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Assessing downward wage rigidity in the United Kingdom

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Madrid, 28 November 2013

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Motivation

Renewed interest in wage rigidity

- **Keynesian/classical model**: In the face of an adverse aggregate shock, existing workers (downward) wage rigidity will amplify employment and output effects.

- **New-Keynesian model**: Sticky prices; employment determined by AD. Existing workers' wage rigidity affects marginal cost and thereby price changes. Monetary policy rule determines extent to which this feeds through to AD and employment.

- **Search-matching model**: Distinction between new hires and existing workers.

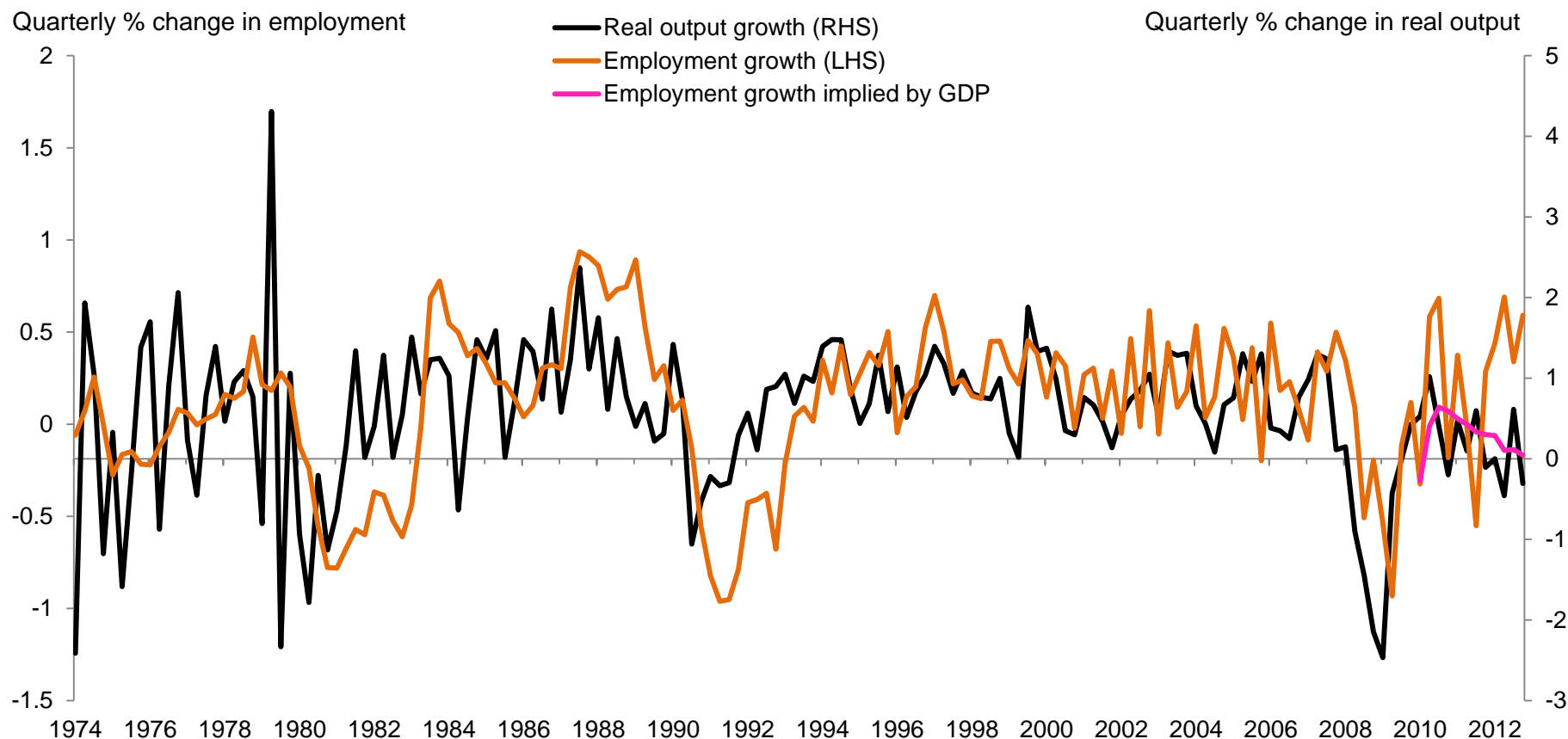BANK OF ENGLAND

Motivation

Policy motivation

- The UK experienced large negative output shock during the Great Recession but a 'muted' fall in the employment rate.

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Motivation

Quarterly % change in employment — Quarterly % change in real output

Legend:
- Real output growth (RHS)
- Employment growth (LHS)
- Employment growth implied by GDP

- Employment response to real output growth 'muted' since 2008
- Unusual relationship between output growth and employment since 2010
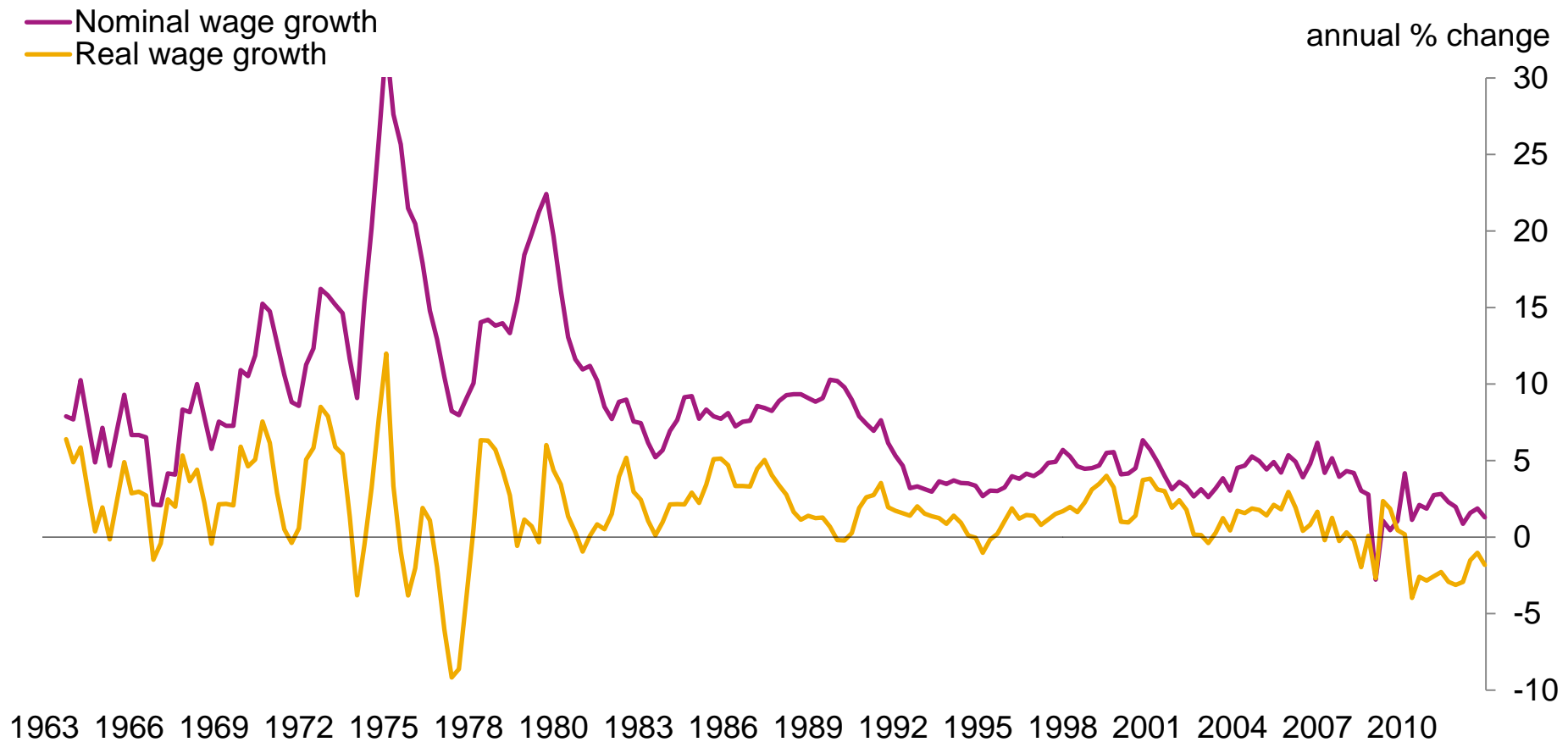
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Motivation

Policy motivation

- The UK experienced large negative output shock during the Great Recession but a 'muted' fall in the employment rate.

- Nominal and real wage growth fell in response and remained weak. This is a historically unusual experience for the UK ('productivity puzzle') and there are many different explanations that account for parts of the story.

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Motivation

- Nominal and real wage growth also unusually low

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Motivation

Policy motivation

- The UK experienced large negative output shock during the Great Recession but a 'muted' fall in the employment rate.

- Nominal and real wage growth fell in response and they remained weak. This is a historically unusual experience for the UK ('productivity puzzle') and there are many different explanations that account for parts of the story

- **One hypothesis is that wages have been more flexible in the downward direction.**

- In our project, we assess the extent of downward nominal and real wage rigidity in the UK and how this has varied over time.

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Outline for the presentation

- **Downward wage rigidity from firm-level analysis**

- Measures of downward wage rigidity using individual micro-data

  - **Downward nominal wage rigidity** (DNWR)

  - **Downward real wage rigidity** (DRWR)

  - **Analysis of developments in the wage growth distribution**
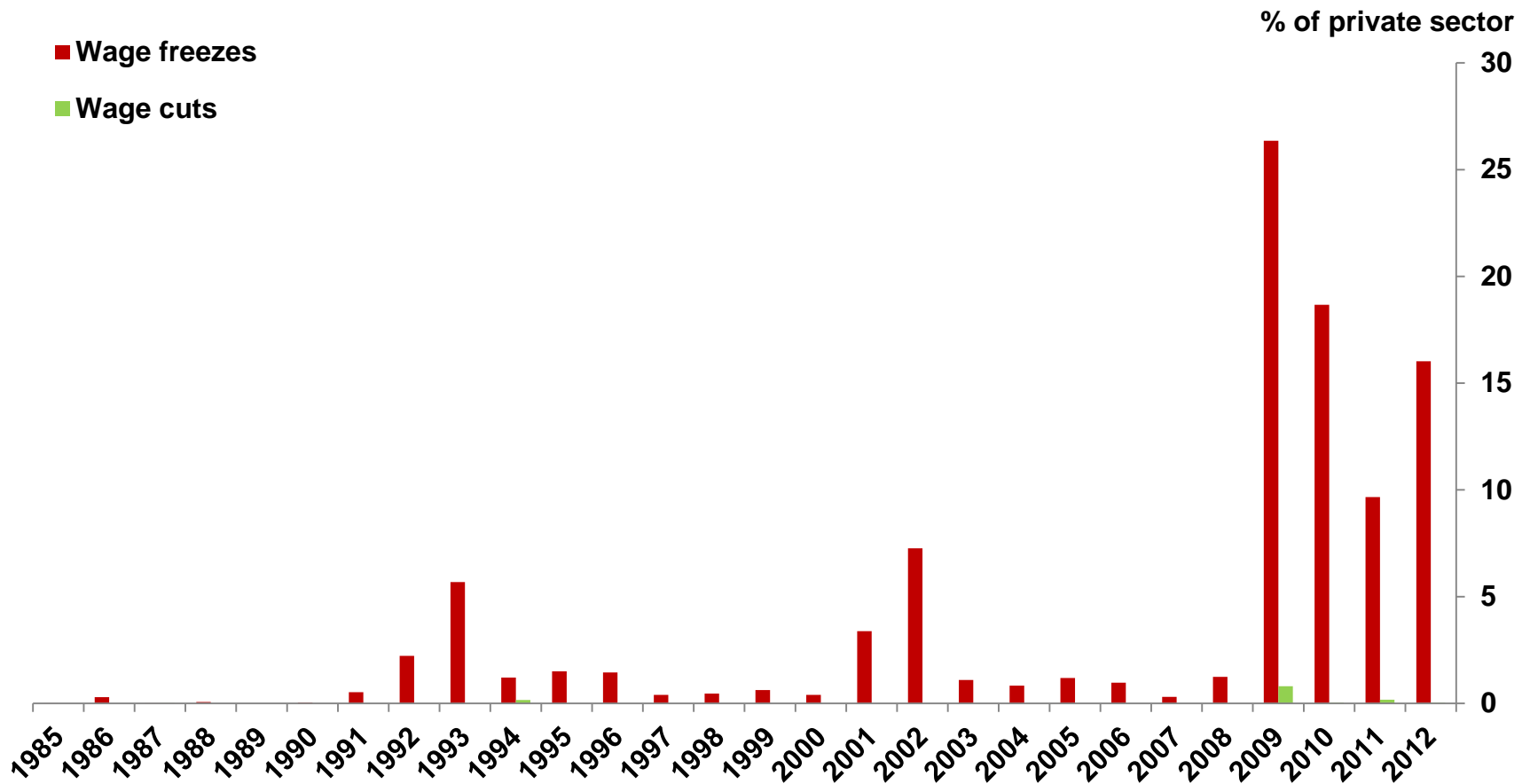
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Downward wage rigidity from a firm perspective

- **How do wages adjust to negative shocks at the level of the firm?**

  - Evidence from wage settlements

- **Which factors influence this adjustment? What seems to matter?**

  - Analysis of firm-level company visit scores

- **What happens to other components of compensation?**

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How do wages adjust to negative shocks at the level of the firm?

- The proportion of wage settlement freezes rose substantially in 2009
- Wage settlement cuts are very rare

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Which factors influence this adjustment? What seems to matter?

- **We use firm-level data: Company Visit Scores**
  - Bank of England data set on firms based in the UK
  - Data collected by different Agencies through face-to-face interviews every month
  - Qualitative scores on firm-level variables: demand, spare capacity, pay settlements, employment, non-labour costs, etc.
  - Information on sector classification also allows us to merge in additional explanatory factors at a sector level

- **We model firms' pay outcomes in a logit model**
  - The dependent variable is takes the value of "1" if it is a pay freeze and the value "0" if it is a raise (makes it easier to interpret the results)
  - Approach similar to other WDN studies (Babecky et al 2008 ECB WP)

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Which factors influence this adjustment? What seems to matter?

Variable	Description	Source	Pay freeze
Profit	Agents' score	CVS	Less likely
Demand	Agents' score	CVS	Less likely
Non labour costs	Agents' score	CVS	Less likely
Capacity utilisation	Agents' score	CVS	Less likely
Firm size	The number of employees in a firm	CVS	Less likely

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Which factors influence this adjustment? What seems to matter?

Variable	Description	Source	Pay freeze
Skill composition	Highly-skilled workers as a proportion of the workforce in each sector	LFS	Less likely
Tenure	Proportion of workers with the same employer for five or more years in each sector	LFS	More/less likely
Production tech	The share of capital in total output by sector	EU KLEMS	More/less likely
Union density	Proportion of workforce who are members of a union for each sector	LFS	Less likely
Sectoral wage growth	Annual total wage growth in average weekly earnings for each sector	AWE	Less likely
Labour market tightness	Ratio of vacancies to unemployment for each sector	LFS, Vacancy survey	Less likely

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Which factors influence this adjustment? What seems to matter?

	2008-2012	2008	2009	2010	2011	2012
firm profitability	-	-	-	-	-	-
firm demand	-	-	-	-	-	-
firm spare capacity	-	-	-	-	-	-
non-labour costs	-			-		
firm size	-		-	-	-	-

significant at the 1% level

significant at the 5% level

significant at the 10% level

insignificant

Note: Year and SIC dummies are also included in the regression

- Most factors have the expected sign
- But non-labour costs only seemed to matter in 2010
- Firm size did not matter pre-recession

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Which factors influence this adjustment? What seems to matter?

	2008-2012		2008	2009	2010	2011	2012
firm profitability	-		-	-	-	-	-
firm demand	-		-	-	-	-	-
firm spare capacity	-			-	-	-	-
non-labour costs	-				-		
firm size	-			-	-	-	
union density	-			-	-	-	-
capital as a share of output	+			+	+		
sector-level wage growth				+	-		+
proportion of highly skilled workers	-			-	-	-	
proportion of permanent workers			+			+	
worker tenure	+		-		+	+	
ratio of vacancies-to-unemployment					+	+	

significant at the 1% level
significant at the 5% level
cant at the 10% level
insignificant

Note: Year and SIC dummies are also included in the regression

- Similar results to the previous model
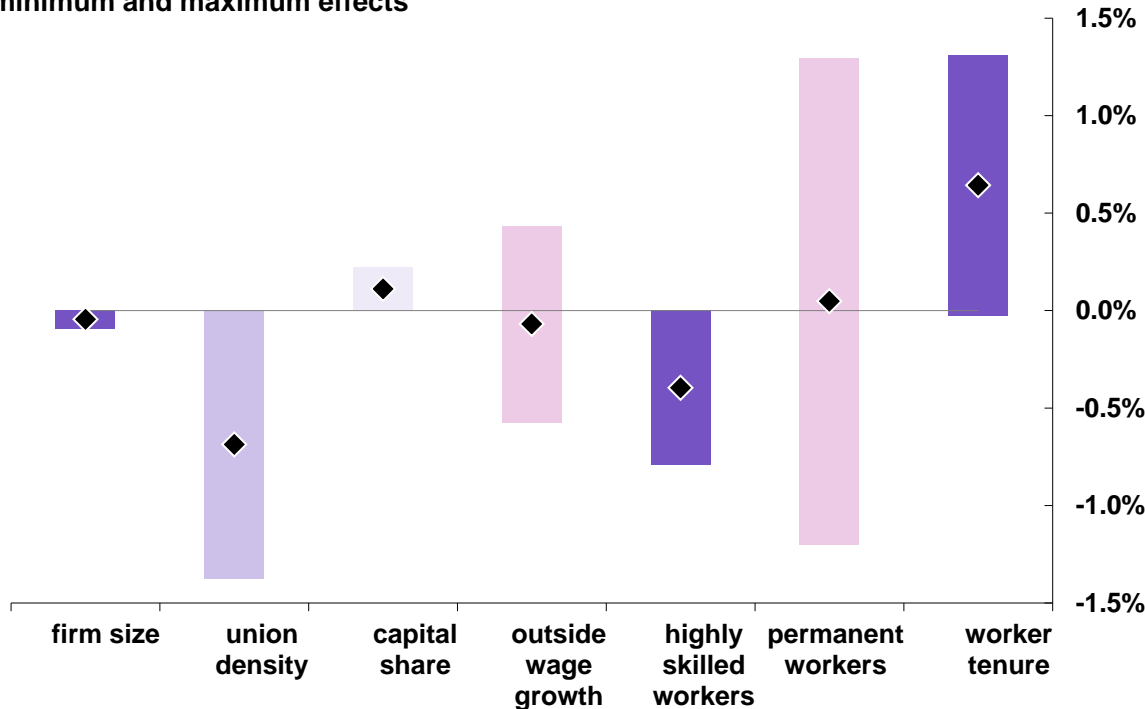- Other explanatory variables that seem to be robust: union density and highly skilled workers

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Which factors influence this adjustment? What seems to matter?

The columns represent the minimum and maximum effects

marginal effects at the mean

Mean %	
firm size	**20.8**
union density	**15.7**
capital share	**27.5**
outside wage growth	**2.4**
highly skilled workers	**24.9**
permanent workers	**95.2**
worker tenure	**51.6**

- **Pink is insignificant**

- **Purple is significant**

- **Diamonds are marginal effects for a 1 unit rise in each variable**

- A 1pp increase in union density seems to decrease the probability of a pay freeze by a bit more than 0.5%

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Which factors influence this adjustment? What seems to matter?

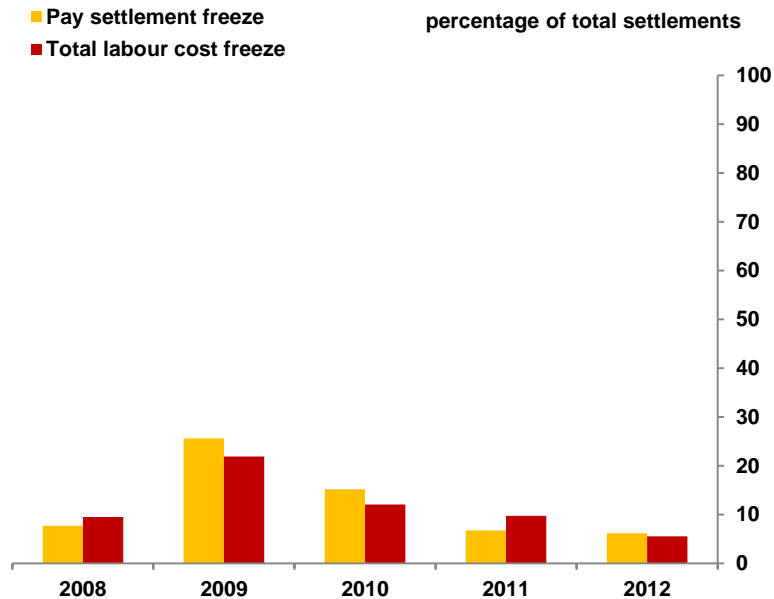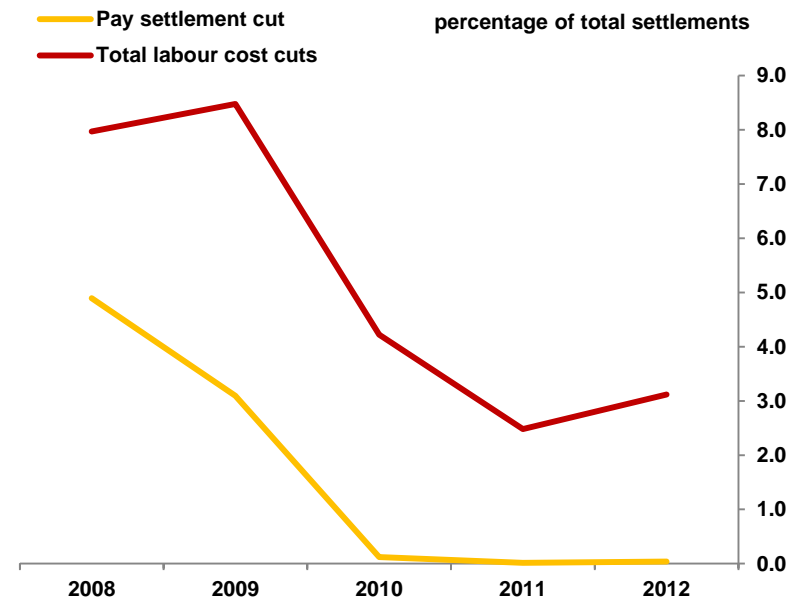**CHART A - FREQUENCY OF NOMINAL WAGE FREEZES IN THE PRIVATE SECTOR (CVS SCORES)**

■ Pay settlement freeze
■ Total labour cost freeze

percentage of total settlements

CHART B - FREQUENCY OF NOMINAL WAGE CUTS IN THE PRIVATE SECTOR (CVS SCORES)

— Pay settlement cut
— Total labour cost cuts
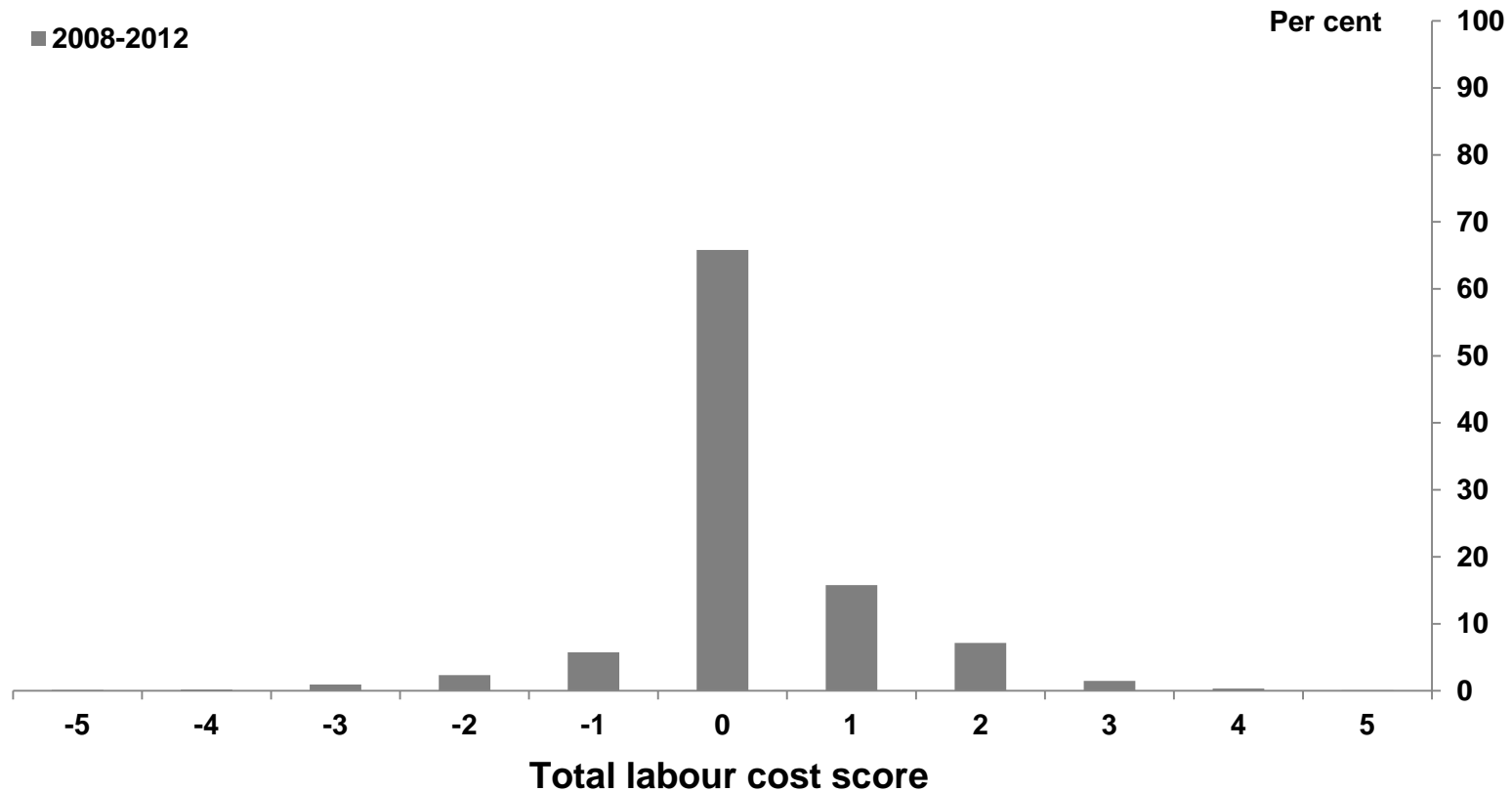
percentage of total settlements

- So far, we could not analyse other components of pay
- A comparison with total labour costs indicates that they could be more flexible

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Which factors influence this adjustment? What seems to matter?

- But by looking at firms with pay freezes we can infer something about these other costs
- This suggests that some pay freezes are offset with other components of pay

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Key points to take away from the firm-level analysis

KEY POINTS

- **Firm-level evidence of substantial downward nominal wage rigidity**
- **Wage settlements are very rigid; firms rarely cut base pay**
- **Total labour costs seem more flexible**
- **Support for some theoretical explanations of why wages might be rigid in the downward direction**

LIMITATIONS

- The data is qualitative and so we have a limited dependent variable
- We were unable to control for hours (although we control for employment)
- In another version of the model with total labour costs, we modelled cuts v freezes but were unable to identify any reason for why there is a barrier at zero

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Downward wage rigidity in individual wage micro data

- **Descriptive evidence from different data sources**

    - Evidence from wage settlements, the Labour Force Survey (LFS) and the New Earnings Survey Panel Data set (NESPD)

- **Smoothed wage change distributions**

    - Illustrations of what downward wage rigidity might look like

- **A simple measure of DNWR**

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Descriptive evidence from different data sources

NOMINAL WAGE FREEZES

	NESPD		LFS		Settlements
	Hourly	Hourly	Hourly	Weekly	
	basic + incentive	basic wage	pay incl o/t	pay incl o/t	Basic pay
2007	10.4	12.9	4.1	8.2	0.3
2008	10.4	12.0	4.0	8.1	1.2
2009	17.6	16.2	5.0	9.3	26.4
2010	26.5	20.1	6.0	11.3	18.7
2011	20.3	19.7	6.4	11.7	9.7
2012	20.5	18.1	6.7	12.1	16.0

Note: LFS figures are comparable to CPS (US): e.g. 13.9% (19.5.5%) freezes 2011-12 salaried (hourly-paid) (Elsby, Shin and Solon, 2013).

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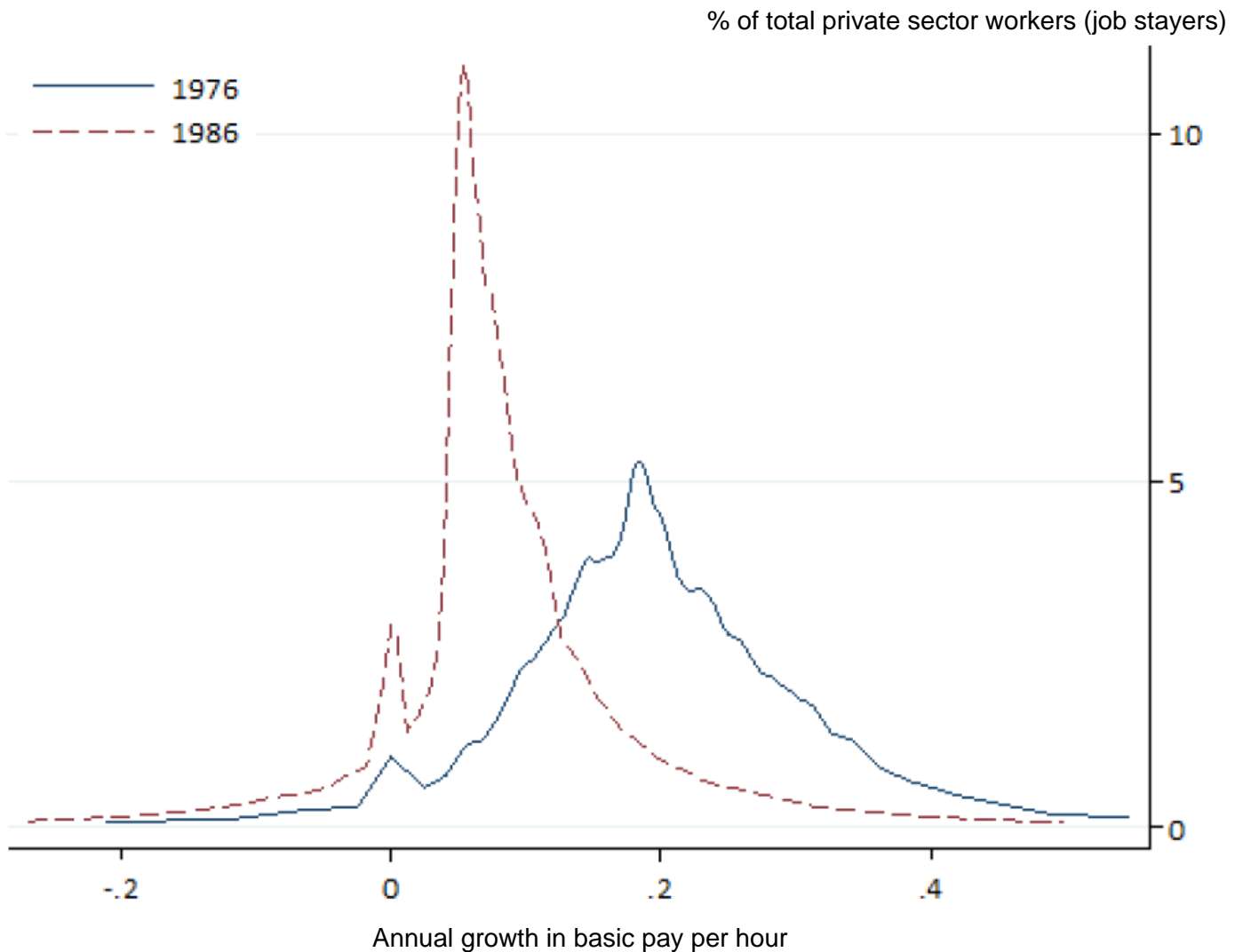
Descriptive evidence from different data sources

NOMINAL WAGE CUTS

	NESPD		LFS		Settlements
	Hourly	Hourly	Hourly	Weekly	
	basic + incentive	basic wage	pay incl o/t	pay incl o/t	Basic pay
2007	16.1	15.5	32.3	30.0	0.00
2008	15.1	15.3	32.8	30.2	0.00
2009	17.3	17.1	33.1	31.8	0.80
2010	18.8	19.2	36.1	33.4	0.04
2011	17.4	20.6	36.1	33.9	0.17
2012	17.0	18.1	36.2	33.5	0.02

Note: LFS figures are comparable to CPS (US): e.g. 33.1% (25.5%) cuts 2011-12 salaried (hourly-paid) (Elsby, Shin and Solon, 2013).

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Evidence from individual wage micro data

% of total private sector workers (job stayers)

Annual growth in basic pay per hour

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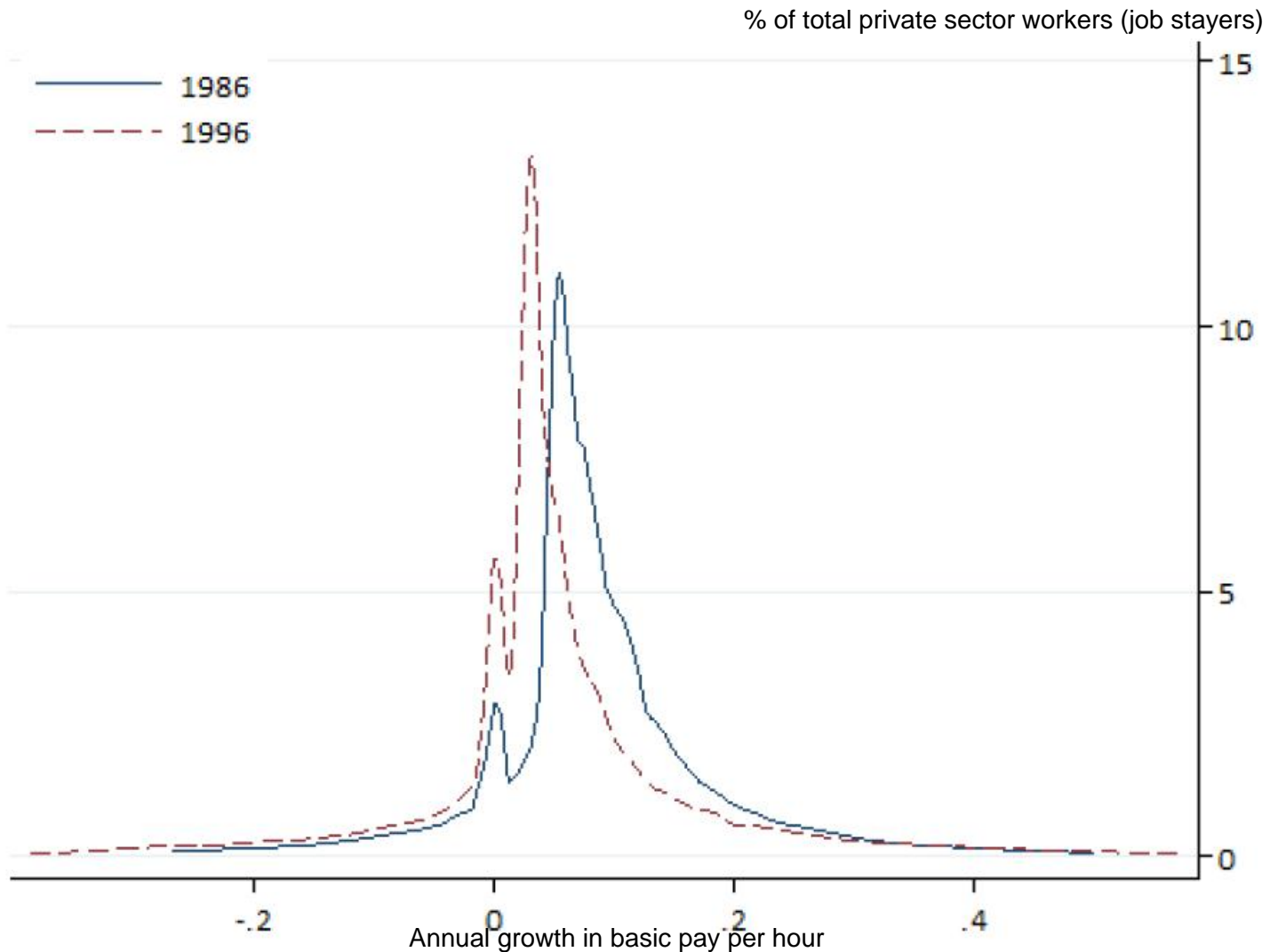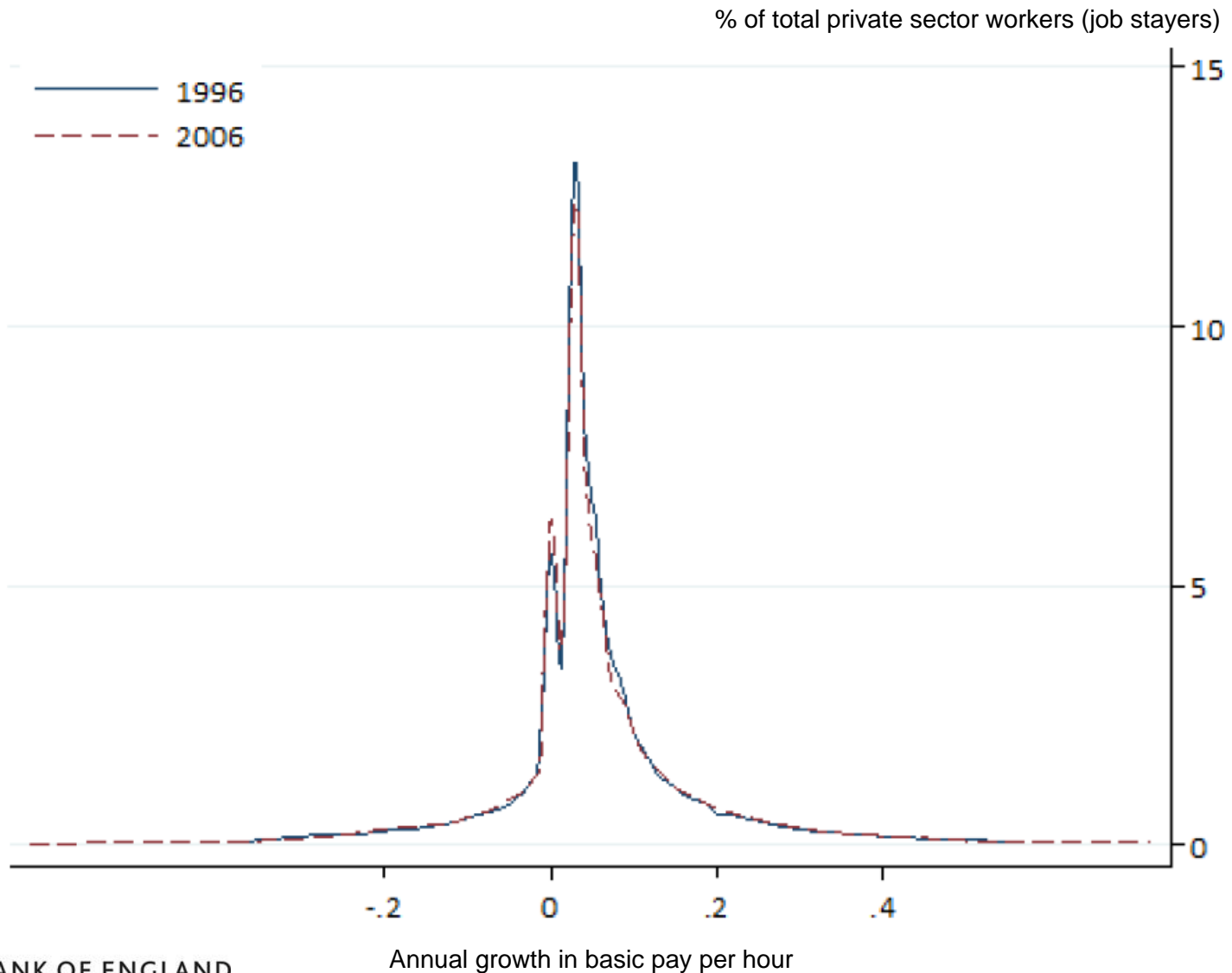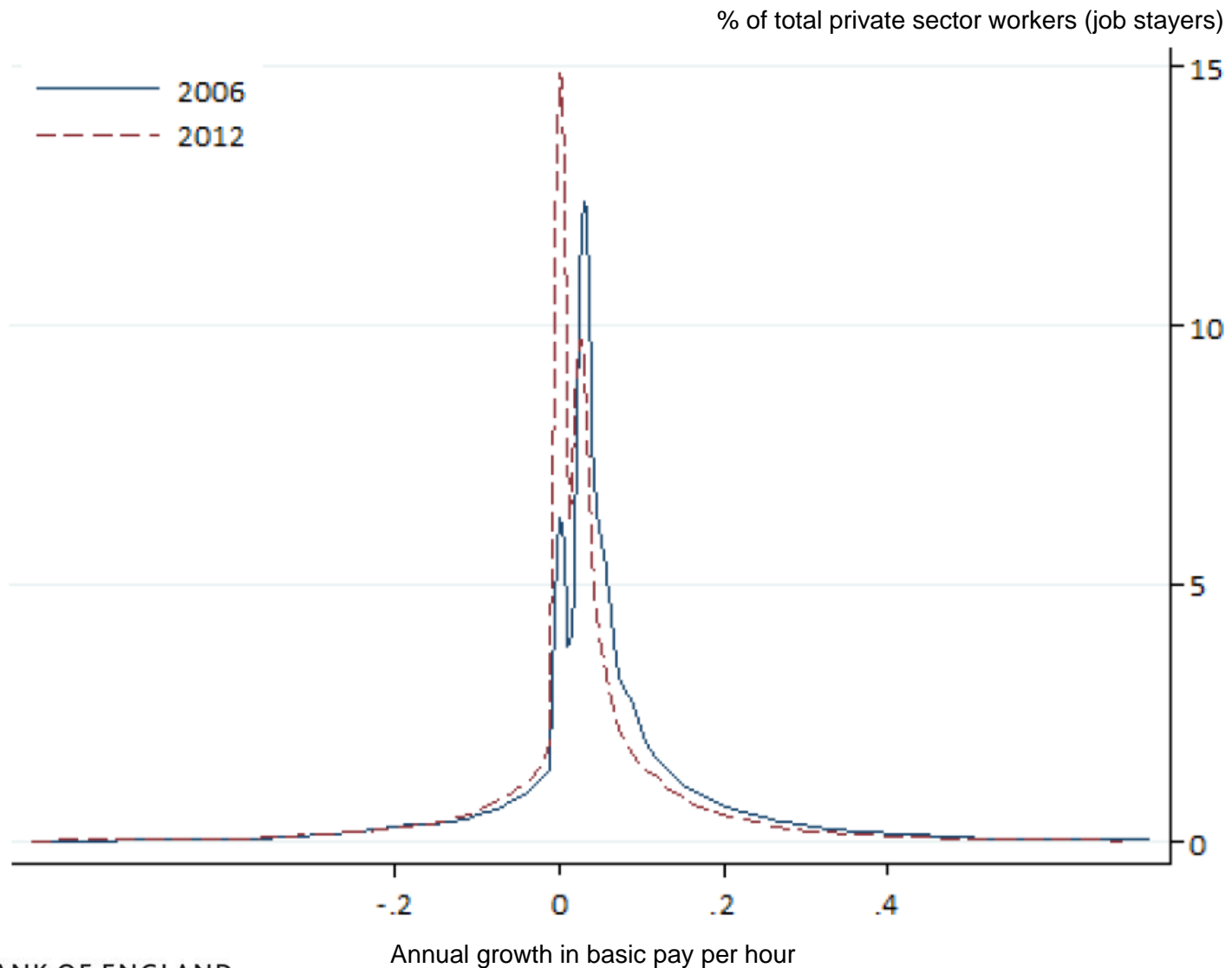
Measuring downward wage rigidity

$$\Delta w_{it}^* = \mathbf{X}_{it}\beta + \varepsilon_{it} \qquad \text{NO RIGIDITY}$$

$$\Delta w = \begin{cases} \Delta w_{it}^* & \text{if} \quad \Delta w_{it}^* \geq 0 \\ 0 & \text{if} \quad \Delta w_{it}^* < 0 \end{cases} \qquad \text{DNWR}$$

$$\Delta w = \begin{cases} \Delta w_{it}^* & \text{if} \quad \Delta w_{it}^* \geq \pi \\ \pi & \text{if} \quad \Delta w_{it}^* < \pi \end{cases} \qquad \text{DRWR}$$

• In the absence of wage rigidity, individual wage changes reflect a set of individual characteristics and macro conditions i.e. return to these characteristics plus a residual

• Rigidity introduces a discontinuity in this relationship

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Measuring downward wage rigidity

$$\Delta w_{it}^* = \mathbf{X}_{it}\beta + \varepsilon_{it}$$ NO RIGIDITY

$$\Delta w = \begin{cases} \Delta w_{it}^* & \text{if} & \Delta w_{it}^* \geq 0 \\ 0 & \text{if} & \Delta w_{it}^* < 0 \end{cases}$$ DNWR

$$\Delta w = \begin{cases} \Delta w_{it}^* & \text{if} & \Delta w_{it}^* \geq \pi^e \\ \pi^e & \text{if} & \Delta w_{it}^* < \pi^e \end{cases}$$ DRWR

- DRWR is really about individual wage outcomes relative to respective inflation expectations

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Different approaches to measuring DNWR

- **Modelling warranted individual wage changes.**

  - The idea is to construct a wage growth distribution that is warranted by individual and macro factors and then compare against this against the actual data.
  - Studies include Altonji and Devereux (1999), Barwell and Schweitzer (2007), etc.

- **Symmetry-based methods.**

  - The counterfactual (rigidity-free) distribution is symmetric and the wage growth distribution above a central point e.g. a median is used to construct the counterfactual. The missing density below zero is the difference between the actual and counterfactual distributions.
  - Studies include Card and Hyslop (1997), IWFP Messina et al (2010), etc.

- **Non-parametric methods.**

  - The counterfactual distributions is estimated using actual data and assuming it does not vary too much over time. This approach also quantifies the missing density below zero.
  - Studies include Kahn (1997), Knoppik and Beissinger (2006), Christofides and Nearchou (2008), Schweitzer (2007, etc.
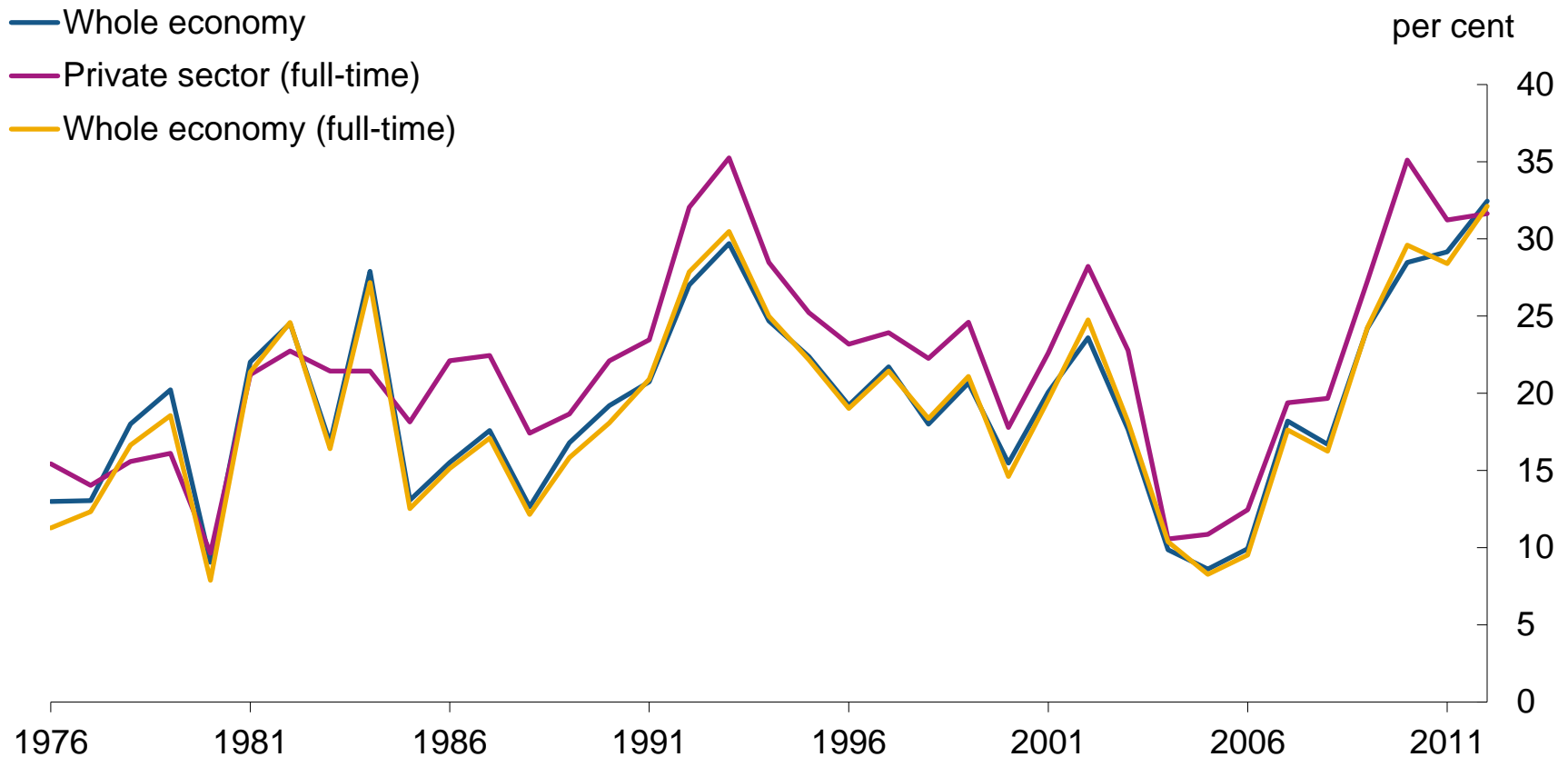
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Different approaches to measuring DNWR

- ## A simple measure.

  - Measures the proportion of wage cuts which were prevented by downward wage rigidity.

  - Studies that have used this measure are IWFP Dickens et al (2007).

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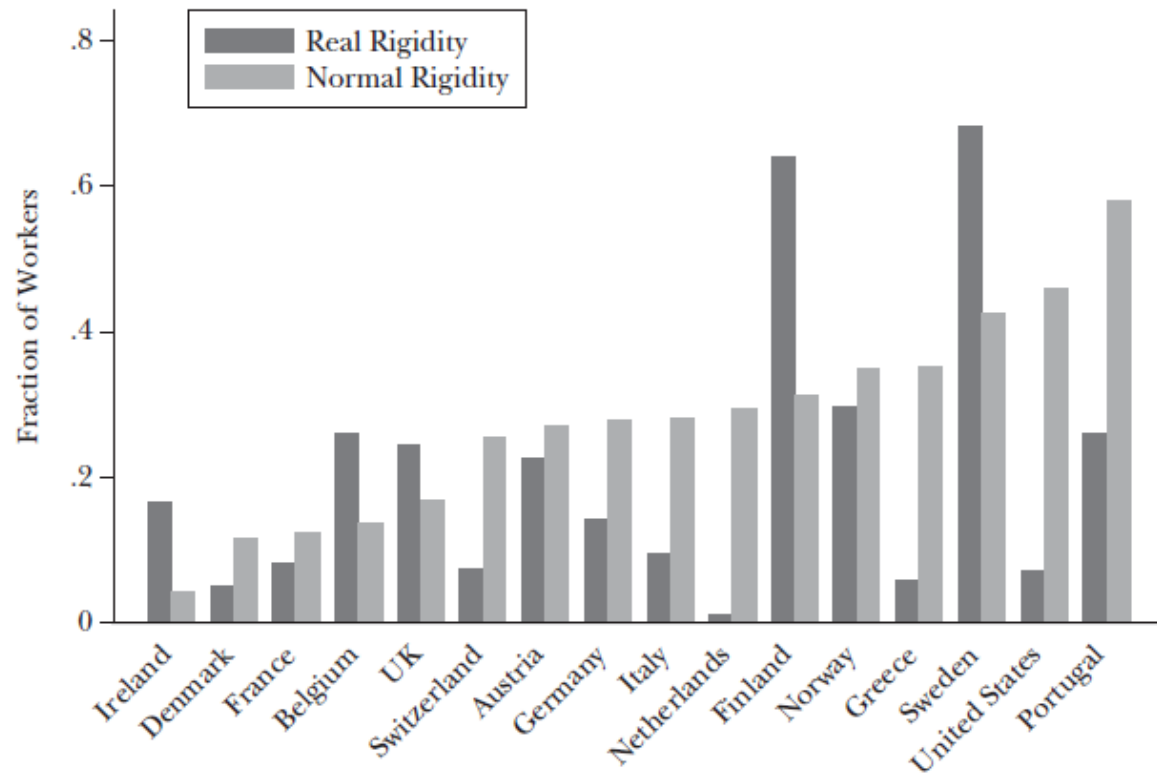
A simple summary measure of DNWR

- Proportion of nominal wage cuts prevented $= \dfrac{P(\Delta w = 0)}{P(\Delta w \leq 0)}$

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A simple summary measure of DNWR in perspective

Figure 3
Real and Nominal Rigidity by Country
(fraction of workers potentially affected)

Note: The table shows the fraction of worker in each country potentially affected by downward real and nominal wage rigidity.

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Source: Dickens et al (JEP 2007)

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Downward real wage rigidity in individual wage micro data

- **Problems with measuring DRWR**

- **Illustrating the relationship between nominal wage growth distributions and inflation expectations distributions**

- **Our measure of DRWR**

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Problems with measuring DRWR

- We think of DRWR as the resistance to real wage cuts

- Issues with measuring DRWR:

  - A simple approach is inadequate. There is **no clear spike at the median inflation expectation (sometimes a cluster). Inflation expectations are heterogeneous.**

  - Symmetry-based DRWR measures have similar problems. Moreover, we cannot use the DRWR measure used in IWFP **because inflation expectations exceed median wage growth during most of our period of interest**

  - **Non-parametric methods (a la Kahn) do not identify DNWR and DRWR particularly well**

- Our measure of DRWR uses information on both the nominal wage growth distribution and the distribution of inflation expectations

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Distributions of nominal wage growth and inflation expectations

**Proportion of private
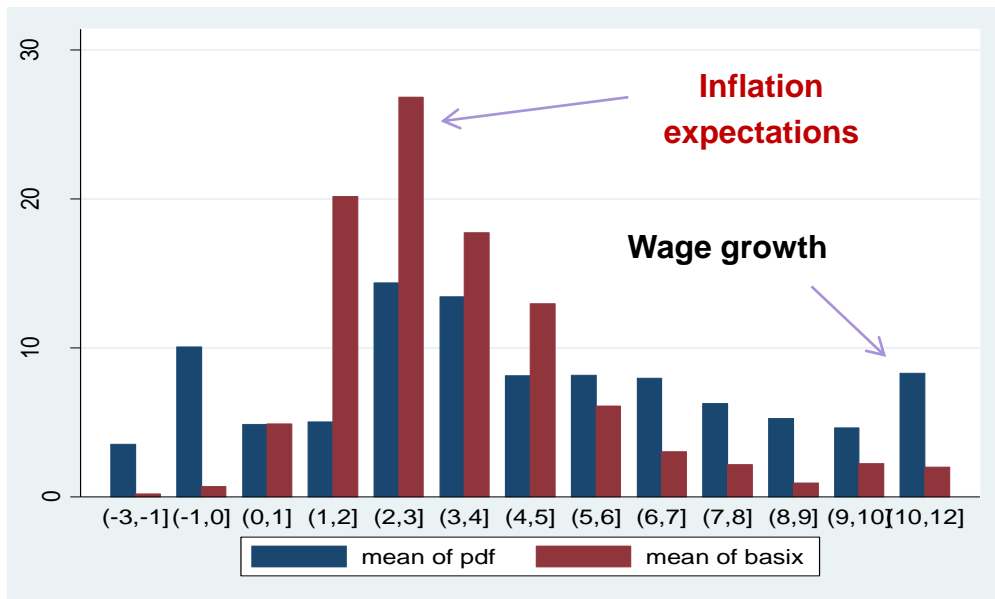sector employees**
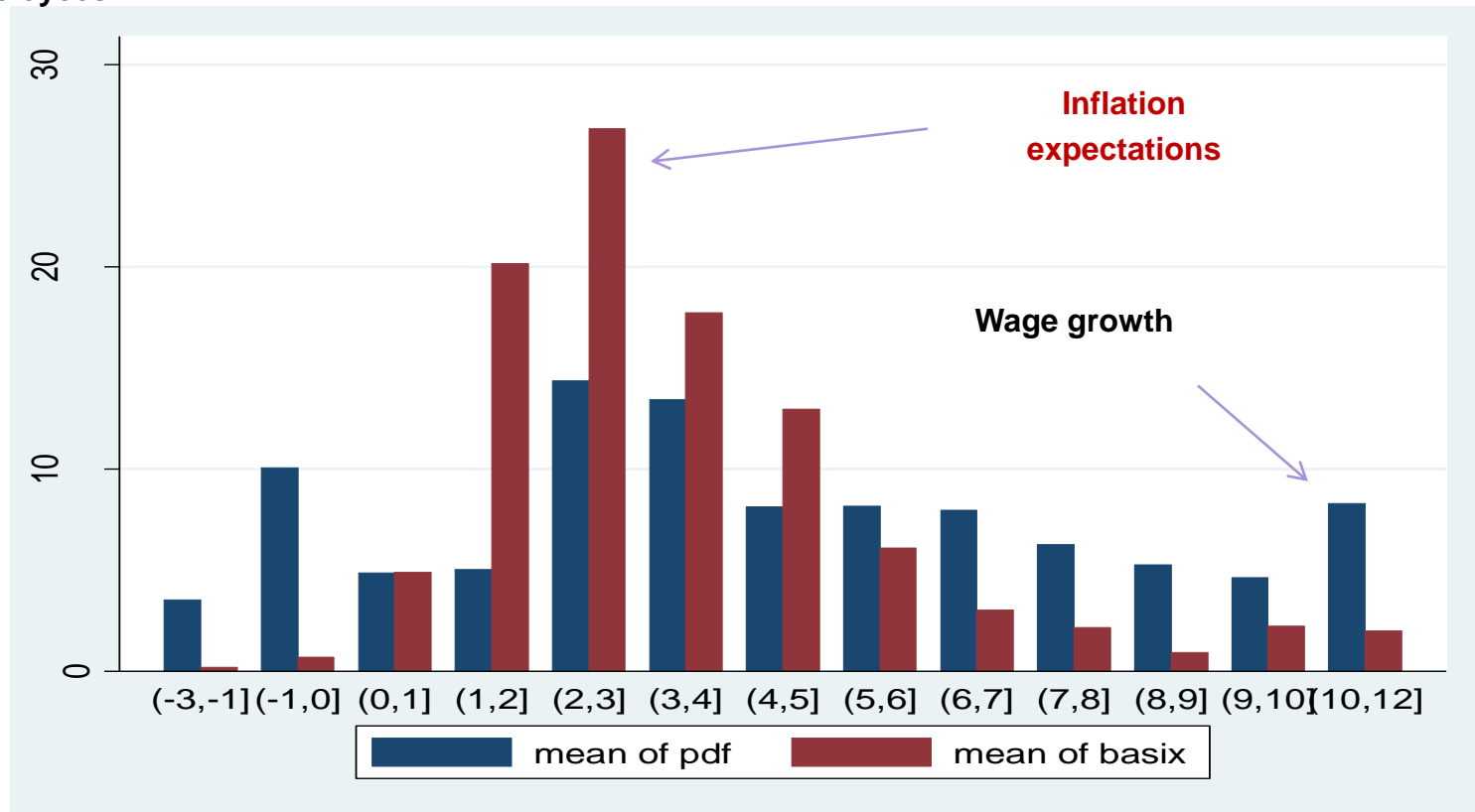
- The idea is to measure the proportion of nominal wages that match inflation expectations (real wage freezes) and the proportion which are below these expectations (real wage cuts)

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Our DRWR measure

**Proportion of private
sector employees**

• Our DRWR measure is simple:

$$\frac{P(\Delta w = \pi^e)}{P(\Delta w < \pi^e)}$$

• Everyone with $\Delta w < \min(\pi^e)$ has a real wage cut

• Everyone with $\Delta w < \max(\pi^e)$ has a real wage raise

• Data: Distribution of consumers' inflation expectations (**Barclays Basix**).Very similar to US Michigan survey (Mankiw, Reis and Wolfers, 2004)

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Our DRWR measure

Assumption 1: Maximum possible correspondence of wage growth with inflation expectations.

- Then $P(\Delta w = \pi^e | a < \Delta w \leq b) = \min[P(a < \Delta w \leq b), P(a < \pi^e \leq b)]$

Assumption 2: Excess wage growth density is reallocated to the nearest available inflation expectation.

- Then all reallocated wage growth is to a higher inflation expectation – thus involving a real cut – until $F(\Delta w) = F(\pi^e)$.

- All reallocated wage growth is to a lower inflation expectation – thus involving a real raise – after $F(\Delta w) = F(\pi^e)$.

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Our DRWR measure – the results

% of cuts and freezes

Legend:
- DRWR (Entire Basix)
- DRWR (0-10 Basix)
- DRWR (25th-75th Basix)
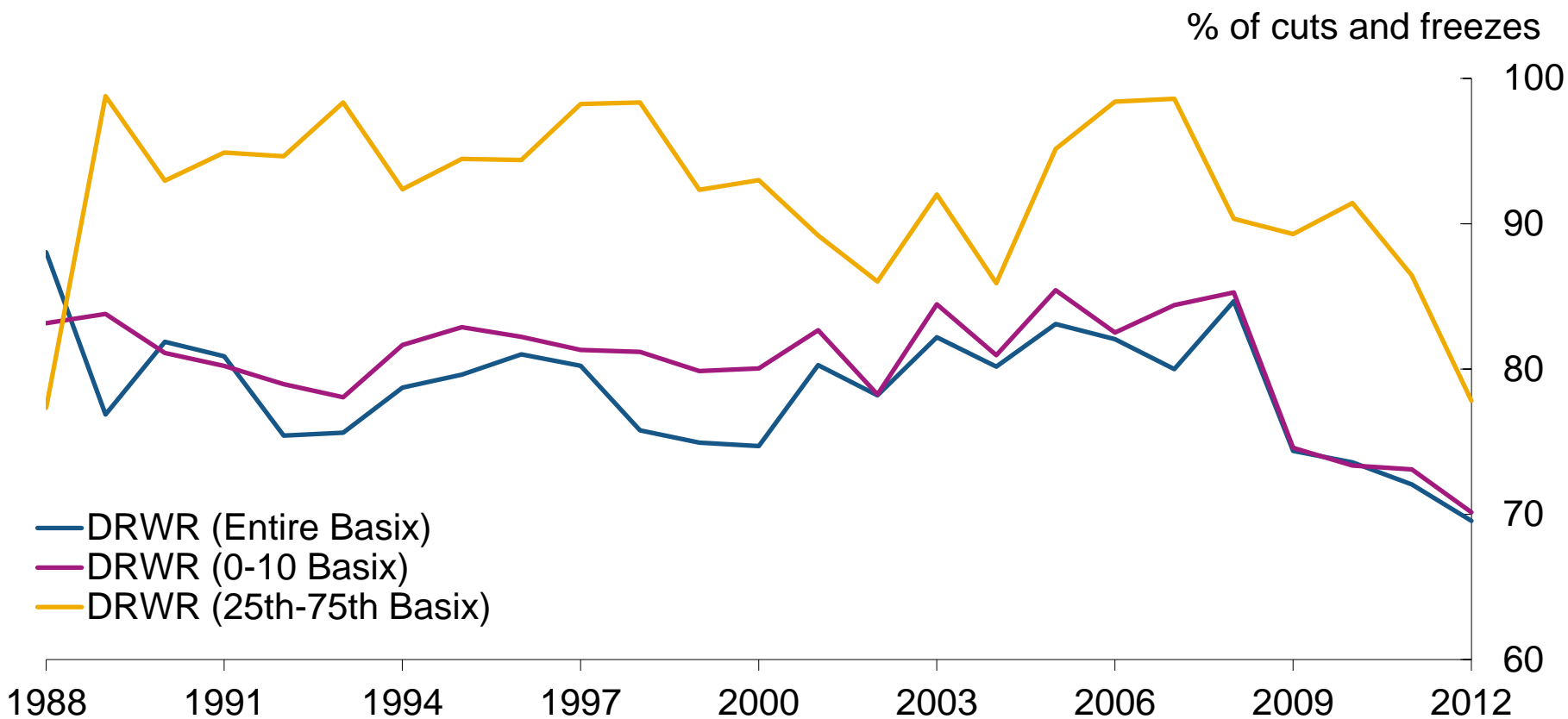
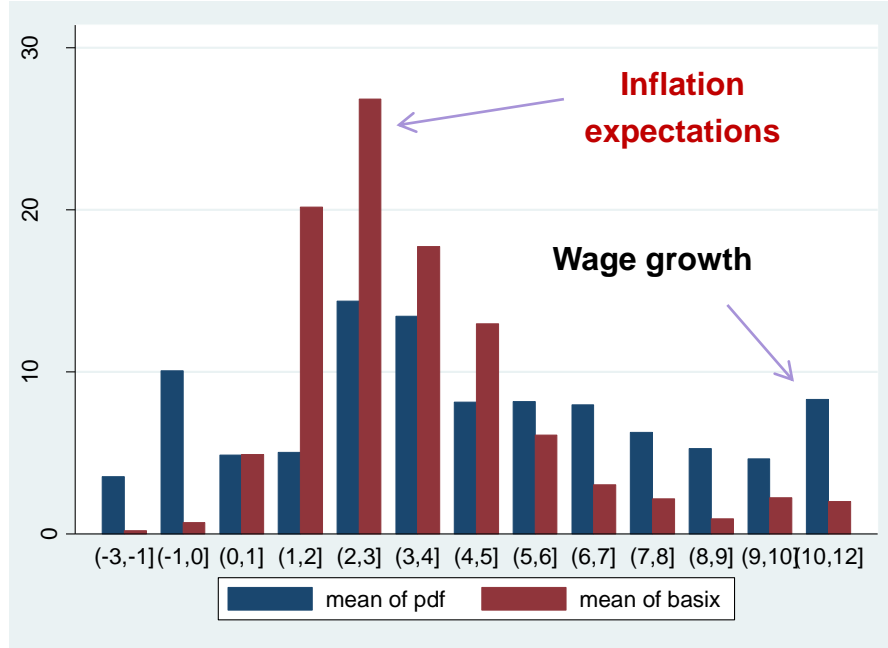- We vary the range of inflation expectations to check the sensitivity of our measure

- Relatively flat DRWR flat trend in DRWR until the crisis when we get a fall in the maximum extent of DRWR

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Our DRWR measure – the intuition

2005

2012
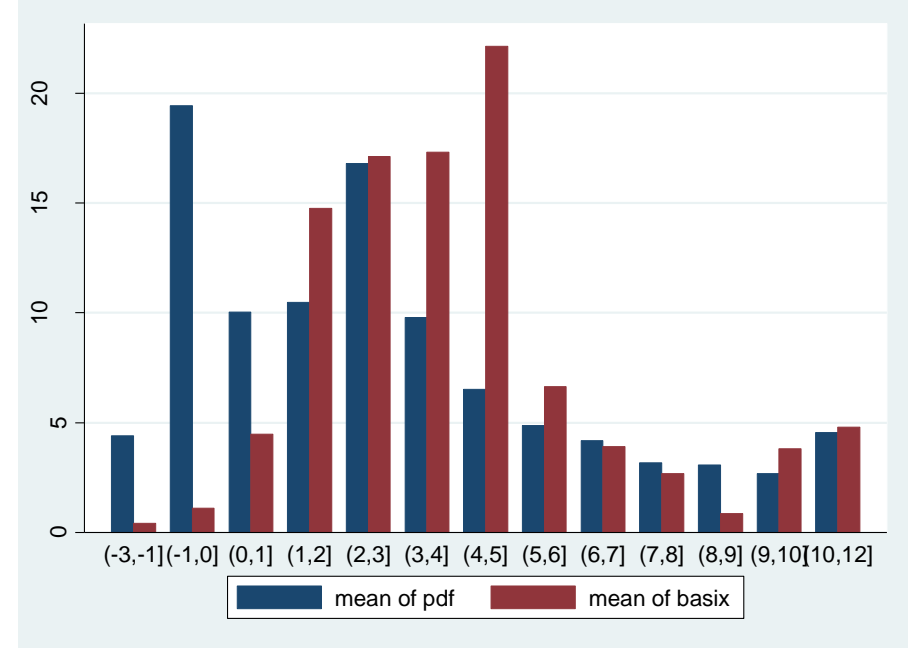
- In "normal" times, wage growth usually exceeds the distribution of inflation expectations.

- Since the recession, this has reversed.

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An interesting feature of recent wage growth distributions

Proportion of private sector employees
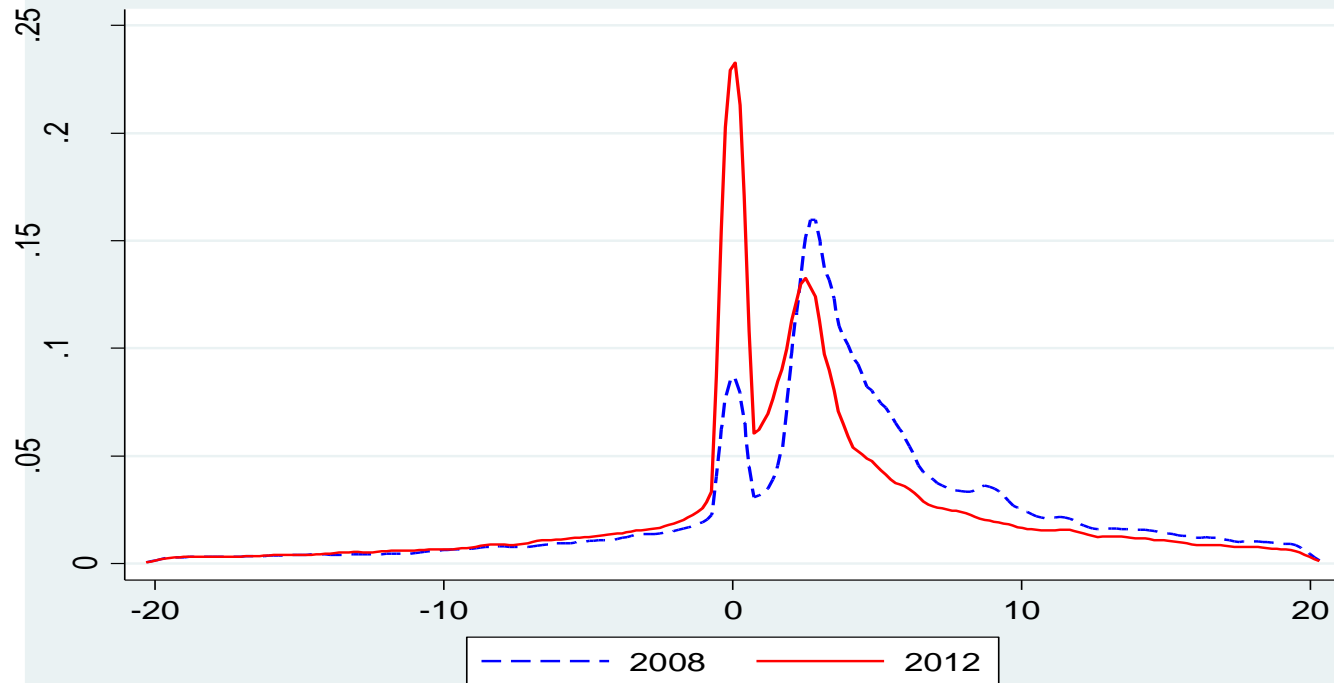
- Evidence of higher DNWR since 2008

- The extent of DRWR may have fallen

- But descriptive analysis also shows **considerable upper-tail compression**

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Measuring compression in the upper tail

Density between percentiles in the nominal wage growth distribution

p.p.	1976	1986	1996	2006	2012
50-10	18.6	16.4	16.9	16.5	14.4
90-50	18.2	18.8	21.0	20.4	17.8
90-10		-1.6		-1.0	
			+2.7		-4.7

- Differences in wage growth between the highest percentiles and the median have fallen in the recent past

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Wage growth differentials

DNWR might well be responsible for the reduction in lower-tail dispersion since the financial crisis

What is responsible for the upper-tail compression?

Our approach

• Investigate factors determining changes in wage growth distribution, controlling for changes in median wage growth (driven by inflation and productivity growth).

• Estimate impact of observable characteristics, and of returns to observable characteristics, to changes in wage growth distribution.

• Use Oaxaca-Blinder-type decompositions to investigate compression in lower and upper tails.

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Wage growth differentials

- Use the method of FFL (2011): Estimating linear regressions of recentred influence functions (RIF-regs) at 90th, 50th and 10th quantiles.

    - Taking differences from median accounts for changes in macro factors driving median wage growth (inflation, productivity growth).

    - $\Delta_X^{90-50} = \left[Q_{A,.9}^C - Q_{A,.9} \right] - \left[Q_{A,5}^C - Q_{A,.5} \right]$ and

      $\Delta_X^{50-10} = \left[Q_{A,.5}^C - Q_{A,.5} \right] - \left[Q_{A,1}^C - Q_{A,.1} \right]$

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Counterfactual distribution: reweighting method

- A counterfactual wage growth distribution is the wage growth distribution that would obtain if the distribution of characteristics X was the same in year B as in base year A.
- Follow DFL (1996) and FFL (2011) in estimating a counterfactual wage growth distribution using reweighting methods.
- Replace the marginal distribution of X for year A with the marginal distribution of X for year B using a reweighting factor $\Psi(X)$, where (using Bayes' rule)
- $\Psi(X) = \dfrac{\Pr(X|D_B=1)}{\Pr(X|D_B=0)} = \dfrac{\Pr(D_B=1|X)}{\Pr(D_B=0|X)} \dfrac{\Pr(D_B=0)}{\Pr(D_B=1)}$
- Weights Ψ are estimated using a probit model.

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Detailed decomposition

Composition effect: $\quad \widehat{\Delta}^{\tau}_{X,p} = \left(\overline{X}^{C}_{A} - \overline{X}_{A} \right) \widehat{\gamma}_{A,\tau} \quad$ where

$$p \lim \left(\overline{X}^{C}_{A} \right) = p \lim \left(\overline{X}_{B} \right)$$

and

Wage structure effect: $\quad \widehat{\Delta}^{\tau}_{S,p} = \overline{X}_{B} \left(\widehat{\gamma}_{B,\tau} - \widehat{\gamma}^{C}_{A,\tau} \right)$

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Accounting for wage growth dispersion

Base: earlier year	1976–1986		1986–1996		1996–2006		2006–2012	
Units: p.p.	50-10	90-50	50-10	90-50	50-10	90-50	50-10	90-50
Unadjusted	-2.2	0.6	0.5	2.2	-0.4	-0.7	**-2.1**	**-2.5**
Composition effects attributable to								
union	0.1	0.1	-0.6	-0.1	0.0	0.0	0.0	-0.0
gender	0.2	0.2	-0.2	-0.1	-0.2	-0.1	-0.1	0.0
part-time	-0.1	-0.1	0.3	0.2	1.1	0.5	**0.5**	0.2
age	-0.1	-0.1	0.0	-0.1	-0.3	-0.5	0.0	0.0
region	0.2	0.0	0.0	-0.1	-0.0	0.0	0.0	-0.0
industry	0.0	0.1	-0.2	-0.2	-1.0	-0.3	0.1	**0.3**
occupation	0.2	0.2	-0.4	-0.3	-0.6	-0.3	0.1	0.2
Total	0.3	0.4	-1.1	-0.8	-1.0	-0.6	**0.6**	**0.6**

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Accounting for wage growth dispersion

Base: earlier year	1976–1986		1986–1996		1996–2006		2006–2012	
Units: p.p.	50-10	90-50	50-10	90-50	50-10	90-50	50-10	90-50
Unadjusted	-2.2	0.6	0.5	2.2	-0.4	-0.7	**-2.1**	**-2.5**
Wage growth structure effects attributable to								
union	0.3	-0.1	-0.2	0.0	-0.6	0.2	-0.3	-0.3
gender	-4.4	-1.1	0.7	1.3	1.6	2.3	0.6	0.6
part-time	0.8	0.2	1.5	0.5	0.8	-0.3	-0.5	-0.4
age	-0.6	-0.6	0.1	-0.2	0.8	1.0	0.3	0.6
region	0.6	-0.4	-0.3	1.3	-0.9	-1.6	**-1.1**	-0.2
industry	-0.9	0.3	1.3	-1.5	0.6	-0.5	-0.5	**3.7**
occupation	3.7	-0.1	-1.1	2.6	1.0	0.5	1.0	-0.7
constant	-1.3	2.8	0.0	-0.8	-2.6	-1.8	-2.3	-6.5
Total	-2.0	1.0	1.9	3.2	0.7	-0.2	**-2.8**	**-3.2**

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Key points to take away from our analysis

Firm-level data

• **Evidence of substantial downward wage rigidity in firms. This may have risen since the beginning of the recession.**

• **More wage rigidity positively correlated with firm size, union density, proportion of highly skilled workers.**

Individual worker micro data

• **Nominal wage rigidity has risen since 2008.**

• **Real wage rigidity has fallen.**

• **Composition changes do not appear to explain either phenomenon: it appears to be a substantial 'behavioral shift'.**

• **Nominal wage growth currently lies well below its normal level in relation to inflation expectations. A big question for policymakers is whether this will persist, or whether nominal wage growth will rebound as the economy recovers.**

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