Salaried	0.220^{***}	-0.116^{***}	-0.068^{***}	-0.021	0.020
	(0.005)	(0.007)	(0.016)	(0.017)	(0.011)
Hourly-paid	0.199^{***}	-0.125^{***}	-0.129^{***}	-0.063^{***}	-0.064^{***}
	(0.008)	(0.007)	(0.021)	(0.012)	(0.012)
N (in 000s)					
Salaried	592	47	16	31	78
Hourly-Paid	325	54	11	35	29

Notes: Least squares coefficient estimates of ρ in Equation (4).
***, *, * indicate significance from zero at the 0.1%, 1%, 5% levels, respectively. Two-sided tests, and standard errors in parentheses are robust to clustering within match.
Sample for each pay component restricted to job stayers who received the pay component in consecutive years.

Appendix D. Measurement Error in Job-Stayer Wage Changes

This appendix discusses a previously undocumented source of errors in the ASHE dataset, concerning the accuracy of the reported hours of work. As mentioned earlier, if an employee's pay period is a calendar month, but working hours are weekly, then the ASHE asks employers to multiply the weekly hours by 4.348 and to report the result as hours per calendar month. In our sample, almost 75 percent of job stayers are paid per calendar month. Because the questionnaire only allows employers to report hours and minutes worked, respondents have to round decimal values that result from the conversion of weekly hours. Unfortunately, no guidelines are provided to employers on how they should round in such cases.

For example, if an employee works 40 basic hours per week, then the hours worked in the calendar month are 173 hours, 55 minutes, 12 seconds ($40 \times 4.348 = 173.92$). It is in the discretion of the person who is answering the questionnaire whether she rounds up this number to 173 hours and 56 minutes, or rounds it down to 173 hours and 55 minutes. Another potential source of error is the conversion from decimal to minutes: the employer might incorrectly supply decimal numbers instead of hours and minutes. For example, a 38-hour week results in a monthly value of 165.224 ($38 \times 4.348 = 165.224$), so 165 hours and 13 minutes (omitting seconds). It is conceivable that some employers might incorrectly report 165 hours and 22 minutes.[4] The ONS converts these reported values back to average weekly hours, dividing monthly hours by 4.348. This can potentially explain the relatively high frequency of weekly hours worked in the ASHE dataset with values of 39.999 and 40.003.

To gain a better understanding of the significance of this novel source of measurement error, we compute the share of job stayers with non-zero changes in working hours of less than one minute from year-to-year. This is the case for around 21.5 percent of salaried job stayers who are paid per calendar month in consecutive years. To check whether these small hours changes are more likely to be erroneous or actual changes, we turn to these affected job stayers' *weekly* pay. These data should be reported directly from payroll, without requiring a conversion for the pay period, and so we expect them to be relatively more accurate. Only 6 percent of the affected job stayers show adjustments in weekly basic pay. This strongly suggests that the recorded marginal changes in weekly hours are more likely to be measurement error than actual changes.

We perform another check by looking at changes in weekly basic pay which are unaffected by any measurement error in basic hours worked in the data. We consider *exact* zero changes, instead of a range around zero, to define a year-to-year freeze, because payroll data on weekly basic pay are more reliable. The results are displayed in Table D1 columns (I) & (II). The shares of exact freezes and cuts in weekly basic pay are not notably different from the shares found using basic (hourly) wages in a 0.005 range around zero (columns (III) & (IV), Table D1). If anything, basic wages appear less rigid than basic weekly pay, suggesting our approach of using a range around zero to define a freeze is a conservative choice. Since weekly basic pay changes can also occur when basic hours worked change, we repeat the same exercise for a sub-sample of job stayers who recorded an exactly zero year-to-year change in hours worked (around 20 percent of salaried job stayers). The results are displayed in Table D2 columns (I) & (II). The average spike at zero is 18 percent and the frequency of cuts is only

[4] This is no hypothetical issue. The authors know from personal employment experience that some employers in the Scottish hospitality sector frequently make mistakes when converting decimal values into hours and minutes worked.

7 percent, suggesting that our adjustment in the main results of using a 0.005 range around zero provides a lower bound on the true proportion of basic wage freezes and an upper bound on the share of cuts.

TABLE D1: Nominal changes in weekly basic pay and basic wages, salaried job stayers.

Years	Weekly basic pay		Basic wages	
	Exact Freezes (%) (I)	*Exact* Cuts (%) (II)	Freezes (%) (III)	Cuts (%) (IV)
2006-07	10.3	9.0	10.0	11.3
2007-08	7.8	7.7	7.5	10.0
2008-09	15.6	10.2	15.0	11.1
2009-10	21.8	12.5	21.1	14.5
2010-11	21.3	10.8	21.4	11.9
2011-12	27.3	10.3	27.2	12.2
2012-13	25.1	10.1	24.3	12.3
2013-14	13.8	8.6	13.9	9.9
2014-15	12.5	9.1	13.0	10.1
2015-16	17.7	9.8	17.6	11.1
2016-17	13.9	9.3	14.4	10.8
2017-18	15.3	9.2	15.1	11.2
Average	16.9	9.7	16.7	11.4

Notes: Freezes and cuts show the percentage of job stayers with no change and negative change in the pay measure indicated. See Appendix Table E1 column (III) for annual sample sizes.

TABLE D2: Nominal changes in weekly basic pay with unchanged hours worked, salaried job stayers.

Years	Weekly basic pay, constant hours subsample		Basic wages	
	Exact Freezes (%) (I)	*Exact* Cuts (%) (II)	Freezes (%) (III)	Cuts (%) (IV)
2006-07	14.1	5.0	10.0	11.3
2007-08	8.3	5.0	7.5	10.0
2008-09	15.1	8.3	15.0	11.1
2009-10	22.9	11.3	21.1	14.5
2010-11	21.8	7.5	21.4	11.9
2011-12	29.6	8.0	27.2	12.2
2012-13	27.0	8.2	24.3	12.3
2013-14	14.1	6.4	13.9	9.9
2014-15	12.5	6.8	13.0	10.1
2015-16	18.2	7.6	17.6	11.1
2016-17	14.8	7.1	14.4	10.8
2017-18	16.5	7.0	15.1	11.2
Average	17.9	7.4	16.7	11.4

Notes: Freezes and cuts show the percentage of job stayers with no change and negative change in the pay measure indicated.

Appendix E. Additional Tables and Figures

Here we provide further statistical evidence on nominal wage changes to allow a comparison to previous studies We consider a statistical indicator proposed by Lebow, Saks, and Wilson (2003), hereafter the 'LSW statistic', to assess the asymmetry of the wage change distribution. Underlying the LSW statistic is the assumption that the notional wage change distribution is symmetric around its median, and that its upper half is largely unaffected by any nominal rigidities.[5] The LSW statistic is then calculated as the difference between the notional and observed mass of negative wage changes, and is interpreted as the missing mass of wage cuts.[6]

Figure E1 displays the LSW statistic for job stayers and each year in 2007-2018, as well as the UK unemployment rate and the inflation rate. For reference, we also show the share of year-to-year freezes among job-stayer wage changes over time.

See Appendix Tables E1 for sample sizes by year. Inflation is measured as the April-to-April log change in the UK Consumer Price Index (CPI). The unemployment rate refers to UK individuals aged 16 and over, seasonally adjusted and for the second April of each period, expressed as a percentage of the economically active population. Output per hour worked is calculated as gross value added (GVA) divided by the number of hours worked. All series are from the Office for National Statistics.

The LSW statistic suggests that the missing mass of wage cuts increased during the recession to 15.3 percent for salaried job stayers and to 19.3 percent for hourly-paid job stayers, indicating that the wage change distribution became more asymmetric. The substantial spike in 2016 is due to the introduction of the National Living Wage to the UK.[7] The visible large spikes at zero and the lack of wage cuts in the histograms, combined with the cyclical increases in both year-to-year wage freezes and the missing mass of wage cuts, provide statistical evidence that basic wages exhibit significant downward nominal rigidity in Great Britain.

[5]The assumption that the notional wage change distribution is symmetric is commonly invoked, see, for example, Card and Hyslop (1996) or Dickens et al. (2007).

[6]The LSW statistic is computed as $[1-F(2\cdot P_{50}+0.005)]-F(-0.005)$, where $F(\cdot)$ is the cumulative distribution function of wage growth and P_{50} is its median. See Lebow, Saks, and Wilson (2003) for further discussion.

[7]In 2015, the UK government announced the introduction of a new National Living Wage that would apply to all workers aged 25 and over from April 2016. The rate was set at £7.20, which represented a substantial increase of 7.5 percent over the previous National Minimum Wage.

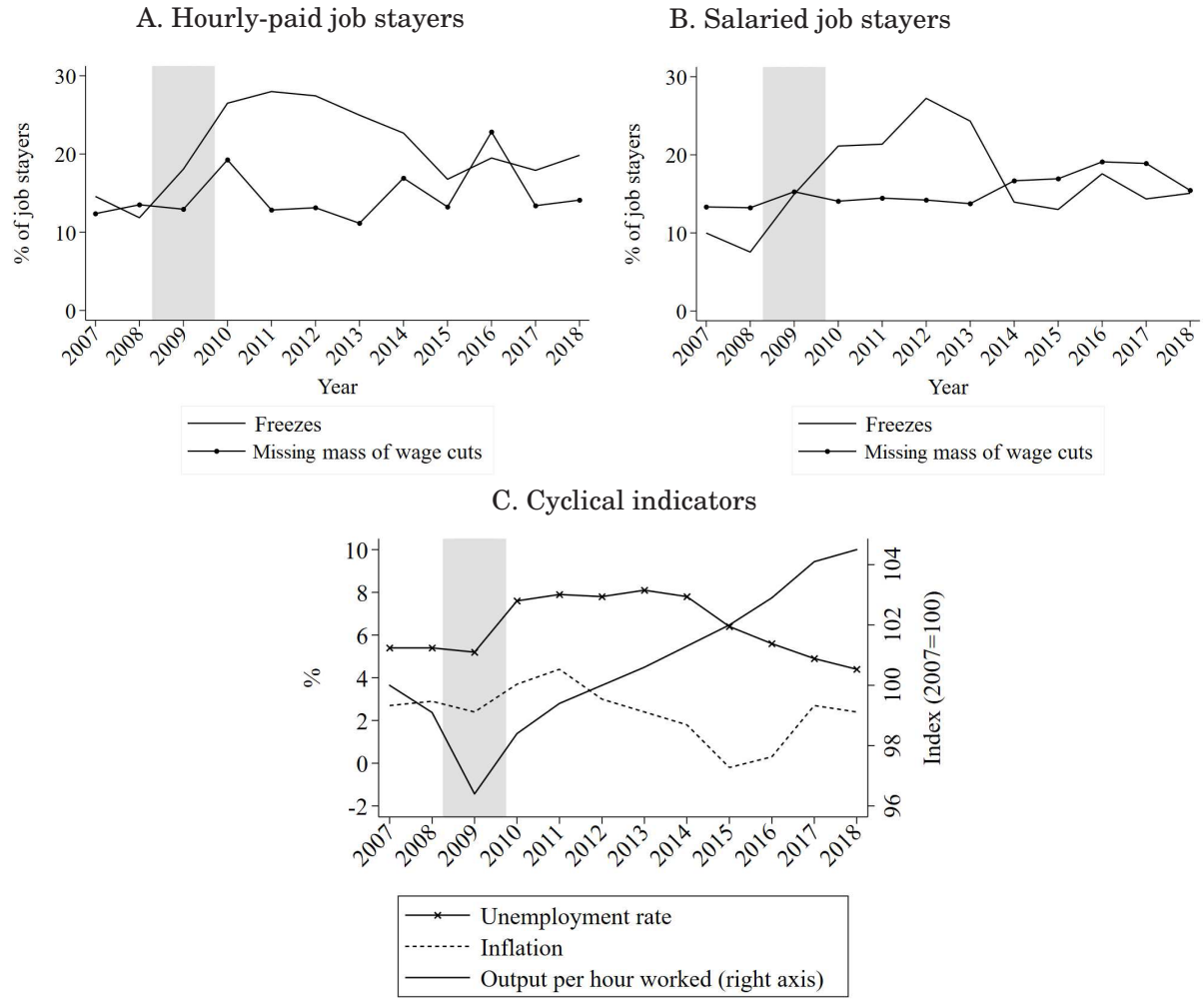

FIGURE E1: Statistical indicators of DNWR in the year-to-year basic wages of job stayers, and cyclical indicators

Notes: 'Freezes' show year-to-year changes in log basic wages for job stayers in the interval $[-0.005, 0.005]$. 'Missing mass of wage cuts' show the LSW statistic. Inflation is measured as the April-to-April log change in the UK Consumer Price Index (CPI). The unemployment rate refers to UK individuals aged 16 and over, seasonally adjusted and for the second April of each period, expressed as a percentage of the economically active population. Output per hour worked is calculated as gross value added (GVA) divided by the number of hours worked. All series in panel C. are from the Office for National Statistics. See Appendix Tables E1 for the sample sizes by year.

TABLE E1: Sample sizes of job-stayer wage change observations

Years	Total (I)	Hourly-paid (II)	Salaried (III)
2006-07	64,618	20,962	43,656
2007-08	64,558	21,494	43,064
2008-09	65,010	21,854	43,156
2009-10	82,258	29,140	53,118
2010-11	81,920	30,240	51,680
2011-12	81,973	30,603	51,370
2012-13	80,707	28,911	51,796
2013-14	83,362	28,672	54,690
2014-15	82,159	28,921	53,238
2015-16	78,952	27,578	51,374
2016-17	75,193	25,847	49,346
2017-18	74,086	25,865	48,221

Notes: Displays annual sample sizes of job stayers for the different sub-samples used.

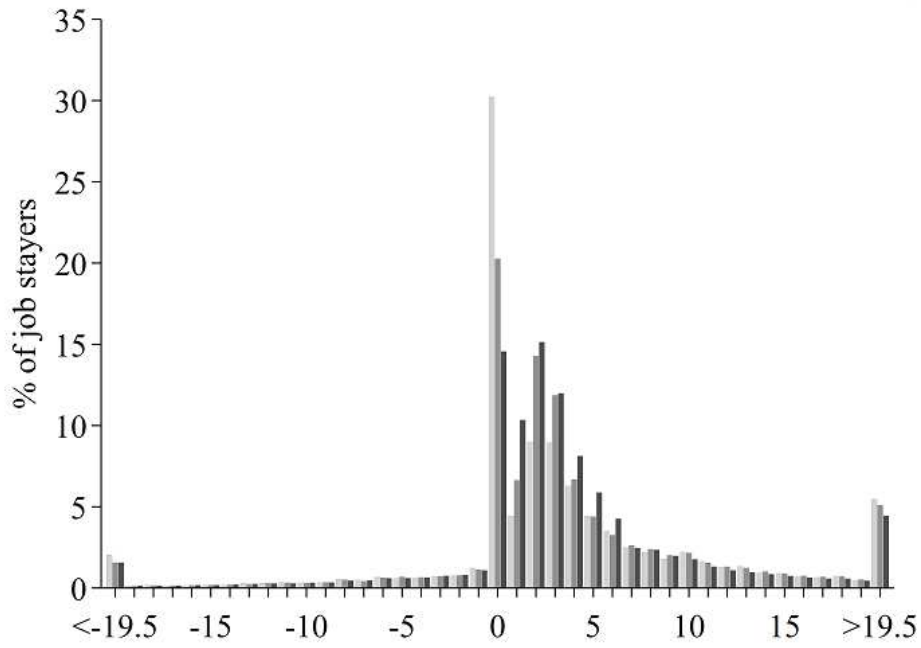

FIGURE E2: Frequency distribution of year-to-year changes in log basic wages of salaried and hourly-paid job stayers by firm size

Notes: See Figure 2. Pooled data for 2006-18. **Light grey bars**: small firms (< 50 employees). **Medium grey bars**: medium-sized firms (50 – 249 employees). **Dark grey bars**: large firms (≥ 250 employees). The size of a job stayer's firm is defined in the first of two consecutive years.

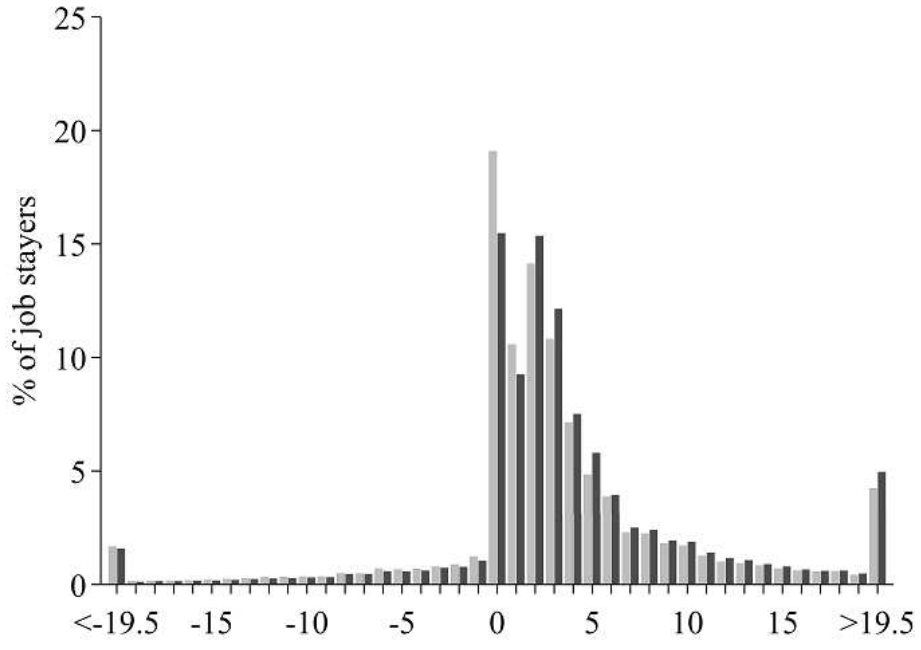

FIGURE E3: Frequency distribution of year-to-year changes in log basic wages, shrinking vs expanding firms, job stayers

Notes: See Figure 2. Pooled data for 2006-2018. **Light bars:** 277,001 job stayers whose firms experienced *negative* year-to-year employment growth over the same period. **Dark bars**: 259,236 job stayers whose firms experienced *positive* year-to-year employment growth over the same period.

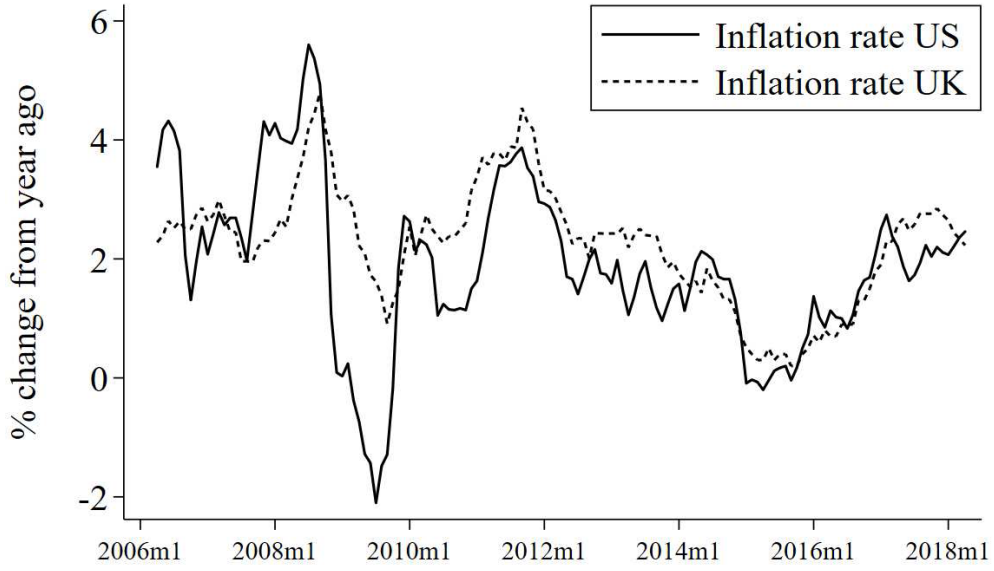

FIGURE E4: Change in Consumer Price Index from Year ago (in %), US and UK

Notes: Average UK inflation rate April 2006 - April 2018: 2.4 percent; Average UK inflation rate May 2008 - Dec 2016: 2.2 percent; Average US inflation rate May 2008 - Dec 2016: 1.6 percent.
Sources: US CPI: U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average; UK CPI: Organization for Economic Co-operation and Development, Consumer Price Index of All Items in the United Kingdom.

Appendix F. Year-To-Year Adjustments in Earnings Per Hour

In the main text, we presented evidence on DNWR using basic wages. We have argued that basic wages are the relevant wage notion for macroeconomic models that include stickiness in nominal wages to generate fluctuations in unemployment. Basic wages exclude various kinds of extra pay: shift premium pay, overtime pay, commissions and incentive pay, and other pay (e.g., meal and travel allowances). In this Appendix, we analyse changes in average earnings per hour, excluding overtime, for further comparison with the existing literature where data availability did not permit an analysis of basic wages. This is the same wage measure as previously analysed by Nickell and Quintini (2003) and Elsby, Shin, and Solon (2016). For a discussion on the likely effects of measurement error in hours worked on the results presented in the previous studies, and how our proposed corrections lead to different estimates of wage freezes and cuts, see Appendix D.

How should changes in earnings per hour, excluding overtime, be interpreted? Changes in labour income caused by changes in working hours do not affect a firm's marginal labour input cost per hour (except for the very first overtime hour). Similarly, changes in commissions and incentive pay or allowances are likely linked to a worker's output (e.g., sales) and labour input (e.g., business travel). Again, the marginal production costs a firm faces are likely unaffected by these extra pay components. However, from a worker's perspective, changes in earnings per hour might be perceived as income risk, depending on whether workers welcome reductions in long working times or less business travel (Devereux, 2001; Jardim, Solon, and Vigdor, 2019).

We begin by describing the year-to-year changes in job-stayer earnings per hour, excluding overtime. Figure F1, reproduced here for convenience, displays the results for hourly-paid (dark bars) and salaried (light bars) job stayers. The patterns in Figure F1 are similar to the ones seen in Figure 2 for basic wages. Nominal cuts are somewhat more common; the average share of hourly-paid job stayers receiving cuts is 11 percent, and for salaried job stayers this share is 17 percent. However, the distributions show strong signs of a censoring of earnings cuts. The spike at zero is substantial, though slightly lower than for basic wages. On average, 17 percent of hourly-paid and 14 percent of salaried job stayers have their earnings per hour, excluding overtime, frozen from year-to-year. The numbers imply constant quarterly wage-change probabilities of 0.36 and 0.39, respectively.[8] However, we caution against taking these probabilities at face-value as evidence against nominal rigidity, given the above described ambiguity in interpreting nominal changes in earnings per hour, excluding overtime.

Figure F2 displays time series evidence for the earnings per hour, excluding overtime, adjustments of job stayers comparable to Figure E1 for basic wages. The share of year-to-year freezes is strongly rising throughout the recession period for hourly-paid and salaried job stayers, peaking at 21.2 percent and 21.9 percent, respectively, in 2011-12. The Lebow, Saks, and Wilson (2003) statistic, indicating the missing mass of cuts, does not provide clear evidence for binding DNWR in earnings per hour, excluding overtime, for salaried workers. For hourly-paid workers, the missing mass falls from 12.2 percent to 9.1 percent from 2008 to 2009, but substantially increases to 14.1 percent for job stayers from 2009 to 2010.

[8] As before, we convert values as follows: $p_q = 1-(1-p_y)^{1/4}$, with p_q denoting the quarterly wage-change probability, and p_y the yearly wage-change probability.

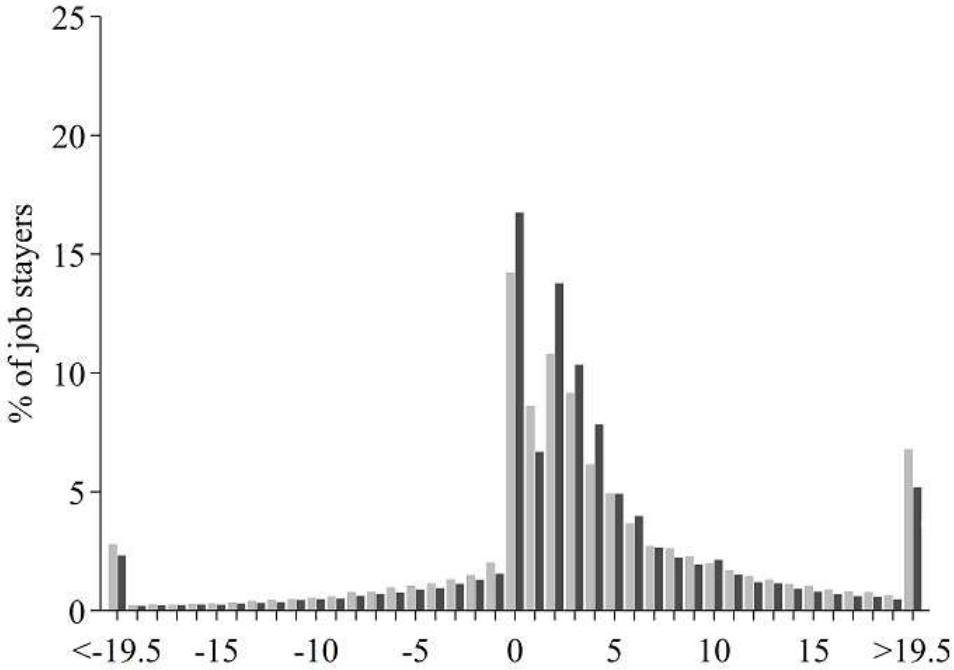

FIGURE F1: Frequency distribution of year-to-year changes in log earnings per hour, excluding overtime, job stayers

Notes: See Figure 2. **Light bars**: salaried. **Dark bars**: hourly-paid.

Our results for job-stayer adjustments in earnings per hour, excluding overtime, support the findings in the literature from studies of employer payroll records or payslips, recently summarised by Elsby and Solon (2019): cuts in average earnings per hour occur commonly, typically affecting more than 15 percent of job stayers. We view this as important evidence that workers face considerable earnings risk. Our results are also in line with findings for the US from Fallick, Villar, and Wascher (2020). They used data from the Employment Cost Index of the US Bureau of Labor Statistics, where the unit of analysis is not the worker, but the job. For each job, they observed the average nominal compensation per employee, including benefits such as pension payments. They reported an average proportion of year-to-year compensation freezes of 16 percent and nominal cuts of 15 percent. Because they cannot control for any changes to worker characteristics in the jobs, average nominal compensation changes can occur when the unobserved underlying skills of the employees in a job change. Consistent with that, they find much more variation in nominal compensation in jobs than we find here.

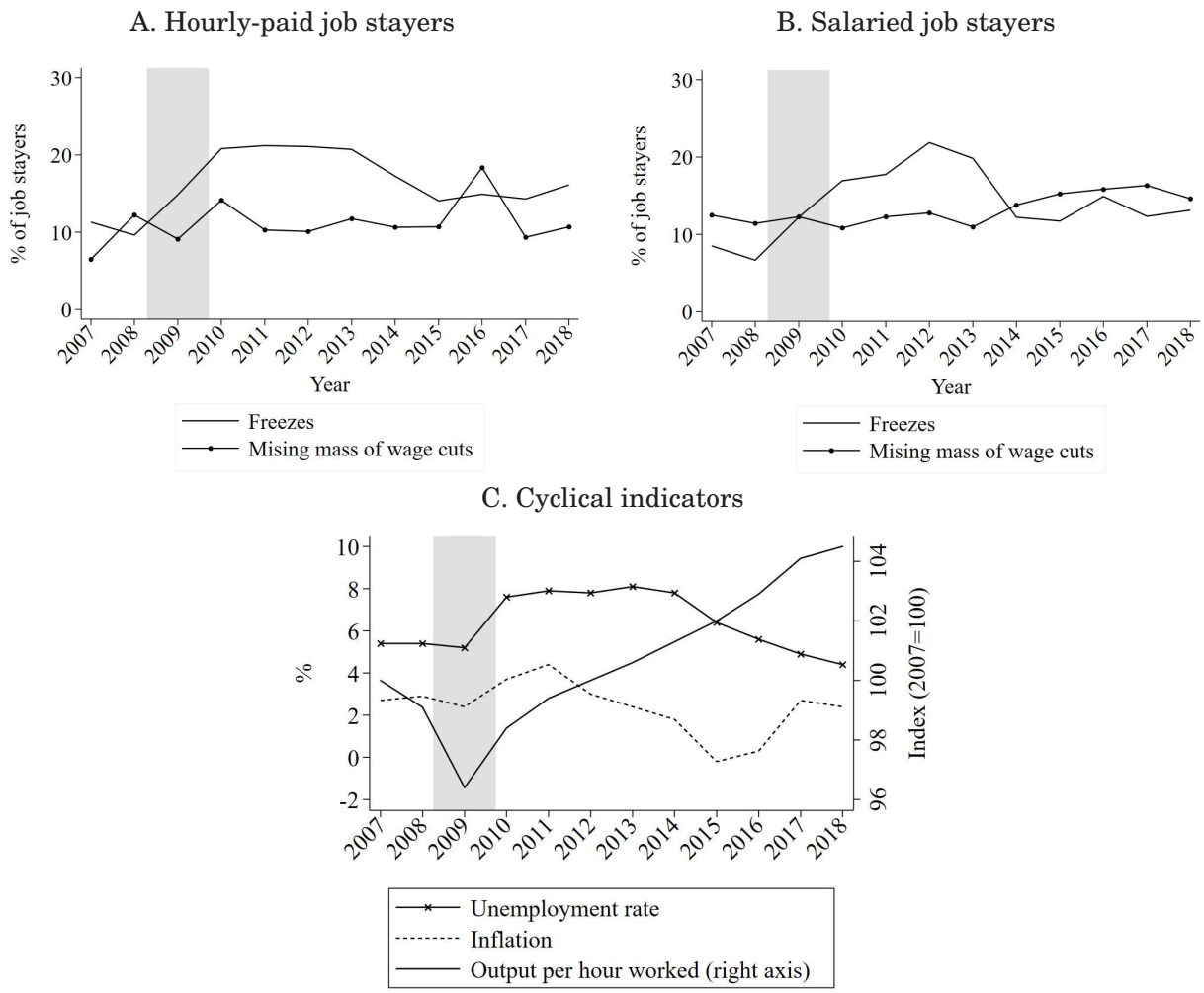

FIGURE F2: Quantitative indicators of DNWR, earnings per hour, excluding overtime

Notes: 'Freezes' show year-to-year changes in log earnings per hour, excluding overtime, for job stayers in the interval $[-0.005, 0.005]$. 'Missing mass of cuts' show the LSW statistic. See Appendix Tables E1 for sample sizes by year. Inflation is measured as the April-to-April log change in the UK Consumer Price Index (CPI). The unemployment rate refers to UK individuals aged 16 and over, seasonally adjusted and for the second April of each period, expressed as a percentage of the economically active population. Output per hour worked is calculated as gross value added (GVA) divided by the number of hours worked. All series are from the Office for National Statistics.

Appendix G. Further Details on the Heterogeneity in Wage Freezes and Cuts across Workers and Firms

We study the conditional likelihood of year-to-year nominal wage cuts or freezes of job stayers, conditional on the state of the economy. The following process describes whether a wage cut or freeze between periods $t-1$ and t is observed for job-stayer i:

$$y_{it} = \begin{cases} 1 & \text{if} \quad y_{it}^* > 0, \\ 0 & \text{if} \quad y_{it}^* \leq 0 \end{cases} \tag{5}$$

whereby the latent variable y_{it}^* for job stayer i is

$$y_{it}^* = \gamma_t + \mathbf{x}_{it}'\boldsymbol{\beta} + \varepsilon_{it}, \qquad \varepsilon_{it} \sim N(0,1) \tag{6}$$

Here, y_{it} either represents basic wage freezes or cuts. We include year-fixed effects, γ_t, to account for the state of the business cycle. $\mathbf{x}_{it}$ includes dummy variables indicating an employee's gender, whether their employer is in the private or non-private sector, whether their wage is set according to any form of collective agreement, whether the job is in the 'Wholesale & Retail Trade, Hotels & Restaurants sectors' industry (SIC G-H), and the worker's age band. We also include dummies in $\mathbf{x}_{it}$ for employer sizes: 'small' (<50 employees), 'medium' (50-249 employees), 'large' (500-4,999 employees), and 'very large' ($\geq 5,000$ employees). Additionally, we include dummy variables for the employee's position in the basic weekly pay distribution among all ASHE employees in the respective year, whereby 'low earnings' or 'high earnings' indicate that the employee earned below 2/3 or above 4/3 of median basic weekly wages that year, respectively, and 'medium earnings' refers to all remaining job stayers. All these dummy variables refer to period $t-1$ values. We also include indicator variables for the year-to-year growth in the number of employees at a job-stayer's firm, over the corresponding period (shrinking, expanding or constant), which proxy for the state of the firm.[9] For hourly-paid job stayers, we further include a dummy variable indicating whether the reported hourly basic wage is a multiple of ten pence ('round'). The results of estimating the probit models are displayed in Tables G1 and G2, with both slope coefficients and margins (probabilities) displayed, with the latter evaluated at the sample averages using the delta method.

[9]The employee counts of firms are provided in the ASHE dataset from the Inter-Departmental Business Register (IDBR), which is the official list of UK enterprises. We use the more common term 'firm' interchangeably with 'enterprise', which refers to a UK-specific administrative definition of an employer that could contain several local units or plants.

TABLE G1: Probit estimates: Incidence of year-to-year basic wage freezes for job stayers

	Salaried		Hourly-paid	
	Coefficient (I)	Margin (Pr.) (II)	Coefficient (III)	Margin (Pr.) (IV)
1. Female		0.157		0.187
2. Male	0.079***	0.177	0.112***	0.219
3. Non-private sector		0.169		0.226
4. Private sector	−0.012*	0.166	−0.108***	0.195
5. No coll. agree.		0.177		0.222
6. Coll. agreement	−0.072***	0.159	−0.139***	0.183
7. Age 15-29		0.103		0.152
8. Age 30-44	0.261***	0.158	0.184***	0.200
9. Age 45-64	0.417***	0.199	0.275***	0.226
10. Low earnings		0.180		0.178
11. Medium earnings	0.011	0.183	0.140***	0.217
12. High earnings	−0.103***	0.154	0.137***	0.216
13. Small firms		0.265		0.333
14. Medium firms	−0.266***	0.186	−0.288***	0.236
15. Large firms	−0.395***	0.153	−0.484***	0.180
16. V. large firms	−0.432***	0.145	−0.603***	0.151
17. SIC G-H		0.171		0.165
18. Not SIC G-H	−0.017*	0.167	0.202***	0.221
19. Firm expanding		0.145		0.179
20. Firm const. size	0.156***	0.183	0.113***	0.210
21. Firm shrinking	0.165***	0.186	0.171***	0.227
22. 'Non-round'				0.188
23. 'Round' rate			0.211***	0.250
Year-fixed effects	✓		✓	
N of job stayers	503,330		272,648	
Log-likelihood	-225,418		-132,916	

Notes: The dependent variable is an indicator that takes the value one if a job stayer experienced a basic wage freeze from year-to-year, and zero otherwise. Marginal effects are evaluated at the sample average using the delta method. Excludes all job stayers for 2007-2008 and 2017-2018 because firm size was incorrectly recorded by the ONS in the second years of those periods.

***, **, * indicate significance from zero of the model coefficients at the 0.1%, 1% and 5% levels, respectively, two-sided tests and robust standard errors.

TABLE G2: Probit estimates: Incidence of year-to-year basic wage cuts for job stayers

	Salaried		Hourly-paid	
	Coefficient (I)	Margin (Pr.) (II)	Coefficient (III)	Margin (Pr.) (IV)
1. Female		0.109		0.033
2. Male	0.040***	0.117	0.155***	0.046
3. Non-private sector		0.108		0.042
4. Private sector	0.048***	0.117	−0.047***	0.038
5. No coll. agree.		0.116		0.040
6. Coll. agreement	−0.033***	0.110	−0.031**	0.038
7. Age 15-29		0.089		0.035
8. Age 30-44	0.156***	0.117	0.075***	0.041
9. Age 45-64	0.164***	0.118	0.055***	0.039
10. Low earnings		0.164		0.045
11. Medium earnings	−0.204***	0.119	−0.058***	0.040
12. High earnings	−0.302***	0.100	−0.243***	0.026
13. Small firms		0.133		0.034
14. Medium firms	−0.101***	0.112	0.035*	0.037
15. Large firms	−0.122***	0.108	0.007	0.035
16. V. large firms	−0.110***	0.111	0.125***	0.045
17. SIC G-H		0.109		0.022
18. Not SIC G-H	0.027***	0.114	0.353***	0.049
19. Firm expanding		0.113		0.034
20. Firm const. size	0.011	0.115	0.021	0.036
21. Firm shrinking	0.004	0.113	0.148***	0.047
22. 'Non-round'				0.040
23. 'Round' rate			−0.065***	0.035
Year-fixed effects	✓		✓	
N of job stayers	503,330		272,648	
Log-likelihood	-178,276		-46,819	

Notes: The dependent variable is an indicator that takes the value one if a job stayer experienced a basic wage cut from year-to-year, and zero otherwise. Marginal effects are evaluated at the sample average using the delta method. Excludes all job stayers for 2007-2008 and 2017-2018 because firm size was incorrectly recorded by the ONS in the second years of those periods.

***, **, * indicate significance from zero of the model coefficients at the 0.1%, 1% and 5% levels, respectively, two-sided tests and robust standard errors.

Appendix H. Further Details on Benigno & Ricci (2011)

H.1. Description of the Theoretical Framework

In BR's model, households enjoy the consumption of differentiated goods, which are supplied by firms operating in competitive output markets. The prices of consumption goods are fully flexible. The consumption output of each firm is produced using a constant elasticity of substitution production function, which takes as inputs differentiated types of labour inputs. This production function exhibits the 'love-for-variety' property; the differentiated types of labour inputs are imperfect substitutes. Therefore, taking real wages as given, each firm demands a combination of all types of labour inputs. Labour markets are characterised by monopolistic competition, in which each household supplies a variety of types of labour to the output producing firms. Firms' profit-maximisation means that each household faces a downward-sloping labour demand curve for each of its types of labour.

Each household's lifetime utility increases in consumption and falls in labour supply. To maximise lifetime utility, each household chooses nominal wages for each type of labour, taking as given the labour demand curves for each type of labour and the rate of inflation. With inflation given, any change in nominal wages translates into an equally sized change in real wages. Importantly, idiosyncratic preference shocks affect every period the disutility from the differentiated types of labour, generating the need to adjust labour supply across firms by changing real wages. Consider the case where a shock increases the disutility derived from supplying a certain type of labour while the rate of inflation is zero. Each household wants to increase the nominal wage for the type of labour affected, which implies that firms would demand less of that type of labour input. Similarly, if a shock decreases the disutility derived from supplying a certain kind of labour, each household wants to decrease the nominal wage for that type of labour.

To build the intuition, consider first the case where nominal wages cannot be cut under any circumstances and the rate of inflation is zero. Forward-looking firms and households internalise the effect that their current wage setting will have on the likelihood of being constrained by downward rigidity in the future, consistent with Elsby (2009); households that raise the nominal wage of a type of labour today are more likely to be bound by downward nominal rigidity in the future. Therefore, households, when they are hit by a preference shock that increases the disutility derived from supplying a certain type of labour, will raise nominal wages for that type of labour less than they would have done in the absence of nominal rigidities. DNWR thus leads to wage growth moderation. Despite this forward-looking wage setting, households are sometimes hit by sufficiently large preference shocks, given the current level of their real wages, that they would like to cut nominal wages to increase labour supply. This is how DNWR leads to an output loss: constrained households end up charging a higher real wage than they want to after being hit by a preference shock. Stuck with the high nominal wage, they end up supplying less labour inputs than they want to supply. This negative effect on employment is partially offset by wage growth moderation that makes downward nominal rigidity less likely to bind. However, as BR show analytically, the net effect is a drop in employment relative to the case of flexible wages. By allowing real wages to fall sufficiently to increase labour demand, inflation in the model can grease the wheels of the labour market.

So far, we assumed that nominal wages could not be cut. However, this is not supported by our data, since we have documented that some nominal wage cuts do occur. Here, we calibrate a version of BR's model, as presented in Section V.C of their article, wherein nominal wages cannot be cut except when a 'very large' preference shock hits the households. This captures the finding by Bewley (1999) that, under rare circumstances such as when the survival of the entire firm is at stake, workers are more likely to agree to wage cuts. When such a very large shock occurs, nominal wages can freely be adjusted upwards or downwards. This version of the model still results in an output loss relative to the flexible wage case, because nominal wages are typically stuck at too high levels despite wage growth moderation. But the output loss in this version of the model is smaller than in the version with completely rigid wages, since nominal wages occasionally become flexible downwards when a very large shock occurs.

H.2. Description of the Calibration and Simulation

The model is calibrated at a quarterly frequency. We keep all parameters at the values calibrated by BR based on the US, except the annual inflation rate and the frequency at which the previously described very large shocks hit households. For the former we choose 2.4 percent annually, consistent with the average value observed in the UK during the sample period of our main analysis (see Table 3 in the main text). We choose the frequency of shocks to match the shares of basic wage freezes and cuts that we observe in British payroll data (Section 4). Intuitively, the more frequently these large shocks occur, the more nominal wage cuts will be observed, while the spike of wage freezes will decline. At the extreme case in which such shocks occur every period, we would observe no spike at zero and the distribution of wage changes would be symmetric around the rate of inflation, since the idiosyncratic 'normal' preference shocks are independent across households.

We initialise 100 workers and simulate their optimal wage setting based on the optimality conditions in BR, specifically equations (27) and (28) on page 1457. Each quarter, households are either subject to DNWR or they are hit by 'very large' preference shocks and nominal wages become flexible. We simulate 12,500 quarters to ensure that the economy is in steady state and that initial conditions do not affect outcomes. We discard the first 12,492 quarters, and compute year-to-year nominal wage changes in the remaining eight quarters for each worker, giving us 400 year-to-year wage change observations. We repeat this simulation 100 times. Our simulated dataset contains 40,000 wage change observations, from which we compute a relative frequency distribution of wage changes.

To match the share of wage cuts and freezes in our data, we set the model parameter governing the frequency of large shocks to $\lambda dt = 0.05$, implying that nominal wages are expected to become downward flexible one quarter in every five years. Figure H1 displays the frequency distribution of year-to-year log wage changes simulated by the model. It generates frequencies of wage freezes (18.7 percent) and wage cuts (9.1 percent), which correspond closely to our main empirical findings. Additionally, the model replicates the empirical feature of a markedly asymmetric wage-change distribution, with positive changes occurring far more frequently than negative changes.

Using the simulated wage paths, we compute the resulting labour demand from firms' first order conditions. Once the quantity of labour is determined, we can compute the level of output produced in

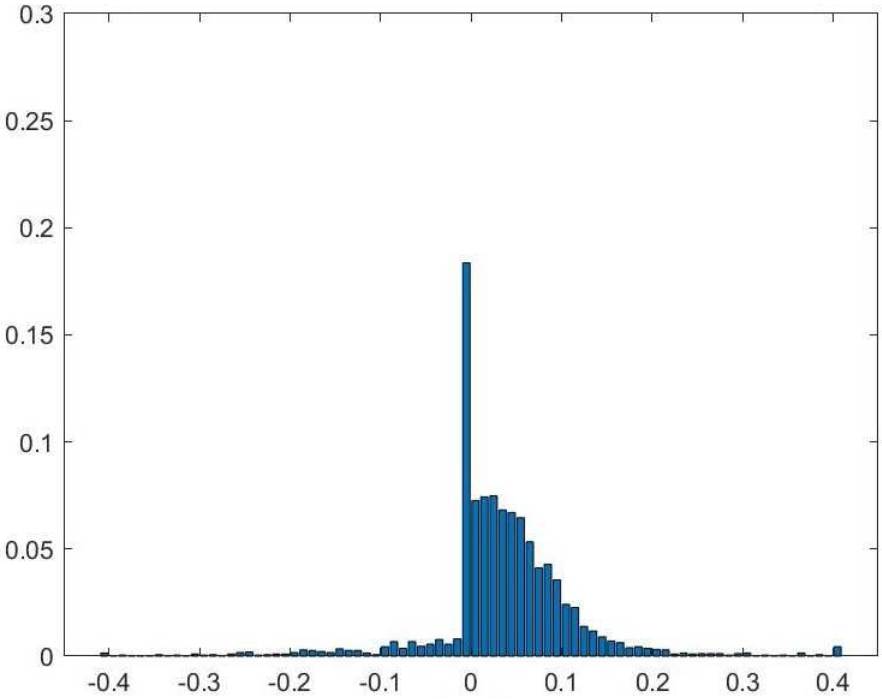

FIGURE H1: Simulation results for year-to-year changes in log wages

Notes: Equivalent to Benigno and Ricci (2011): Figure 5, p. 1458. Simulation uses exactly the same parameters as BR, except $\lambda dt = 0.05$, meaning nominal wages become flexible one quarter in every five years, on average.

each period. Comparing this level of output under DNWR with the level under full employment that results from flexible wages, we obtain the output gap. Repeating this computation for varying values for the annual inflation rate produces the results displayed in Figure 5 in the main text.

As a robustness check, we conduct a second simulation exercise, in addition to the results displayed in the main text. We consider an economy where only some workers are subject to DNWR, while the wages of the other workers can be adjusted flexibly at all times. We use the model presented in Section V.B of BR, no longer allowing for the previous very large idiosyncratic shocks. We parameterise the share of workers with rigid wages, α, to the observed share of workers in our data for which basic wages make up their entire labour income: 53 percent. Figure H2 displays the long-run Phillips curve of this economy. Even if DNWR only affects around half of all workers, the resulting negative output gap is sizeable, with the model implying that around 0.9 percent of long-run equilibrium output is lost when mean annual inflation is 2 percent.

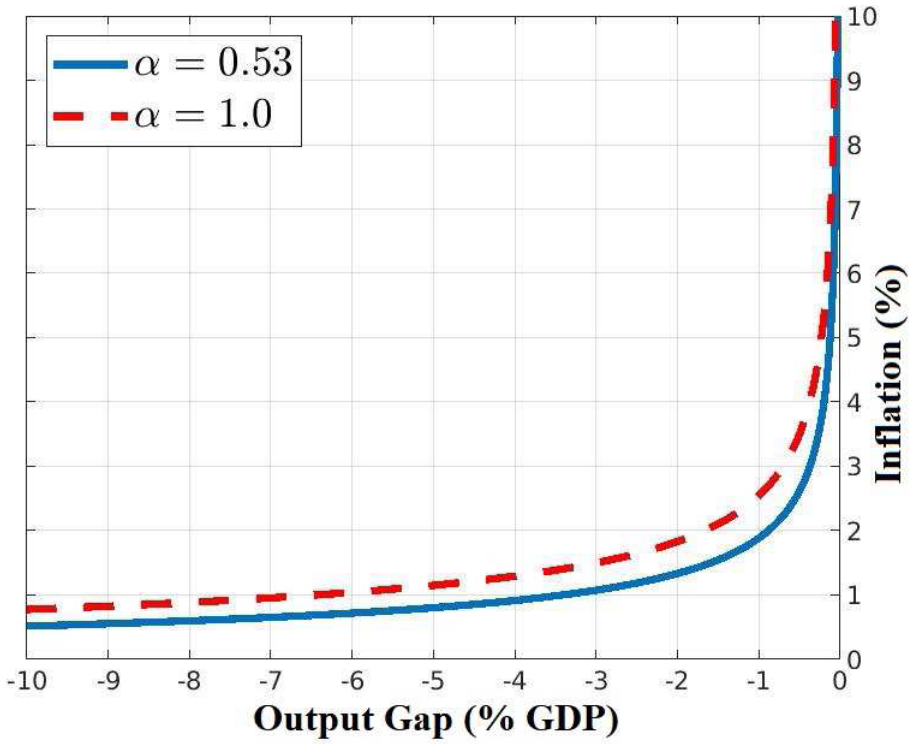

FIGURE H2: Long-run Phillips curve with binding DNWR for an α-share of workers

Notes: Equivalent to Benigno and Ricci (2011): Figure 4, p. 1455. Simulation uses the same parameter values as BR, except α. The dashed line shows the long-run output gap (in percent of GDP) when nominal wages can never be cut. The solid line shows the gap when nominal wages can never be cut for an α-share or employees, while the remaining $(1-\alpha)$-share of employees has completely flexible nominal wages.