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# Follow the Leader?

## The Interaction between Public and Private Sector Wage Growth in the UK

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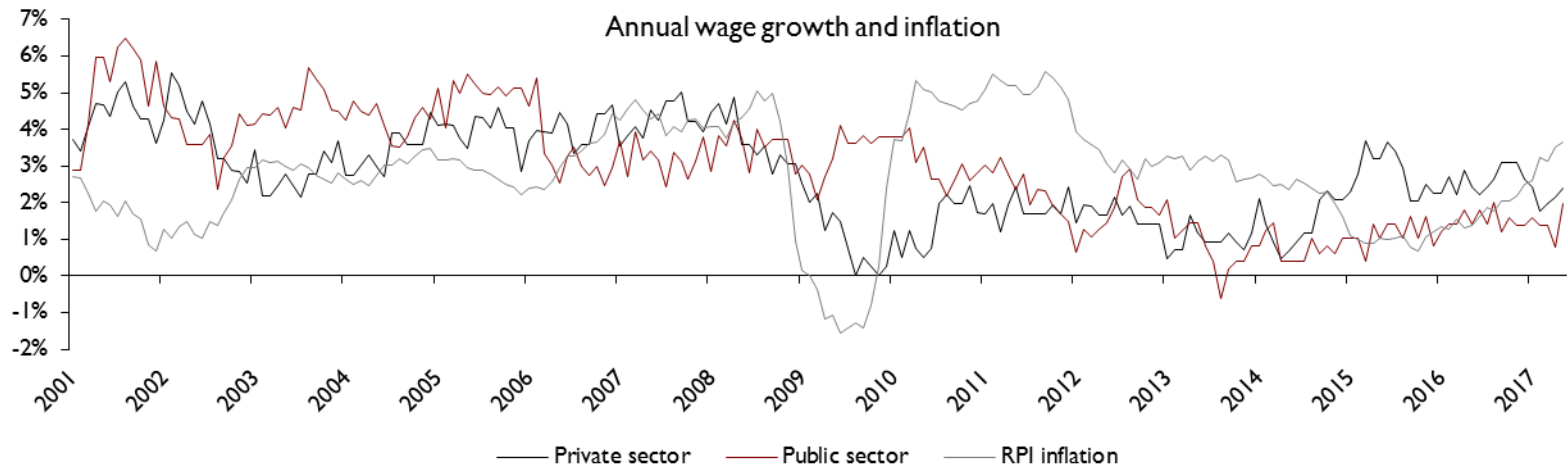
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# Lifting the cap?

- The 2017 Autumn Budget ended a 1% cap on public sector pay; pay rises are expected for the 2018/19 pay round.
- Historically, co-movement between public and private sector pay has been strong.
- If there were sizeable spillovers from public sector pay increases to the private sector, currently anaemic wage dynamics could be revived but inflationary pressure in the current low-productivity, low-unemployment environment may rise.



# Background

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- Scandinavian model of inflation:
  - Nominal wage changes in competitive sector driven by productivity changes + international terms of trade (Aukrust 1970, Lindquist & Vilhelmsson 2006).
  - The competitive sector acts as wage leader in long run.
- Public sector wage determination different from private sector:
  - e.g. political economy considerations (de-Córdoba et al. 2012).
  - Spillovers into private sector depend on relative level of wages and skills (Gomes 2015), as well as institutions, skill comparability, openness of private sector etc.
- Previous findings:
  - Wage leadership and spillover directionality varies across countries (Lamo et al. 2012) and broad sectors (Camarero et al. 2014).
  - Our paper confirms private sector wage leadership and short-run public sector spillovers for the UK using wage and settlements data, + explores spillover channels in detail.



# Methodology

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Building on Lindquist & Vilhelmsson (2006) and Lamo et al. (2012), we estimate an error correction model for the log of private (public) sector wages  $w_t^p$  ( $w_t^g$ ):

**Long-run equilibrium:** 
$$w_t^p = \alpha^p + \beta w_t^g + u_t^p$$

**Short-run:** 
$$(w_t^p - w_{t-1}^p) = -\delta^p u_{t-1}^p + \sum_{l=1}^{12} \pi_l^p (w_{t-l}^p - w_{t-l-1}^p) + \pi_g^p (w_{t-1}^g - w_{t-13}^g) + \pi_C^p C_t^p + \varepsilon_t^p$$

where

- $\alpha^p$  is a wage premium (employment composition, etc.), imposing  $\beta = 1$
- $(w_t^p - w_{t-1}^p)$  is the monthly change in log wages,
- $(w_{t-l}^p - w_{t-l-1}^p)$  is the lagged dependent variable,
- $(w_{t-1}^g - w_{t-13}^g)$  is the lagged annual wage change in the other (public) sector,
- $C_t^p$ : controls including month fixed effects (seasonality), inflation, business cycle
- $\varepsilon_t^p$ : potentially serially correlated error term (Newey-West standard errors reported)



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## Long-run leadership:

- A long-run relationship exists if  $w_t^p$  and  $w_t^g$  are cointegrated ( $u_t^p$  stationary)
- A sector is considered wage leader if wages do not converge to the long-run equilibrium (absence of error correction, weak exogeneity), i.e.  $\delta^p = 0$



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## Short-run spillovers:

- Granger causality:  $\pi_g^p \neq 0$
- If lagged wage changes in the public sector can explain (Granger-cause) current private sector wage changes (or vice versa), we consider it a spillover



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**Conditional spillovers:**

- $I_t^p$  allows for variation of spillovers over calendar months, business cycle, etc.



# Three types of data

	Average weekly earnings	Aggregate settlements data	Individual settlements data
<i>Description</i>	level of nominal wages, w/o and w/ bonuses, arrears	settlements on basic pay (w/o bonuses, arrears, incremental pay rises)	98,600 firm-level settlements, aggregated at sub-sectors
<i>Source</i>	ONS	XpertHR	CBI, IDS, IRS
<i>Dimension</i>	2000-2017, 1990-2017 (exper.)	1990-2017	1975-2010, 27 sectors
<i>Frequency</i>	monthly	monthly	quarterly
<i>Avg private wage growth (std dev)</i>	3.4% (2.0)	3.1% (1.6)	5.3% (3.7)
<i>Avg public wage growth (std dev)</i>	3.3% (2.1)	2.8% (2.0)	4.9% (3.7)

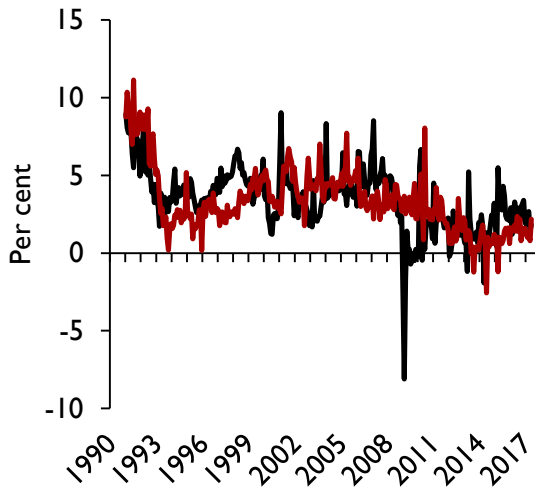




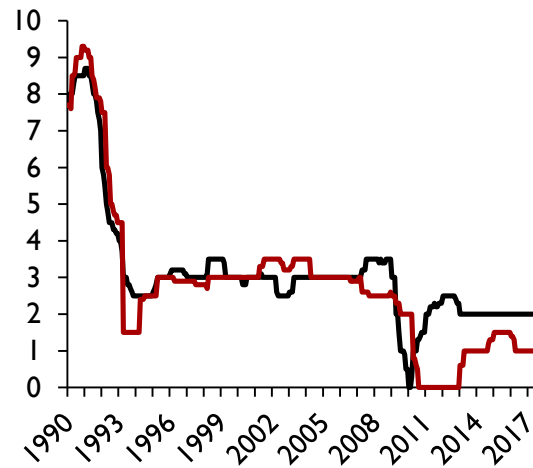
# Three types of data

- Private and public sector wages tend to follow a similar trend.
- Periods of stronger private wage dynamics followed by stronger public wage growth, and vice versa.

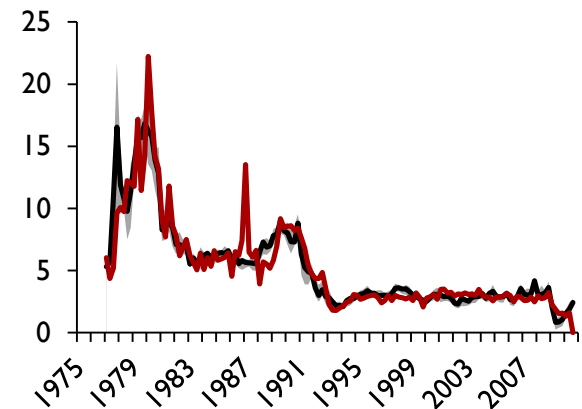
**Average weekly earnings**  
(incl. bonuses, arrears)



**Aggregate settlements**  
(annual)



**Individual settlements**  
(average, interquartile range)



— Private sector — Public sector



# Long-run results

- Private sector wages are weakly exogenous to public sector wage dynamics.
- Public sector wages converge to equilibrium defined by private sector wages.
- The half-life of a deviation lies between 17 and 23 months.

## Long-run results: Estimates of the error correction term

Time-varying composition:	Public → private		Private → public	
	no	yes	no	yes
Excl. bonuses, arrears	-0.012 (0.01)	0.024 (0.02)	-0.032** (0.01)	-0.031** (0.01)
Incl. bonuses, arrears	0.011 (0.02)	0.061 (0.06)	-0.042*** (0.01)	0.016 (0.03)

*Notes:* estimates of error correction parameter. ONS average weekly earnings series. Newey-West standard errors in brackets. Significance level given by given by \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .



# Long-run results: private sectors

- Within the private sector, manufacturing is the long-run leader (higher share of tradables, more open to international competition).

## Long-run equation

	Manufacturing	Construction	Financial, business services	Wholesale, retail, hospitality
Error correction term	0.015 (0.04)	-0.033 (0.03)	-0.127*** (0.04)	-0.052* (0.03)
Manufacturing		0.152** (0.07)	0.082* (0.05)	0.107** (0.04)
Construction	0.031 (0.02)		0.015 (0.02)	-0.008 (0.02)
Financial, business services	-0.025 (0.03)	-0.079 (0.07)		-0.050 (0.04)
Wholesale, retail, hospitality	-0.022 (0.03)	-0.044 (0.05)	0.034 (0.03)	

Notes: error correction equation. ONS average weekly earnings series. Newey-West standard errors in brackets. Significance level given by given by \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .



# Short-run results

- In the short run, public sector wage growth has statistically significant spillover effects on private sector wage growth.
- The size of spillovers depends on whether bonus payments are taken into account, and on the timing over the calendar year (seasonality).

## Granger causality

Accounting for seasonality:	Public → private		Private → public	
	No	Yes <sup>a</sup>	No	Yes <sup>a</sup>
Excl. bonuses, arrears	0.031 (0.128)	0.024** (0.008)	0.001 (0.961)	0.006** (0.034)
Incl. bonuses, arrears	0.122*** (0.002)	0.108*** (0.000)	0.055* (0.060)	0.068* (0.062)

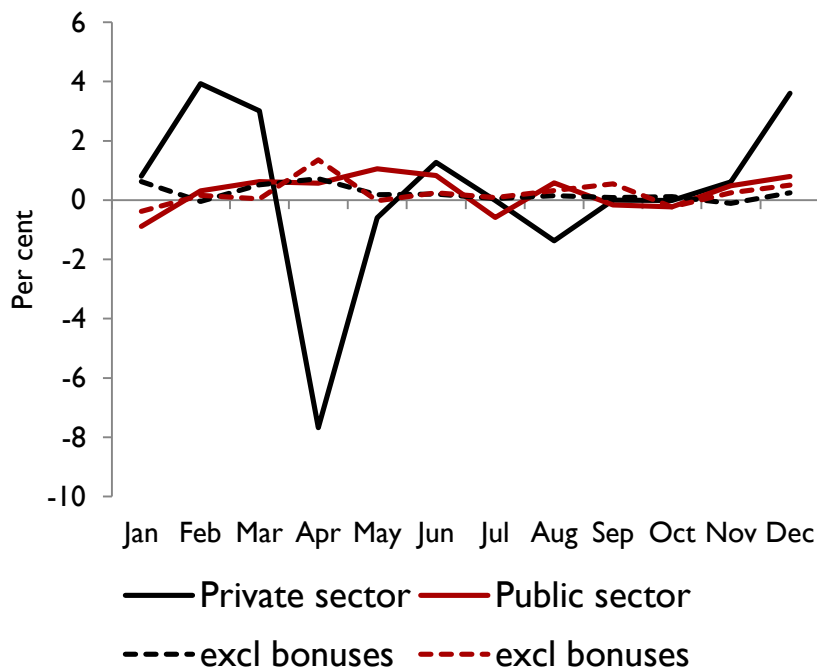
*Note:* p-values in brackets. ONS average weekly earnings series. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. <sup>a</sup> Average coefficient and p-value for F-test of joint significance reported.



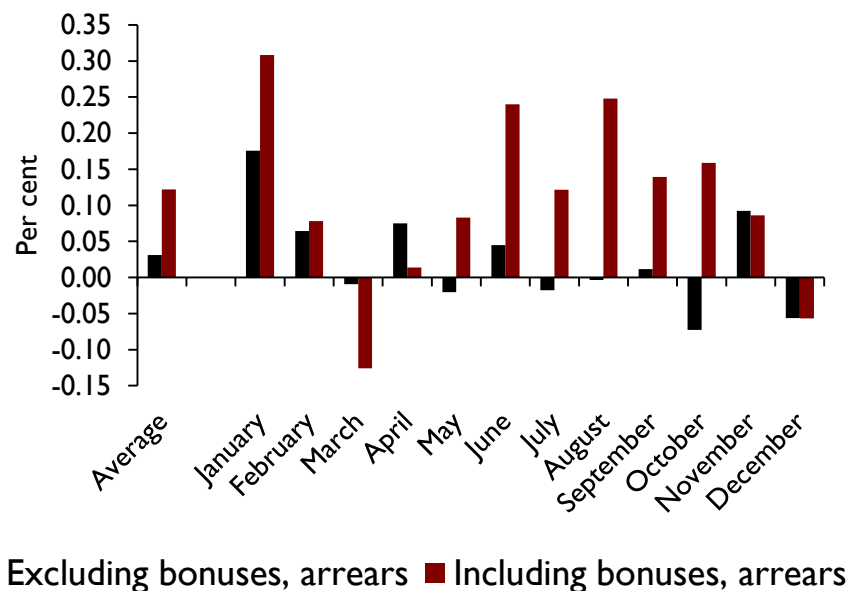
# Conditionality of spillovers

- Public-to-private sector spillovers vary substantially over the course of the calendar year.

**Average earnings increase by month**



**Spillovers from 1% annual increase in public sector on private sector wages**

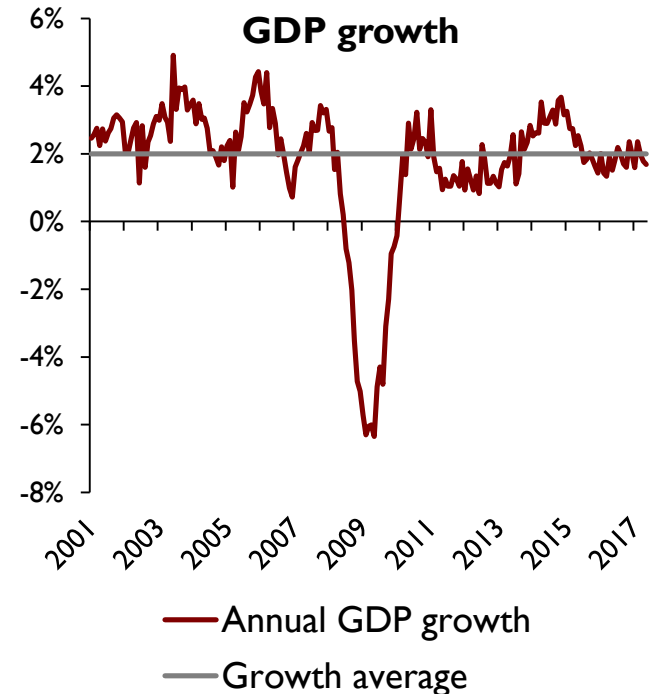


# Conditionality of spillovers

- Public wage spillovers are smaller
  - during periods of below-average output growth,
  - after the public sector wage cap was put in place

	I	II
Public → private	0.173*** (0.04)	0.154*** (0.04)
× I(GDP growth < 2%)	-0.095** (0.05)	-0.085* (0.05)
× I(wage cap)		-0.167* (0.10)

Note: Private sector wage equation. ONS average weekly earnings series. Newey-West standard errors in brackets. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



# Results: settlements data

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- Result of public-to-private spillovers remains robust for aggregate settlements data:

## Aggregate settlements data

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Accounting for seasonality:	Public → private	
	No	Yes <sup>a</sup>
Public sector settlements	0.205*** (0.00)	0.201** (0.03)

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*Note:* p-values in brackets. XpertHR aggregate settlements series. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. <sup>a</sup> Average coefficient and p-value for F-test of joint significance reported.



# Results: settlements data

- At the sector-level, findings of public-to-private sector spillovers depend on the public sector that is source of the shock ...

## Individual settlements data: panel results

Public sector:	Public admin	Education	Health	Other services <sup>a</sup>	International organisations
Public → private	0.067 (0.06)	-0.068 (0.05)	0.045* (0.02)	0.231*** (0.04)	0.104 (0.08)
R-Squared	0.764	0.731	0.703	0.793	0.521
Observations	2,236	1,167	1,624	2,065	290
Sectors	23	23	23	23	23

*Note:* CBI, IDS, IRS settlements data aggregated at 32 sector-level. Driscoll-Kraay standard errors in brackets. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

<sup>a</sup> Other community, social and personal services including culture, research, NGOs, i.e. some public sector entities included.





# Results: settlements data

- ... and on the private sector hit by the shock.

## Individual settlements data: sector-specific results

	Public admin	Education	Health	Other services
Agriculture, hunting and forestry	-0.184	-0.049	-0.060*	0.228**
Mining and quarrying	0.037	0.001	0.074**	0.457*
Manufacture of wood and wood products	-0.086	-0.295**	0.030	0.312***
Manufacture of chemicals, chemical products, fibres	0.280*	0.204	0.193	0.252*
Manufacture of other non-metallic mineral products	0.242**	0.134	0.014	0.024
Manufacture of basic metals and fabric	0.005	-0.186***	0.051**	-0.059
Manufacture of electrical and optical	0.101	0.058	0.113**	-0.148
Manufacturing not elsewhere classified	0.008	-0.029	0.039	0.244**
Electricity, gas and water supply	0.232**	0.249	0.067	0.534***
Construction	-0.047	-0.073	0.022	0.321***
Wholesale, retail trade; repair of motor vehicles, etc.	0.247*	-0.037	0.087*	0.033
Hotels and restaurants	0.183	-0.029	-0.039	0.482***
Transport, storage and communication	0.163	-0.052	0.165	0.829***
Financial intermediation	0.358**	0.409*	0.078	0.486**

Note: CBI, IDS, IRS settlements data aggregated at 32 sector-level. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



# Summary

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We find ...

- ... that in the long term, the level of wages is determined in the (internationally competitive) private sector.
- ... statistically significant wage spillovers from the public to the private sector in the short term.
- ... that spillover size varies over the course of the calendar year, the business cycle, institutional arrangements and sub-sectors.

Going forward ...

- ... we will explore spillover channels in more detail by analysing settlements data at the micro level.

*Thank you!*



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# Appendix: pre-tests

- Private and public sector wage series follow unit root processes.

	Private sector	Public sector
w/o bonuses, arrears	0.233	0.117
w/ bonuses, arrears	0.426	0.356

*Note:* Dickey-Fuller test of hypothesis that series are non-stationary, p-values.

- Private and public sector wages are cointegrated.

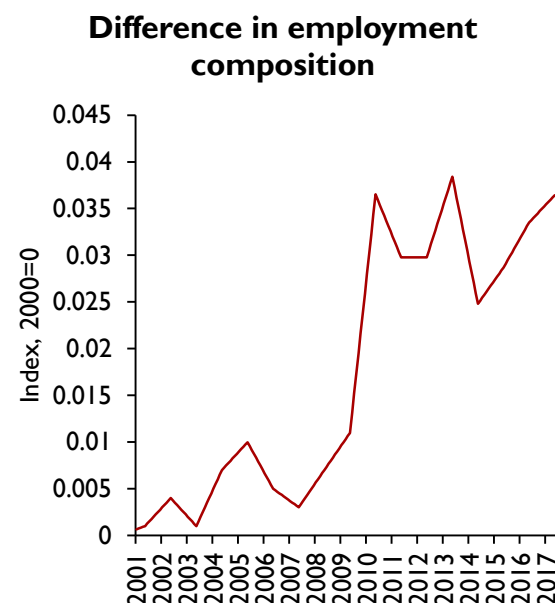
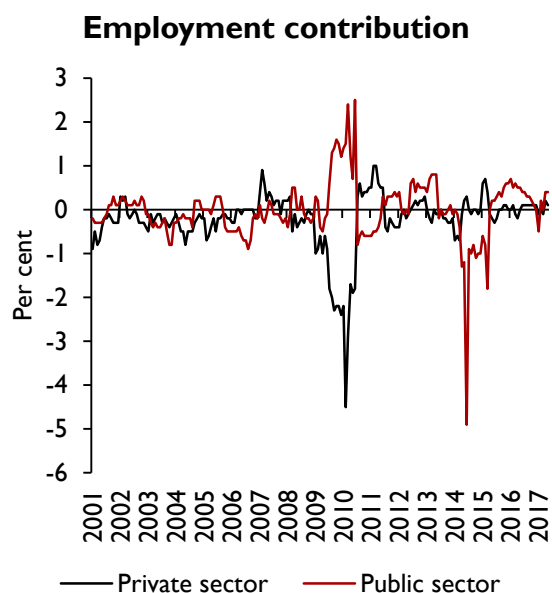
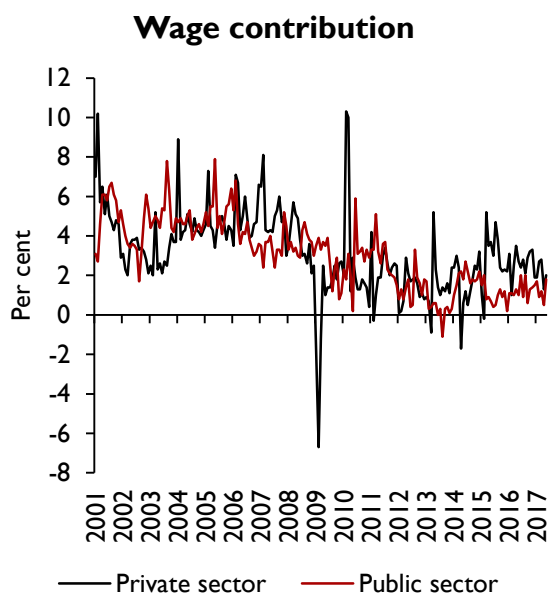
	Max rank	5% critical value	Trace statistic
w/o bonuses, arrears	0	19.96	26.14
	1	9.42	2.61**
w/ bonuses, arrears	0	19.96	33.57
	1	9.42	2.66**

*Note:* Johansen rank test for cointegration (rank of matrix  $\delta$ ). Maximum rank is the maximum number of cointegrating relationships under the null hypotheses rank=0, rank=1.



# Appendix: time-varying premium

- ONS provides decomposition of earnings growth:
  - Wage contribution
  - Contribution of employment composition
- Latter used to measure differences in employment composition across sectors



# Appendix: detailed results

## Results for regular earnings

	Private sector		Public sector	
	1	2	3	4
Long-run endogeneity (ECM term)	-0.012 (0.01)	0.005 (0.01)	-0.032** (0.01)	-0.024* (0.01)
Short-run causality (other sector, p-value <sup>a</sup> )	0.128	0.008***	0.961	0.034**
Other sector *				
January		0.176*** (0.05)		-0.128* (0.07)
February		0.064 (0.08)		0.005 (0.09)
March		-0.009 (0.06)		-0.010 (0.09)
April		0.075 (0.07)		0.267*** (0.10)
May		-0.020 (0.05)		-0.129** (0.06)
June		0.045 (0.06)		0.091 (0.07)
July		-0.018 (0.07)		0.027 (0.08)
August		-0.004 (0.06)		0.100 (0.09)
September		0.012 (0.05)		-0.167** (0.07)
October		-0.073* (0.04)		0.020 (0.07)
November		0.092*** (0.03)		-0.019 (0.08)
December		-0.056 (0.08)		0.018 (0.07)
Inflation	0.033* (0.02)	0.019 (0.02)	-0.018 (0.02)	-0.003 (0.02)
Observations	196	196	196	196
R-squared	0.555	0.610	0.659	0.709

Note: Newey-West standard errors in brackets unless stated otherwise. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (a) F-test of joint significance of other sector's lagged earnings growth. Annual growth of other sector's earnings included.

# Appendix: detailed results

## Results for earnings including bonuses and arrears

	Private sector		Public sector	
	1	2	3	4
Long-run endogeneity (ECM term)	0.011 (0.02)	0.026 (0.03)	-0.042*** (0.01)	-0.036** (0.01)
Short-run causality (other sector, p-value <sup>a</sup> )	0.002***	0.000***	0.060*	0.062*
Other sector *				
January		0.308*** (0.10)		-0.030 (0.05)
February		0.078 (0.14)		-0.010 (0.05)
March		-0.126 (0.15)		0.075** (0.04)
April		0.014 (0.20)		-0.003 (0.05)
May		0.083 (0.08)		0.099 (0.07)
June		0.240*** (0.07)		-0.292 (0.23)
July		0.121 (0.08)		0.396* (0.20)
August		0.248*** (0.06)		0.184** (0.09)
September		0.139** (0.07)		0.151 (0.12)
October		0.159*** (0.05)		-0.033 (0.10)
November		0.086 (0.10)		0.095 (0.08)
December		-0.057 (0.11)		0.182* (0.11)
Inflation	0.117** (0.05)	0.112** (0.05)	0.026 (0.04)	0.034 (0.04)
Observations	316	316	316	316
R-squared	0.805	0.890	0.627	0.661

Note: Newey-West standard errors in brackets unless stated otherwise. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. (a) F-test of joint significance of other sector's lagged earnings growth. Annual growth of other sector's earnings included.

# Appendix: detailed results

## Aggregate settlements data

	1	2	3	4
Private sector, lag	0.251** (0.11)	0.335*** (0.06)	0.292*** (0.10)	0.625*** (0.12)
Public sector, lag	0.205*** (0.07)	0.187*** (0.03)	0.185*** (0.06)	0.031 (0.06)
RPI inflation, lag	0.304*** (0.06)	0.265*** (0.03)	0.305*** (0.06)	
CPI inflation, lag				-0.020 (0.04)
GDP growth, lag		0.137*** (0.02)		
Unemployment rate			-0.001*** (0.00)	
Observations	314	314	314	314
R-squared	0.840	0.910	0.852	0.699

Note: Newey-West standard errors in brackets unless stated otherwise. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Month fixed effects controlled for.





# Appendix: detailed results

## Individual settlements data, panel results

	1	2	3	4	5	6
Lagged dep variable	0.456*** (0.04)	0.468*** (0.07)	0.526*** (0.06)	0.475*** (0.05)	0.209* (0.11)	0.377*** (0.13)
Public admin	0.067 (0.06)					-0.162** (0.08)
Education		-0.068 (0.05)				0.005 (0.06)
Health			0.045* (0.02)			0.191*** (0.02)
Other services				0.231*** (0.04)		0.281*** (0.06)
Int organisations					0.104 (0.08)	
Inflation	0.364*** (0.08)	0.485*** (0.09)	0.348*** (0.06)	0.156*** (0.04)	0.507*** (0.12)	0.236*** (0.04)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.764	0.731	0.703	0.793	0.521	0.778
Observations	2,236	1,167	1,624	2,065	290	883
Sectors	23	23	23	23	23	24 25

Note: Driscoll-Kraay standard errors in brackets. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

# Appendix: detailed results

## Individual settlements data, seasonal Granger causality

	1	2	3	4	5
	Public admin	Education	Health	Other services	Int org
Lagged dep variable	0.449*** (0.04)	0.453*** (0.08)	0.478*** (0.07)	0.429*** (0.05)	0.083 (0.10)
Public sector*Q1	0.099 (0.06)	0.231*** (0.08)	0.232 (0.23)	0.322*** (0.11)	0.044 (0.14)
Public sector*Q2	0.031 (0.07)	0.283** (0.11)	0.026* (0.01)	0.345*** (0.10)	-0.445*** (0.07)
Public sector*Q3	0.055 (0.08)	-0.095* (0.05)	0.130* (0.07)	0.216*** (0.03)	0.694*** (0.15)
Public sector*Q4	0.110* (0.06)	-0.101* (0.05)	0.090** (0.04)	0.376*** (0.10)	0.350 (0.44)
Inflation	0.367*** (0.08)	0.510*** (0.09)	0.342*** (0.06)	0.117 (0.07)	0.525** (0.20)
Quarter FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.765	0.737	0.705	0.798	0.577
Observations	2,236	1,167	1,624	2,065	290
Sectors	23	23	23	23	23

Note: Driscoll-Kraay standard errors in brackets. Significance level given by given by \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.