

# Flexible Work Arrangements in Low Wage Jobs

## Evidence from Job Vacancy Data

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# Motivation

- ▶ Technological developments have changed the cost of offering different work arrangements
  - ▶ Easier to provide workers with flexible schedules and schedule work on-demand
  - ▶ Reduced the need for colocation of workers
- ▶ Indeed, by some measures, the structure of work is changing in the labour markets of developed economies
  - ▶ **Gig Economy** (platform mediated work), **Zero Hours Contracts** (no guarantee of a minimum number of hours), **Solo Self-Employment** (low income self-employment, potentially with dependence on a single firm)
  - ▶ only about 55% of jobs are traditional [permanent, full-time, (9-5)] (Mas & Pallais, 2020)



# Motivation

- ▶ Policy interest in “alternative work arrangements” & flexible jobs
  - ▶ Concern about the potential for worker exploitation
  - ▶ Reduced role of firms in income smoothing & can be ineligible for support delivered through the employment relationship
  - ▶ ...what does this mean for the design and delivery of policy to support low-wage workers?
- ▶ Yet, job flexibility can also have benefits for firms & workers
  - ▶ Work-life balance & the ability to quickly adjust labour supply to domestic “shocks” (although evidence for this is weak)
  - ▶ Adjust production to variable demand



# Introduction

- ▶ Surprisingly little is known about the drivers of firm demand for flexible work arrangements
  - ▶ Strong focus of the recent literature has been on worker preferences for flexible jobs
  - ▶ Older literature on temporary jobs but unlikely to be ambiguity in ranking of permanent versus temp jobs
- ▶ Data and measurement issues have held back empirical research in this area
  - ▶ Questions on alternative work arrangements are not asked consistently over time
  - ▶ Challenges with how to interpret responses to some questions
  - ▶ Zero-hours contracts are under-recorded by the main labour force survey



# This Paper

- ▶ In this paper, we analyse over 60million UK job vacancies better to understand firm demand for flexible work arrangements
  - ▶ Has there been any **change over time** in the prevalence of flexible arrangements advertised?
  - ▶ What **other job characteristics** does flexibility correlate with? Does this differ amongst high and low wage postings?
  - ▶ Do employers use flexibility as a dimension along which to **reduce labour costs**?
- ▶ Measure flexible work arrangements from job vacancies text
  - ▶ Burning Glass Technology: text of 50,240,650 job vacancies in the UK from 2013 onwards
  - ▶ Manually annotate 6,500 vacancies to create training data set for supervised machine learning approach
  - ▶ Label a number of characteristics including whether salaried/permanent/full time



# This Paper

- ▶ Considerable heterogeneity in prevalence of flexible work jobs
  - ▶ More likely in low paid & non-salaried jobs, and in lower skilled elementary and sales occupations
  - ▶ Less likely to be salaried: 61% of non-flexible vacancies specified a salary, while only 35% of flexible vacancies do
- ▶ The proportion of flexible vacancies has been growing over time
  - ▶ Growing polarisation in offered work arrangements across the wage distribution
- ▶ Ongoing work is examining the effect of the shift to the NLW on the characteristics of posted jobs
  - ▶ Large (unexpected) announcement to the NMW in July 2015
  - ▶ Triple difference-in-differences strategy using variation in exposure within occupations across space & within counties across occupations



# Outline of Talk

1. Data & Measurement
2. Variation in Flexible Jobs
3. Impact of NLW
4. COVID & Flexible Jobs





# Data

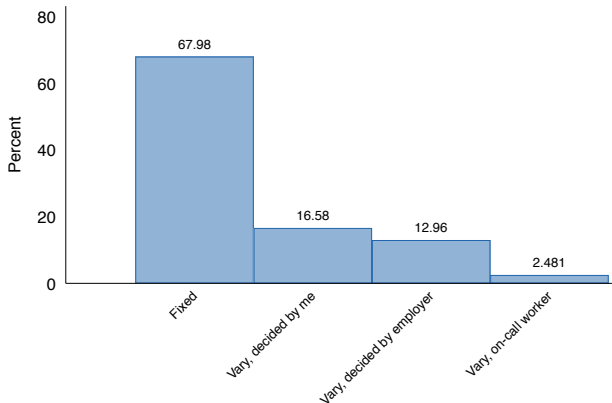


## Issues with Extant Data Sets

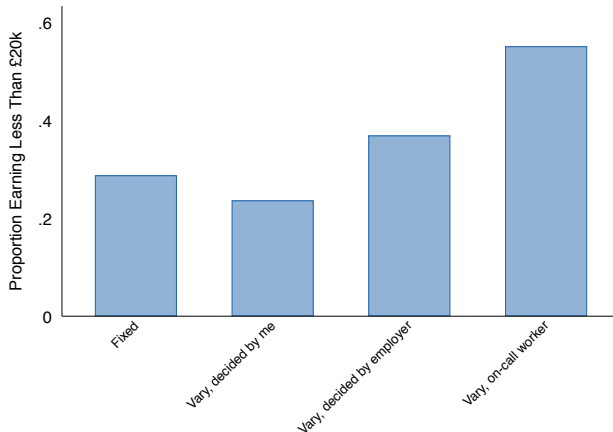
- ▶ Measurement of alternative work arrangements and zero hours contracts challenging for a number of reasons
  - ▶ Only asked for the main work arrangement
  - ▶ Controversy over the wording of the question resulted in the Office for National Statistics having to apologise for the “risk of an undercount”
- ▶ Existing work has therefore focused on bespoke surveys or particular sectors where specialist data exists
  - ▶ Datta et al (2019): focus on social care which has good employer-employee data
  - ▶ CEP 2018 survey: cannot be used to understand changes over time
  - ▶ Adams-Prassl et al (2020): Covid-surveys ask about control of hours (also now used in USoc)



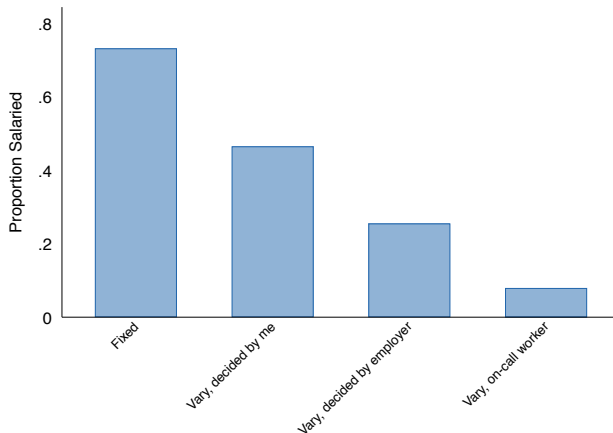
# Control of Hours: Adams-Prassl, Boneva, Golin & Rauh



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# Job Vacancy Data

- ▶ Growing literature using job vacancy data in order to analyse the labour market, some in real-time
  - ▶ Demand for skill: Hershbein & Kahn (2018); Deming & Kahn (2018); Clemens, Kahn & Meer (2020)
  - ▶ Response of hiring strategies to public policy reform: Duchini et al (2020); Marinescu (2017)
  - ▶ Shocks: Javorcik et al (2020); Forsythe et al (2020)
- ▶ Our paper is the first to analyse the characteristics of work arrangements from the job vacancy text



# Job Vacancy Data

- ▶ We measure schedule flexibility on the basis of job vacancy text
  - ▶ Burning Glass Technology: text of 50,240,650 job vacancies in the UK from 2014 onwards
  - ▶ BGT scrapes 7,500 job boards and company web pages
- ▶ Limitations:
  - ▶ Not all jobs are advertised online
  - ▶ Only what firms state in the advert rather than realised arrangement
  - ▶ Not necessarily a neat mapping between characteristics of vacancies & filled jobs: not all vacancies are filled & terms might be negotiated
  - ▶ Jobs posted online are disproportionately professional and  $\approx$  30-40% missing wage info



# Classifying Work Arrangements

- ▶ Goal is to retrieve all vacancies that describe flexible work arrangements from the set of BGT job adverts.
- ▶ Take a supervised machine learning approach that relies on manual annotations
  1. Manually label a set of job vacancies for the dimensions of work arrangements of interest;
  2. Define the vocabulary and represent each job vacancy in a matrix format;
  3. Train a machine learning model to classify work arrangements on the basis of vacancy text;
  4. Apply the machine learning model to all 46 million job vacancies.





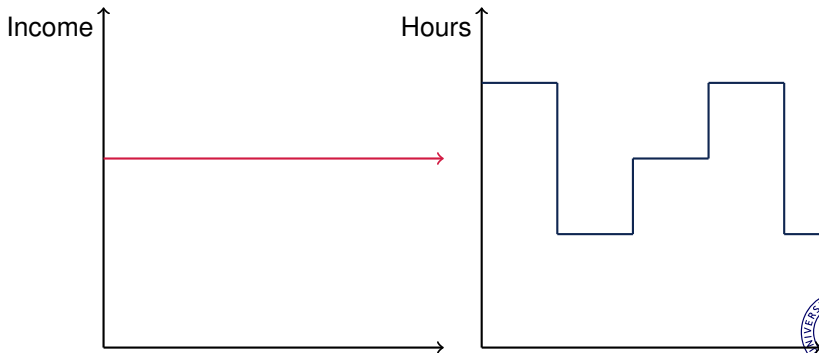
# Schedule Flexibility

- ▶ Treat flexibility as **schedule flexibility**
  - ▶ i.e. any arrangement in which the timing of work is not fixed in the contract and has to be agreed at a later date between the employer and the employee.
- ▶ Difficult to identify control of schedule from vacancy text
  - ▶ We've tried (!! ) and may explore unsupervised machine learning techniques in the future
- ▶ In practice, we categorize a job to be schedule flexible if it mentions shift or rota work without a fixed pattern, offers flexible working, or specifies that work will be organised according to the needs of the business.



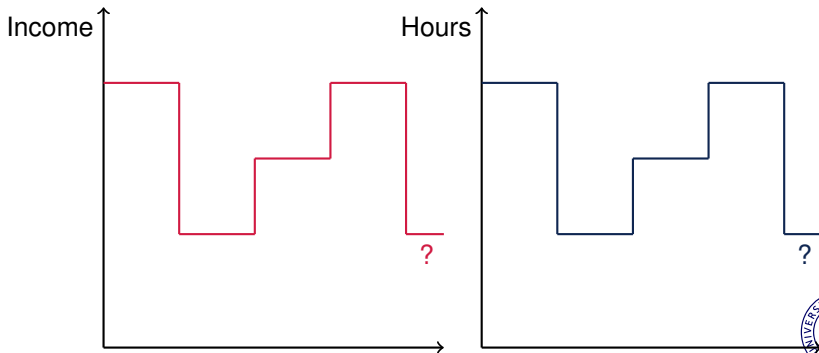
# Schedule Flexible Jobs

Figure: Salaried Job with Flexible Hours



# Schedule Flexible Jobs

Figure: Non-Salaried Job with Flexible Hours



# Manual Annotations

*“As this is a Bank position to **provide cover as and when we need it**, such as for annual leave or sick leave, **the hours and days you work will vary.**”*



# Manual Annotations

*“They are looking for a dynamic Solicitor, Legal Executive or Licensed Conveyancer to join at this incredibly exciting time to work flexibly/from home.*

*You will be given the platform to succeed and take care of your clients, whilst benefiting from flexible working from home!*

*This could suit someone looking to return to work after maternity leave, or **someone looking for flexibility around their working hours/wanting to choose their own working hours!**”*



# Manual Annotations

*“What we offer:*

- ★ Competitive rates of pay- holiday pay, all out of pocket expenses paid including mileage. You should be able to earn £60-£82 per 6 hour day, based on interviews achieved*
- ★Ad hoc working- which allows flexibility and choice”*



## Methodology

- Represent the text of job adverts as a matrix (dropping common words such as “and”, “the”, “job” &c
- Tokenize at the word level (1-gram) and supplement with common 2- and 3-grams identified in manual annotations

$$\begin{array}{l}
 \text{Flexible} \\
 \text{Maternity} \\
 \text{Fixed Term} \\
 \vdots \\
 \text{Permanent}
 \end{array}
 \begin{bmatrix}
 1 & 0 & \dots & 1 \\
 1 & 1 & \dots & 0 \\
 0 & 1 & \dots & 0 \\
 \vdots & \vdots & \vdots & \vdots \\
 0 & 0 & \dots & 1
 \end{bmatrix}
 \quad (1)$$

- So called “bag of words” approach using a binary count vectorizer
  - Use of word vectors or the TF-IDF vectoriser did not improve performance



# Methodology

- ▶ Use a logistic classification model with LASSO regularisation
- ▶ Tuning parameter for the LASSO regularisation was determined using a grid search and cross validation
  - ▶ Draw five repeated test & train samples from the annotated data
  - ▶ Test data is not used for model estimation
  - ▶ Accuracy of the model evaluated using the F-score, precision, and recall





# Methodology

		True Label	
		0	1
Predicted Label	0	True Negative (TN)	False Negative (FN)
	1	False Positive (FP)	True Positive (TP)

$$\text{Balanced F-measure} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

where

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}}$$

$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$



# Accuracy

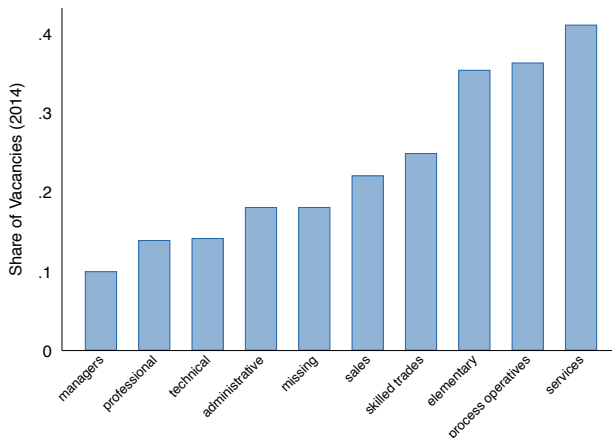
Contract type	Logistic Regression Model			Improvement to keywords		
	Precision	Recall	F	Precision	Recall	F
Schedule flexible	0.8540	0.8083	0.8303	0.0005	0.4399	0.1855
Permanent	0.9294	0.9736	0.9510	0.0471	-0.0067	0.0223
Full-time	0.9162	0.8881	0.9019	0.1898	0.2236	0.1314
Salaried	0.8604	0.8415	0.8503	-0.1032	0.3586	0.2070



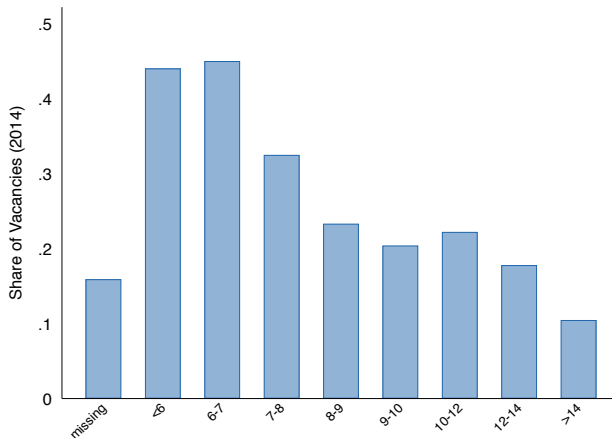
## Variation in Flexible Vacancies



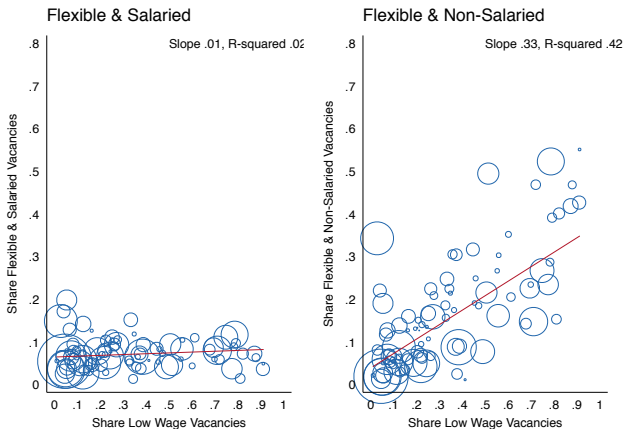
# Share of Flexible Vacancies: Occupation



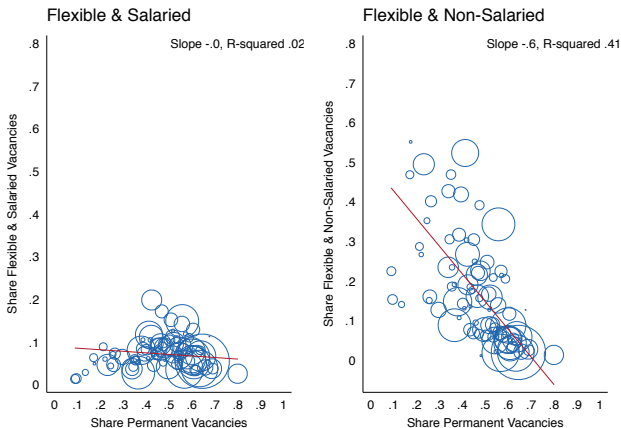
# Share of Flexible Vacancies: Wage



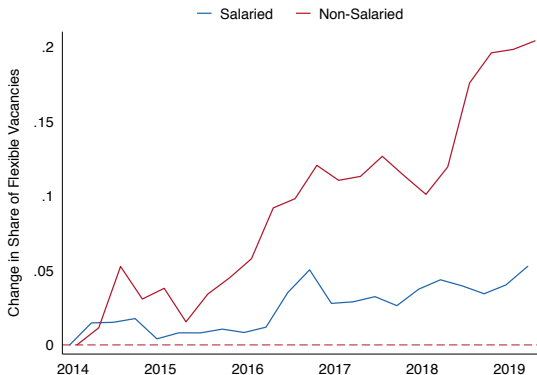
# Relationship with Low-Wage Vacancies



# Relationship with Permanent Vacancies



# Change Over Time





# Minimum Wage



# Minimum Wage Policy

“We strongly support the National Minimum Wage and want to see further real-terms increases in the next Parliament. We accept the recommendations of the Low Pay Commission that the National Minimum Wage should rise to £6.70 this autumn, on course for a Minimum Wage that will be over £8 by the end of the decade.”

Conservative Party Manifesto, April 14<sup>th</sup> 2015.

“I am today introducing a new national living wage. We will set it to reach £9 an hour by 2020. The new national living wage will be compulsory. Working people aged 25 and over will receive it. It will start next April at the rate of £7.20. The Low Pay Commission will recommend future rises that achieve the Government’s objective of reaching 60 percent of median earnings by 2020.”

Budget Speech, July 8<sup>th</sup> 2015.

“I’ve talked to several chief executives and been surprised by the impact on their profits. In one [big] company, it would wipe out all of their profits”

Paul Drechsler, CBI President, September 2015.

Bell & Machin (2017)



# Minimum Wage Policy

- In April 2016, the UK transitioned to a “living wage” arrangement

Year	Age				
	25 and over	21 to 24	18 to 20	Under 18	Apprentice
April 2019 to March 2020	£8.21	£7.70	£6.15	£4.35	£3.90
April 2018 to March 2019	£7.83	£7.38	£5.90	£4.20	£3.70
April 2017 to March 2018	£7.50	£7.05	£5.60	£4.05	£3.50
October 2016 to March 2017	£7.20	£6.95	£5.55	£4.00	£3.40
April 2016 to September 2016	£7.20	£6.70	£5.30	£3.87	£3.30
	21 and over		18 to 20	Under 18	Apprentice
2015	£6.70		£5.30	£3.87	£3.30
2014	£6.50		£5.13	£3.79	£2.73



# Methodology

- ▶ NMW is a national policy so we make use of variation in exposure to the changes across occupations and counties
- ▶ Take a “triple” difference-in-differences strategy
  - ▶ Changes in contract types across counties might be systematically different for reasons other than exposure to minimum wage changes

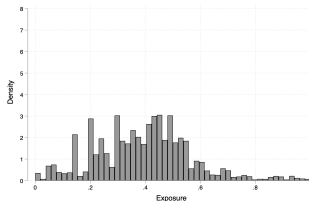
$$\beta = (\bar{y}_{H,T,2} - \bar{y}_{H,T,1}) - (\bar{y}_{L,T,2} - \bar{y}_{L,T,1}) - (\bar{y}_{H,C,2} - \bar{y}_{H,C,1})$$

- ▶  $H/L$ : high/low exposure regions
  - ▶  $T/C$ : high/low exposure occupations
- ▶ Cleaners in Blackpool have lower wages on average than cleaners in Oxford
- ▶ Cleaners in Blackpool have lower wages on average than security guards in Blackpool

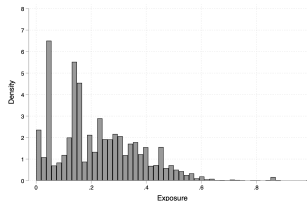


# Variation in Exposure

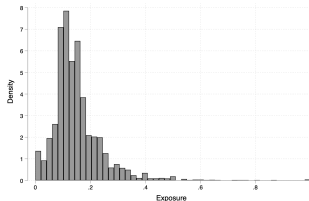
## Services



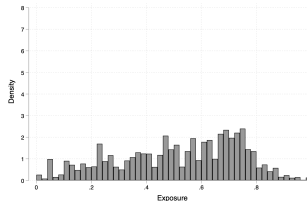
## Sales



## Process Operatives



## Elementary



# Methodology

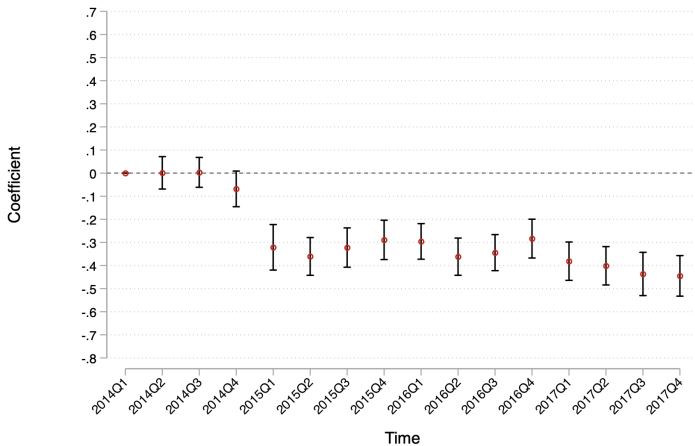
- ▶ Estimating equation:

$$s_{oct} = \delta_t * Exposure_{oc} + \alpha_{ot} + \beta_{ct} + \delta_{oc} + X_{oc}\gamma_t + \epsilon_{oct} \quad (2)$$

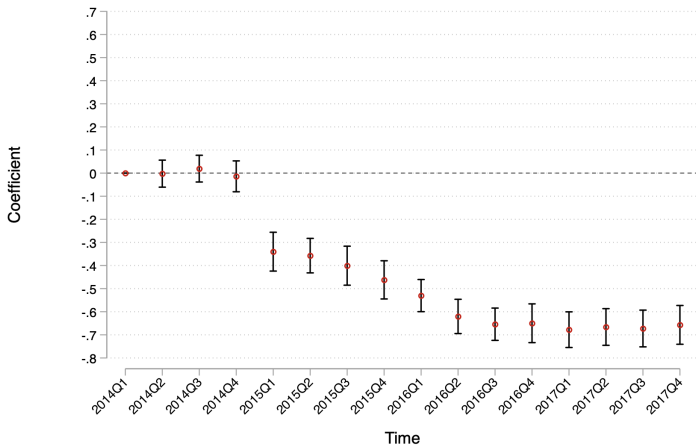
- ▶ Occupation: 3-digit SOC code
- ▶ Geography: county
- ▶  $X$ : county characteristics in 2014
- ▶ Robustness checks on-going & adapting Cengiz et al (2019) approach



# Posted Wages: < £6

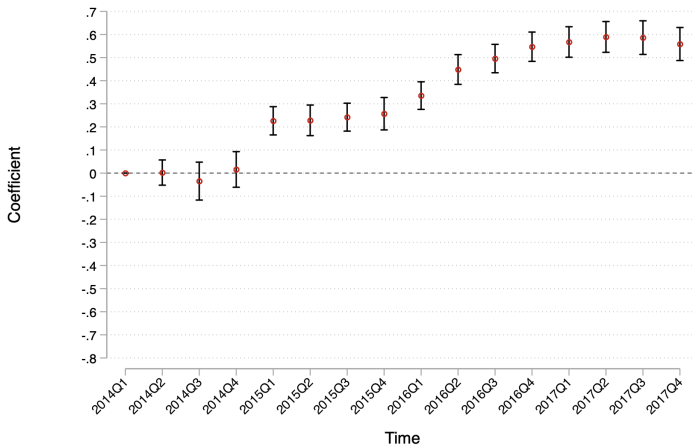


# Posted Wages: £6-7

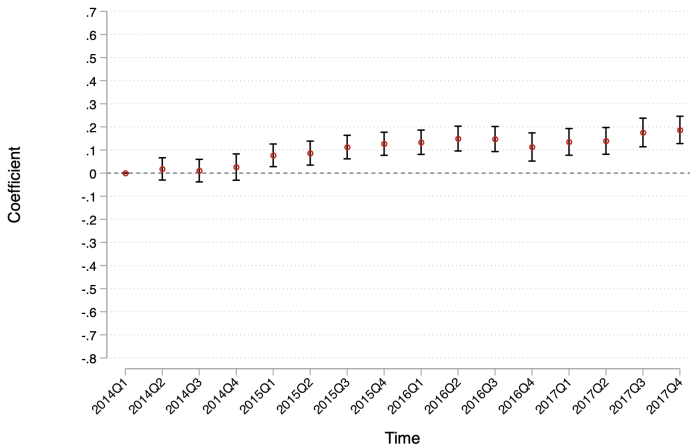




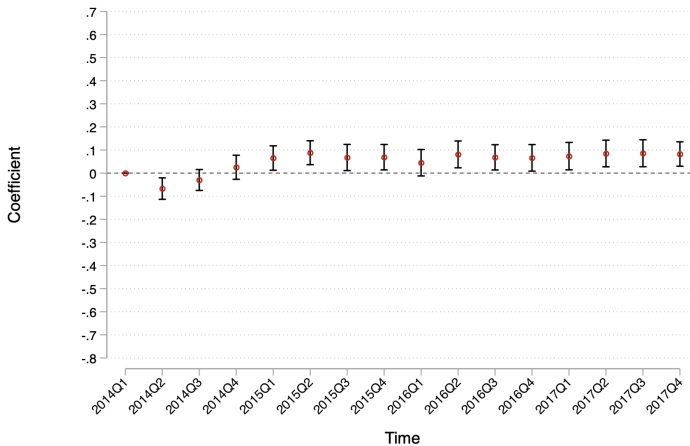
# Posted Wages: £7-8



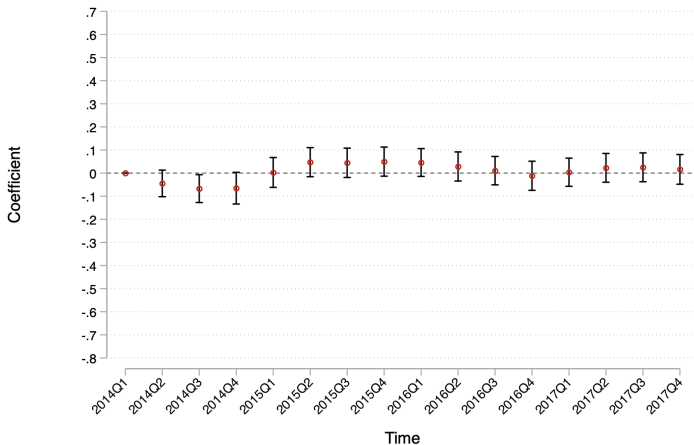
# Posted Wages: £8-9



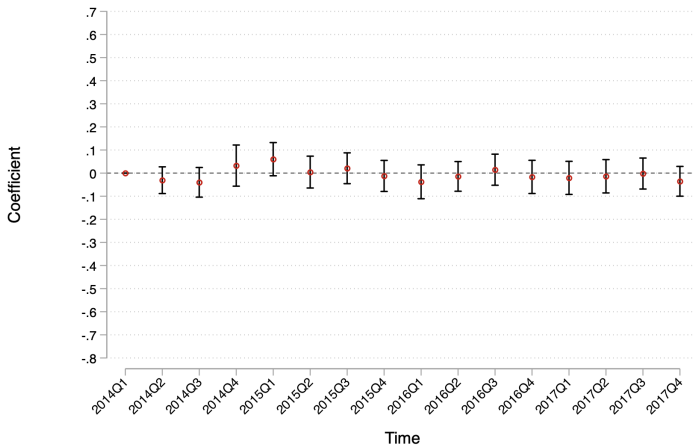
# Posted Wages: £9-10



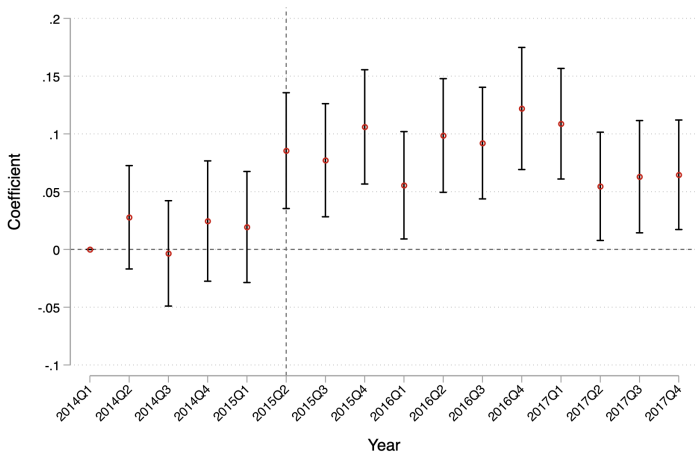
# Posted Wages: £10-12



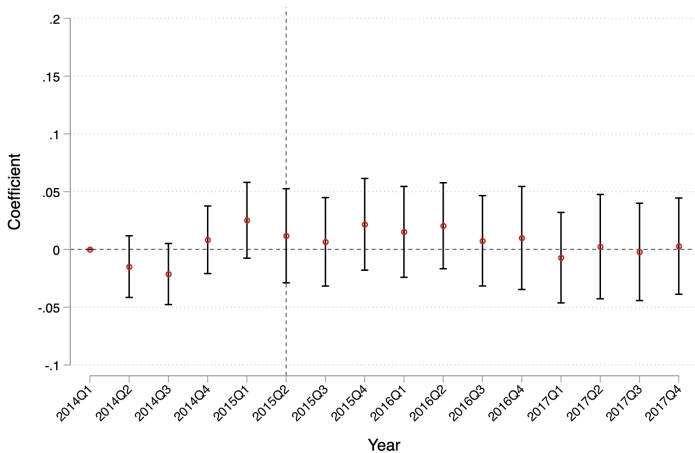
# Posted Wages: £12-14



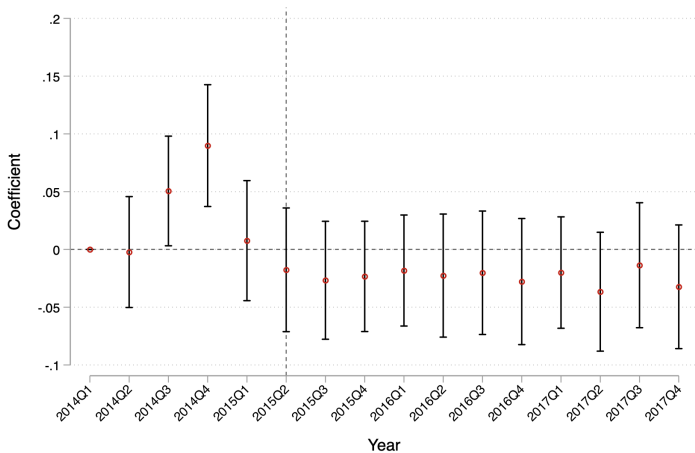
# Flexible Contracts



# Flexible Contracts - Salaried

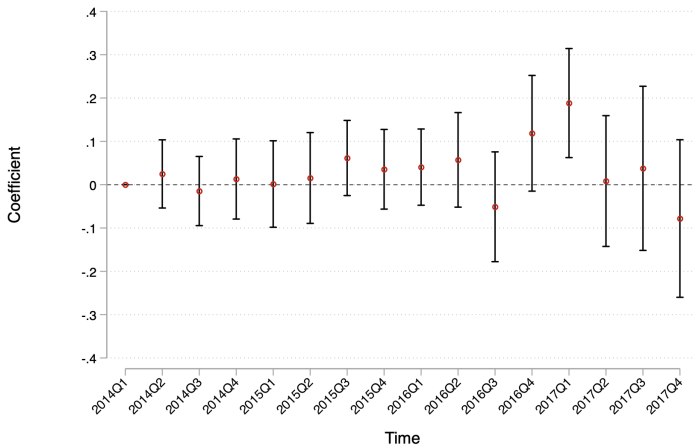


# Permanent Contracts

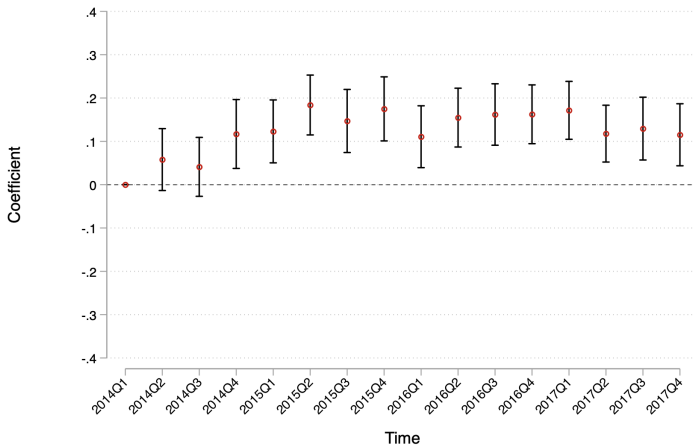




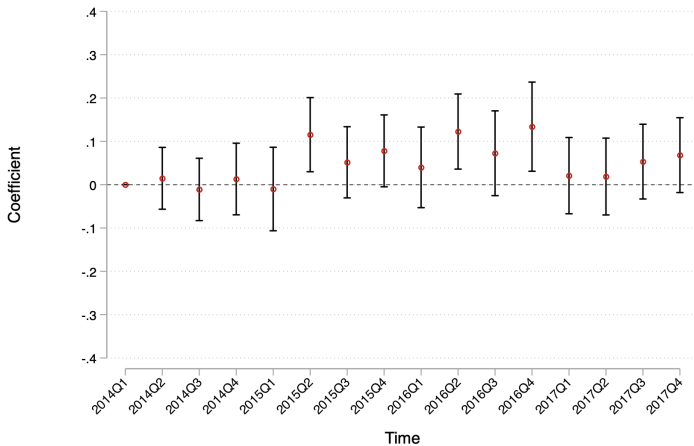
# Flexible Contracts - $\leq$ £7



# Flexible Contracts - £7-9



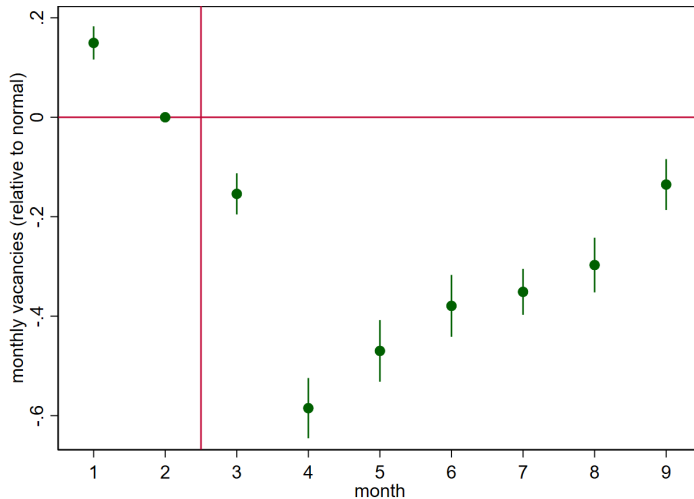
# Flexible Contracts - > £9



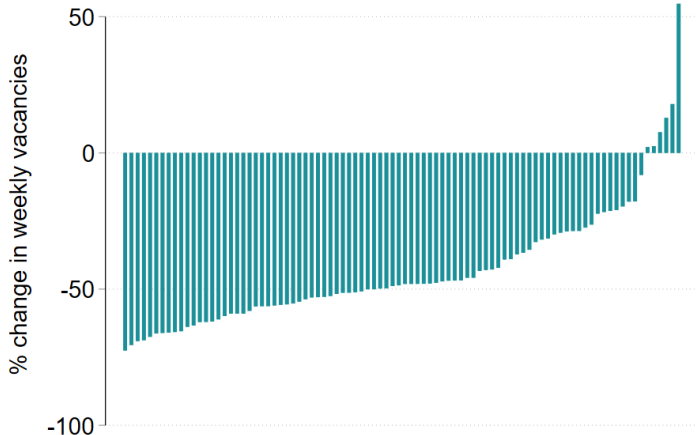
# Covid



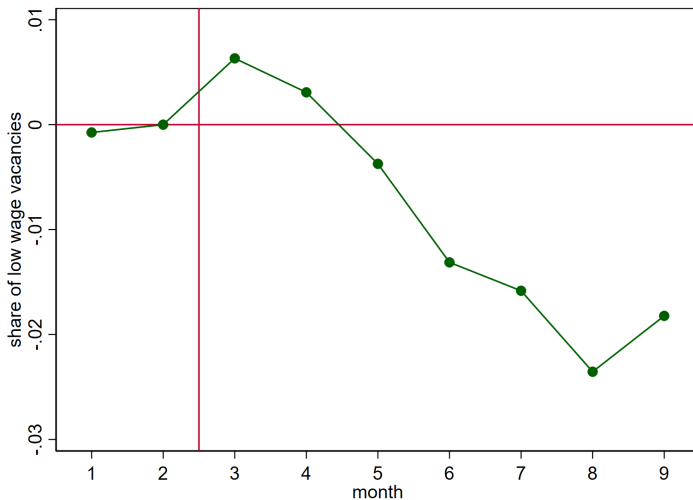
# Change in Vacancies Over Time



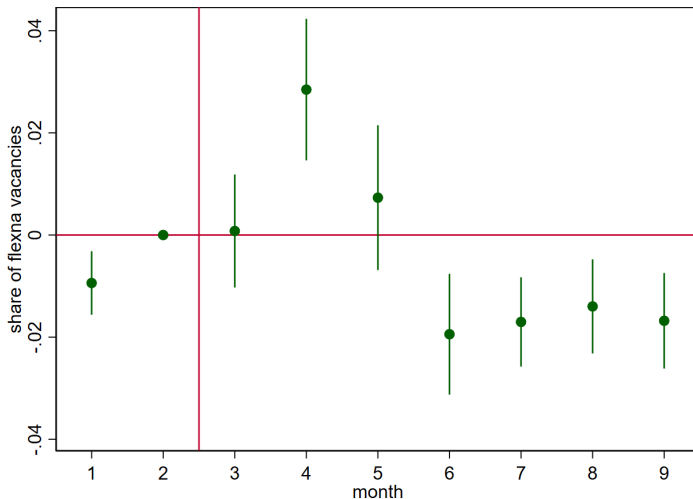
# Variation Across Occupations



# Change in Proportion of Low Wage Vacancies

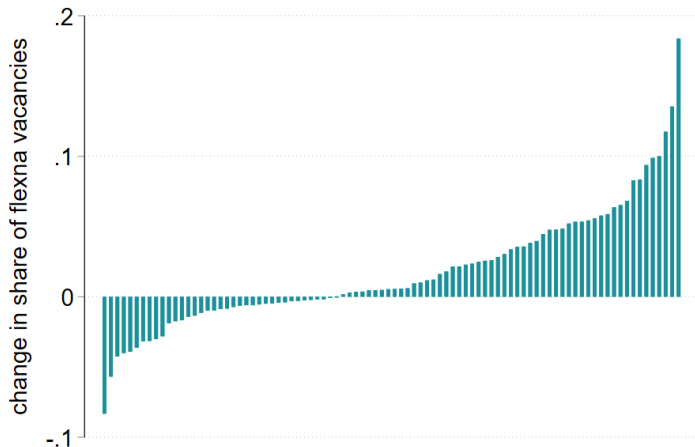


# Impact on Flexibility





# Variation Across Occupations



# Conclusion

- ▶ We extract information on contract terms from job vacancy text to analyse firm demand for flexible work arrangements
- ▶ Vacancies that advertise flexible arrangements are disproportionately low wage, lower skilled and non-salaried
- ▶ On-going work examines the drivers of flexible work arrangements including adjustment to higher labour costs



Thank You!

