

# Staff engagement, job complementarity and labour supply of the hospital workforce: Panel data evidence from the English NHS

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By KATE PICKLES FOR THE DAILY MAIL

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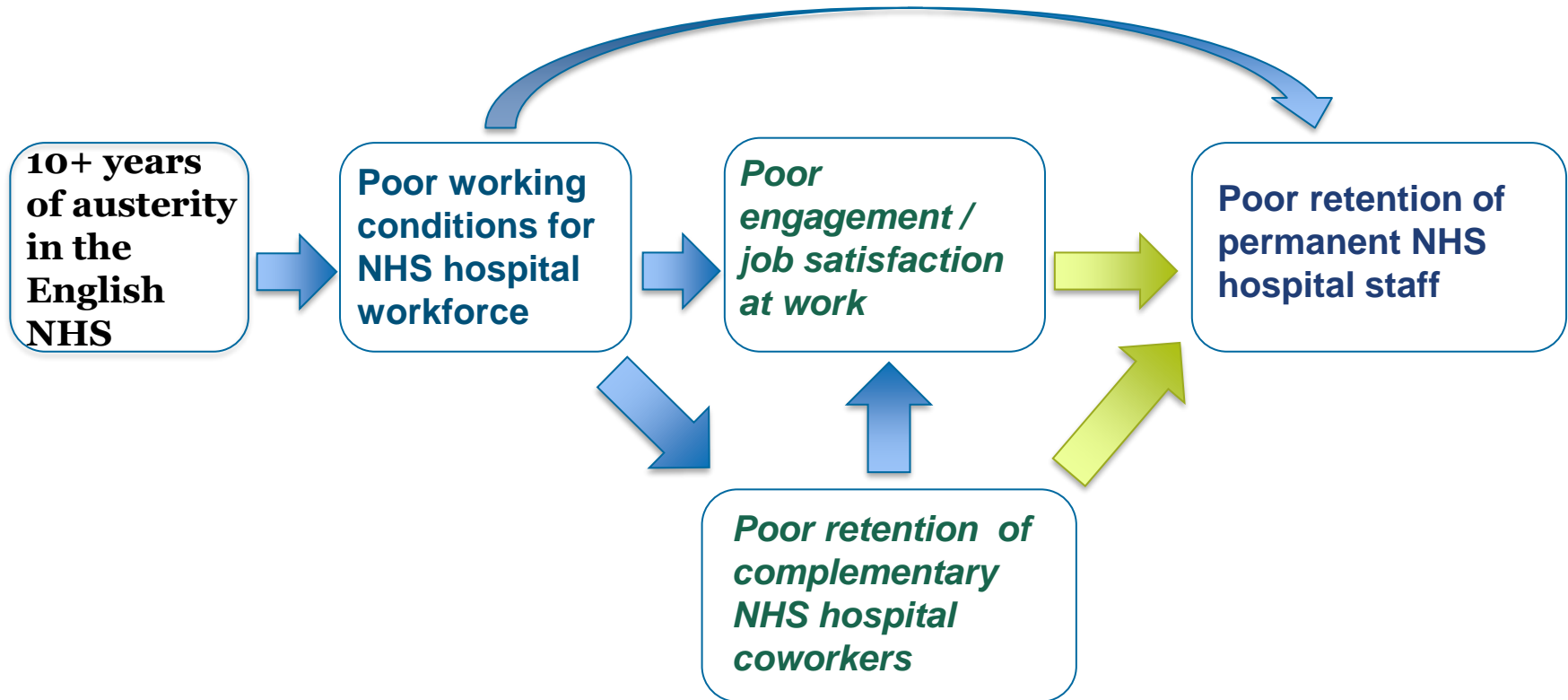
Europe

**Britain braces for an exodus of E.U. doctors and nurses feeling hurt by Brexit**

... But also elsewhere:

- projected shortfall of 18 million health workers by 2030 worldwide (WHO 2016)
- In the US about 1.1 million new registered nurses are needed by 2030 (Bureau of Labor Statistics, U.S. Department of Labor, 2021).

# DGP and relationships to test



- **RQ1:** Staff engagement as an output of working conditions and management input
- **RQ2:** Effect of own occupational group engagement on workforce retention (outcomes: stability index; leaving the NHS) - *What is the relationship between staff engagement and the retention of hospital workers?*
- **RQ3:** Effect of own and complementary group retention on workforce retention (outcomes: stability index; leaving the NHS) - *What is the relationship between retention of nurses and doctors?*
- **RQ4:** Effect of engagement and complementarities on labour supply intensive margins

✓ **Long longitudinal study:**

- aggregate data on NHS Trust-level variables from micro-level datasets on administrative staff records
- using high-quality payroll data on universe of NHS hospital employee
- using the largest healthcare staff survey in the world (NSS)
- linkage of NHS workers payroll data with staff survey data
  - *Limiting measurement error bias in engagement score*
  - *consistency in time measurement between retention indicators and engagement indicators*

✓ **NHS hospital workers' pay is regulated at national level**

→ little/no scope for confounding & endogeneity due to more skilled workers' negotiating higher salaries & being more engaged & with higher retention

- Labour supply (*Blundell and MaCurdy, 1999*)
- Labour supply, retention of workers in the English NHS (*Shields 2002; Crawford et al 2015; Propper et al., 2021*)
- Engagement (*Schaufeli et al., 2002; Schaufeli, 2013*)
  - Schaufeli (2013): “*In business, engagement is defined as a blend of three existing concepts (1) job satisfaction; (2) commitment to the organization; and (3) extra-role behavior, i.e. discretionary effort to go beyond the job description.*”
- Job satisfaction (*Clark and Oswald, 1996; Oswald, 1997; Bockermann, Bryson et al. 2013, 2020*)
- Health care organization (*Propper and Van Reenen, 2010*); management (*Hoffman & Tadelis, 2020; Friebel et al., 2021*)
- Impact of co-workers (*Jarosh, Oberfield, Rossi-Hansberg 2021*)

# *RQs 2 & 3: Methods*

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# Definition: stability index

Following the NHS workforce statistics, we measure retention with stability indices,  $S_{ht}^j$ , at staff group and Trust level. We only use staff on active assignments.

$$S_{ht}^j = \frac{\sum_i I_i(\text{worker } i \in \{\text{staff group } j; \text{hospital Trust } h\} \text{ in } [t, t + \tau])}{\sum_i I_i(\text{worker } i \in \{\text{staff group } j; \text{hospital Trust } h\} \text{ in } t)}$$

- The stability index is the percentage of staff group  $j$  working in Trust  $h$  at time  $t$  and remain in the Trust under same staff group until  $t + \tau$ .
- We use the overlapping annual measure of retention, where  $\tau = 12$ , and we use the September <sub>$t$</sub> -September <sub>$t+1$</sub>  stability indices.
- For example, Trust A had 100 nurses in March 2013 and 90 of those nurses remained in their posts in Trust A until March 2014, then nurses' stability index at Trust A for March 2014 is 90%

$$\begin{aligned} (1 - S_{ht}^j) * 100 &= \% \text{ Workers from group } j \text{ leaving Trust } h = \\ &= \% \text{Churn} + \% \text{ Workers Leaving NHS} \end{aligned}$$



# What drives hospital workforce retention? A simple framework

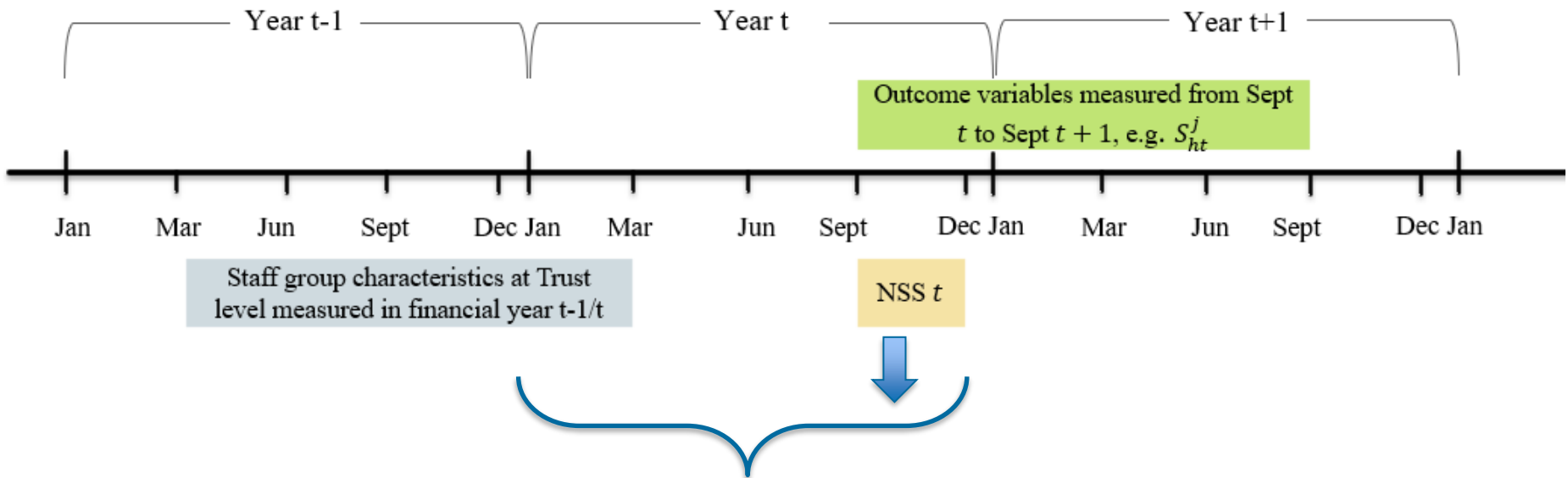
*A model of workforce retention*

$$S_{ht}^j = f \left( S_{h,t-1}^j; \text{Eng\_Score}_{h,t}^j; S_{h,t}^{-j}; X_{h,t}^j; Z_{h,t}^j; \mu_h; \lambda_t \right) \quad (1)$$

- $S_{ht}^j$ : stability index for occupational group  $j = \{\text{nurses, consultants}\}$  in hospital Trust  $h$ , year  $t$
- $\text{Eng\_Score}_{ht}^j$ : engagement score for occupational group  $j = \{\text{nurses, consultants}\}$
- $S_{h,t}^{-j}$ : stability index for the complementary occupational group in hospital  $h$ , year  $t$
- $\mu_h$ : hospital time-invariant characteristics;
- $\lambda_t$ : time trends;
- $Z_{h,t}^j$ , **time-varying demographic & supply-side controls**:
  - ❑ % female, average age, Nationality, Ethnicity of group  $j$  workers in Trust  $h$  at year  $t$
  - ❑ Number of competitor hospitals (NHS Trusts or IS sites) within a 30km radius
- $X_{h,t}^j$ , **time-varying Trust-level controls**:
  - ❑ average hours worked of group  $j$  workers in Trust  $h$  at year  $t$
  - ❑ Gender Pay Gap: male/female monthly pay ratio of group  $j$  workers in Trust  $h$  at year  $t$
  - ❑ % Discrimination at work from manager/colleague in last 12 months ( $j, h, t$ )
  - ❑ % respondents doing at least 11 additional unpaid working hours per week ( $j, h, t$ )

*Empirical specification of interest:*

$$S_{ht}^j = \gamma_1 S_{h,t-1}^j + \beta ES_{h,t}^j + \gamma_2 S_{h,t}^{-j} + \theta_1 X_{h,t-1}^j + \theta_2 Z_{h,t-1}^j + \theta_3 RR_{h,t}^j + \mu_h + \lambda_t + \epsilon_{h,t} \quad (2)$$



Engagement measured in  $t$  (from NSS) describes engagement retrospectively, from December  $t-1$  to November  $t$

## Estimation:

- ❑ Fixed effect linear regressions: account only for time invariant unobserved heterogeneity
- ❑ GMM IV regressions: account for possible feedback effects, e.g. more engaged nurses will be more likely to be retained, but also a Trust with higher retention rate will have more engaged, less burned-out workers

# Empirical strategy II: dynamic panel data models

**Problem:** What if  $ES_{h,t}^j$  and  $S_{h,t}^{-j}$  are not strictly exogenous given fixed effects  $\mu_h$ ? Time-varying endogeneity due to:

- Reverse causality between Engagement and Retention of the same group of workers
- Simultaneity of  $S_{ht}^j$  and  $S_{ht}^{-j}$
- Self-selection into responding to staff surveys  $RR_{h,t}^j$

**Solution:** estimate **dynamic** panel data model with hospital fixed effects

# Empirical strategy III: dynamic panel data models

GMM estimation of

$$S_{h,t}^j = \gamma_1 S_{h,t-1}^j + \beta ES_{ht}^j + \gamma_2 S_{h,t}^{-j} + \theta_1 X_{h,t-1}^j + \theta_2 Z_{h,t-1}^j + \theta_3 RR_{h,t}^j + \mu_h + \lambda_t + \epsilon_{h,t} \quad (2)$$

- System-GMMs *a la* Blundell & Bond (1998) with Forward Orthogonal Deviations (FODs)
  - Endogenous variables:  $S_{h,t-1}^j$ ,  $ES_{ht}^j$ ,  $S_{h,t}^{-j}$ ,  $RR_{h,t}^j$ ;
  - Predetermined variables:  $Z_{h,t-1}^j$ ;
  - Exogenous variables:  $X_{h,t-1}^j$  (demographics char.'s),  $\mu_h$ ,  $\lambda_t$
  - 3 lags of all variables used as “internal instruments” to remove endogeneity bias;
  - Two-step estimation with small sample adjustment correction on SEs
- 
- Estimation of Unconditional Quantile Regressions with Trust FE, to investigate the effects of  $ES_{ht}^j$  and  $S_{h,t}^{-j}$  over the unconditional distribution of  $S_{ht}^j$ .

# *Data*

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# Data sources:

## workforce retention

- NHS Electronic Staff Records: monthly administrative collection of NHS organizations staff payroll systems (financial years 2009/10 – 2019/20)
- Information on staff characteristics: *gender, age range, ethnicity, perm/temp contract, date of start/end of employment, hours worked, pay, NHS organization, area of work*

From ESR:

- % female of group  $j$  workers in Trust  $h$  at year  $t$
- average age of group  $j$  workers in Trust  $h$  at year  $t$
- % UK/EU/Overseas workers of group  $j$  in Trust  $h$  at year  $t$
- % BAME workers of group  $j$  in Trust  $h$  at year  $t$
- average hours worked of group  $j$  workers in Trust  $h$  at year  $t$
- Gender Pay Gap: male/female monthly pay ratio of group  $j$  workers in Trust  $h$  at year  $t$

From NHS National Staff Survey (NSS):

- Engagement score and its components (advocacy, motivation, inclusion)
- % **Discrimination at work** from manager/colleague in last 12 months ( $j, h, t$ )
- % respondents doing **at least 11 hours additional unpaid hours per week** ( $j, h, t$ )

From ESR + ONS postcodes + NHS ODS records:

- **Number of competitor hospitals** (NHS Trusts or IS sites) **within a 30km radius**

Table 1: Summary Statistics

|   | Nurses |                    |         |        | Senior Doctors |                    |         |        |
|---|--------|--------------------|---------|--------|----------------|--------------------|---------|--------|
|   | Mean   | Standard deviation |         |        | Mean           | Standard deviation |         |        |
|   |        | Overall            | Between | Within |                | Overall            | Between | Within |
| <i>Outcomes</i>                                 |        |                    |         |        |                |                    |         |        |
| Stability index (rate), %                       | 86.397 | 3.730              | 2.842   | 2.425  | 87.602         | 4.839              | 3.248   | 3.607  |
| Leaving the NHS rate, %                         | 7.249  | 2.502              | 1.839   | 1.702  | 6.407          | 3.317              | 2.190   | 2.502  |
| Sickness absence rate, %                        | 4.495  | 0.849              | 0.760   | 0.384  | 1.499          | 0.853              | 0.667   | 0.534  |
| Other lost days absence rate, %                 | 2.521  | 0.925              | 0.758   | 0.532  | 0.930          | 0.646              | 0.473   | 0.440  |
| <i>Engagement and components by staff group</i> |        |                    |         |        |                |                    |         |        |
| Overall engagement score                        | 6.961  | 0.426              | 0.302   | 0.302  | 7.021          | 0.602              | 0.425   | 0.428  |
| Component: motivation score                     | 7.373  | 0.315              | 0.196   | 0.247  | 7.507          | 0.495              | 0.293   | 0.400  |
| Component: advocacy score                       | 6.584  | 0.754              | 0.612   | 0.444  | 6.646          | 0.939              | 0.725   | 0.599  |
| Component: inclusion score                      | 6.930  | 0.345              | 0.186   | 0.291  | 6.909          | 0.633              | 0.400   | 0.492  |
| NSS response rate                               | 47.729 | 8.965              | 5.889   | 6.771  | 47.723         | 8.964              | 5.885   | 6.769  |

[Graphs](#)



# Yearly pairwise correlations of workforce retention outcomes at NHS Trust level

| Years                             | 2010     | 2011     | 2012     | 2013     | 2014     | 2015     | 2016     | 2017     | 2018     |
|-----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <i>Stability Index (Nurses)</i>   |          |          |          |          |          |          |          |          |          |
| <i>Stability Index (Doctors)</i>  | 0.16**   | 0.19**   | 0.20***  | 0.15**   | 0.29***  | 0.32***  | 0.23***  | 0.16**   | 0.03     |
| <i>NHS Leaving Rate (Nurses)</i>  | -0.72*** | -0.72*** | -0.84*** | -0.74*** | -0.75*** | -0.73*** | -0.77*** | -0.71*** | -0.78*** |
| <i>NHS Leaving Rate (Doctors)</i> | -0.13*   | -0.05    | -0.19*** | -0.09    | -0.16**  | -0.11    | -0.20*** | -0.08    | -0.02    |
| <i>Stability Index (Doctors)</i>  |          |          |          |          |          |          |          |          |          |
| <i>NHS Leaving Rate (Nurses)</i>  | -0.24*** | -0.32*** | -0.24*** | -0.25*** | -0.37*** | -0.27*** | -0.22*** | -0.20*** | -0.06    |
| <i>NHS Leaving Rate (Doctors)</i> | -0.56*** | -0.78*** | -0.83*** | -0.85*** | -0.79*** | -0.69*** | -0.75*** | -0.78*** | -0.64*** |
| <i>NHS Leaving Rate (Nurses)</i>  |          |          |          |          |          |          |          |          |          |
| <i>NHS Leaving Rate (Doctors)</i> | 0.30***  | 0.27***  | 0.29***  | 0.26***  | 0.32***  | 0.23***  | 0.37***  | 0.25***  | 0.14*    |

Notes: Based on a sample of 190 NHS Trusts. \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

- Mostly weak correlations ( $< 0.3$ ) between retention indicators of nurses and senior doctors

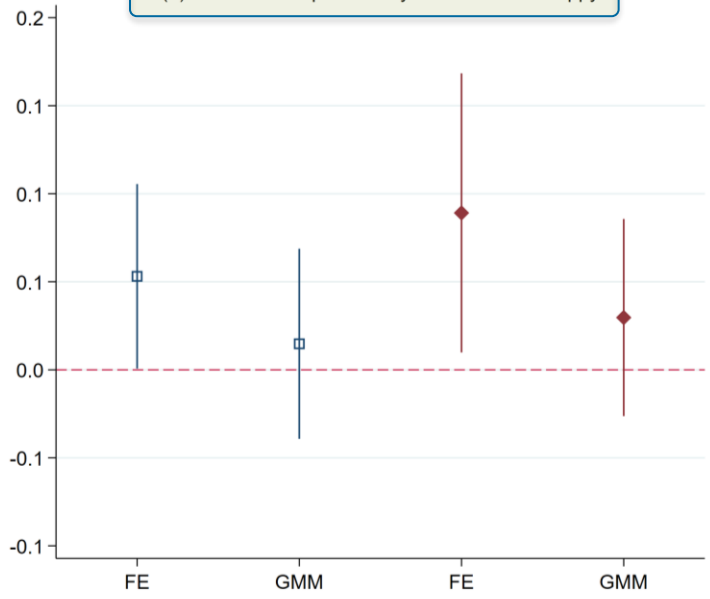
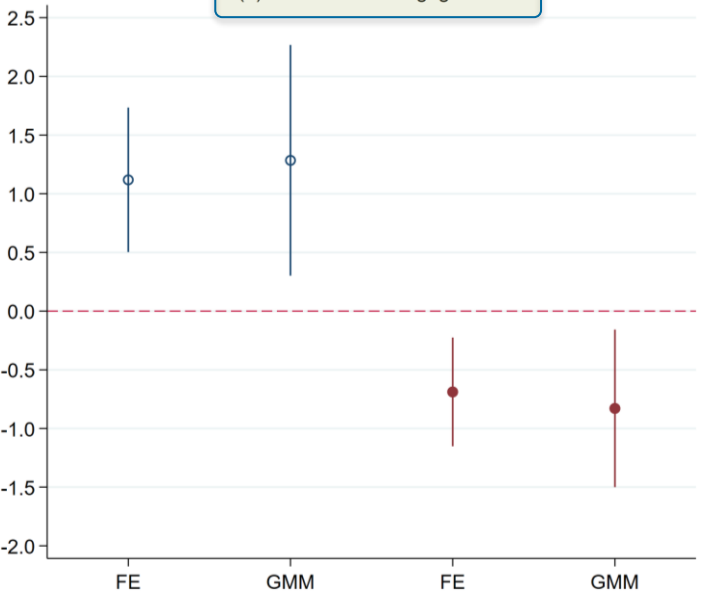
# *Main Results*

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# Main coefficients of interest: FE vs GMM comparison

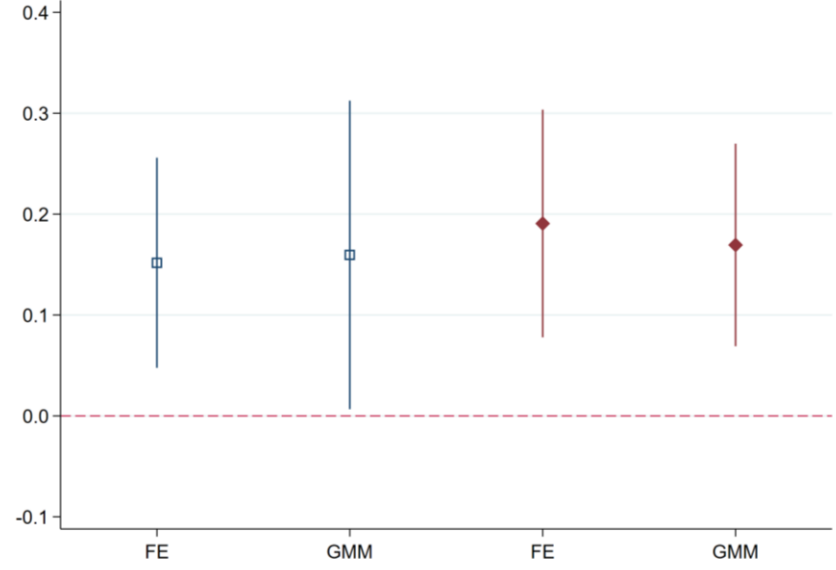
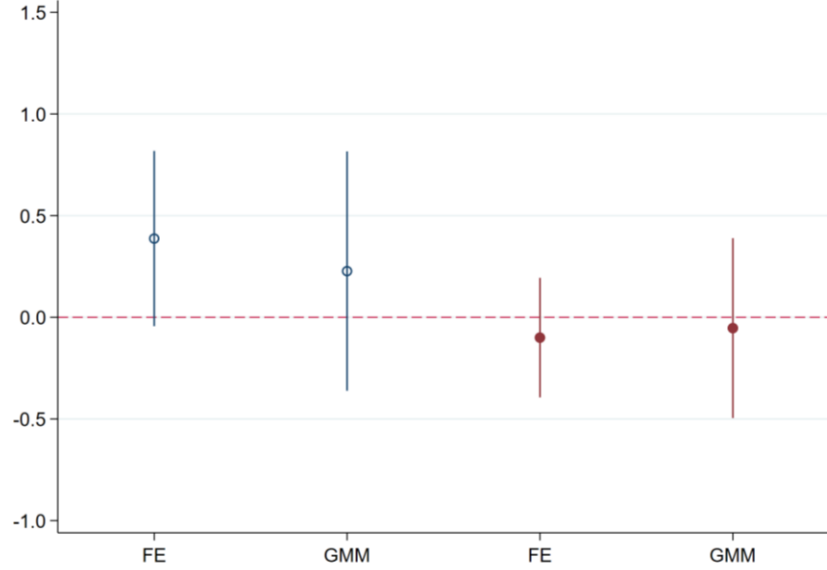
(a) Effect of Staff Engagement

(b) Effect of Complementary Staff's Labour Supply



(a) Effect of Staff Engagement

(b) Effect of Complementary Staff's Labour Supply



Senior Doctors - Labour supply measure  
 ○ Stability rate ● Leaving the NHS rate

Senior Doctors - Labour supply measure  
 □ Stability rate ◆ Leaving the NHS rate

Table 7: Elasticities of labour supply retention

|   | FE                   | GMM                 | Unconditional Quantile Regression |                     |                      |                     |                      |
|---|----------------------|---------------------|-----------------------------------|---------------------|----------------------|---------------------|----------------------|
|   |                      |                     | Q10                               | Q25                 | Q50                  | Q75                 | Q90                  |
| <b>(a) Nurses' Stability Rate</b>           |                      |                     |                                   |                     |                      |                     |                      |
| Own group engagement                        | 0.090***<br>(0.025)  | 0.103***<br>(0.040) | 0.072<br>(0.072)                  | 0.148***<br>(0.048) | 0.114***<br>(0.036)  | 0.079**<br>(0.033)  | 0.015<br>(0.037)     |
| Complementary group stability               | 0.054**<br>(0.027)   | 0.015<br>(0.028)    | 0.091<br>(0.059)                  | 0.054<br>(0.038)    | 0.036<br>(0.029)     | -0.000<br>(0.019)   | 0.011<br>(0.023)     |
| <b>(b) Nurses' NHS leavers Rate</b>         |                      |                     |                                   |                     |                      |                     |                      |
| Own group engagement                        | -0.724***<br>(0.271) | -0.847**<br>(0.350) | -0.465<br>(0.362)                 | -0.216<br>(0.321)   | -1.174***<br>(0.358) | -0.576**<br>(0.284) | -1.432***<br>(0.498) |
| Complementary group NHS leavers' rate       | 0.081*<br>(0.043)    | 0.027<br>(0.026)    | -0.014<br>(0.022)                 | 0.011<br>(0.019)    | 0.019<br>(0.021)     | 0.048**<br>(0.023)  | 0.100*<br>(0.052)    |
| <b>(c) Senior Doctors' Stability Rate</b>   |                      |                     |                                   |                     |                      |                     |                      |
| Own group engagement                        | 0.031*<br>(0.018)    | 0.018<br>(0.024)    | 0.050<br>(0.068)                  | 0.045<br>(0.031)    | 0.016<br>(0.017)     | 0.001<br>(0.019)    | 0.003<br>(0.019)     |
| Complementary group stability               | 0.150***<br>(0.052)  | 0.157**<br>(0.076)  | 0.176<br>(0.186)                  | 0.273***<br>(0.071) | 0.129***<br>(0.047)  | 0.054<br>(0.044)    | 0.031<br>(0.054)     |
| <b>(d) Senior Doctors' NHS leavers Rate</b> |                      |                     |                                   |                     |                      |                     |                      |
| Own group engagement                        | -0.119<br>(0.177)    | -0.063<br>(0.267)   | -0.011<br>(0.370)                 | -0.133<br>(0.228)   | 0.115<br>(0.219)     | -0.208<br>(0.222)   | -0.124<br>(0.370)    |
| Complementary group NHS leavers' rate       | 0.227***<br>(0.066)  | 0.201***<br>(0.059) | 0.133<br>(0.153)                  | 0.064<br>(0.071)    | 0.144***<br>(0.044)  | 0.238***<br>(0.060) | 0.259**<br>(0.104)   |

*Notes:* There are 190 Trusts, and 1,704 Trust-year observations for nurses and 1,701 Trust-year observations for senior doctors. Standard errors are clustered at Trust level and computed with the delta method. \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . For Nurses' NHS Leavers rate at 10<sup>th</sup> quantile only, the specification exclude the control for the share of female nurses. For Senior Doctors' NHS Leavers rate at 10<sup>th</sup> and 25<sup>th</sup> quantile only, the specification exclude the control for the number of rival hospitals.

## **Labour supply at extensive margins (retention)**

- Complementarities in extensive labour supply margins by grade & age
- Controlling for local outside wages or house prices
- Psychometric-based engagement measure
- Staff engagement vs job satisfaction
- Controlling for Junior Doctors NHS Leaving Rates
- Controlling for local support for Brexit
- Separate estimation of Engagement & Complementarities effects
- Unconditional Quantile regressions
- OLS and FEs
- Correlations of nurses' and senior doctors' retention measures
- GMM estimates by staff Engagement components

## **Determinants of Engagement**

### **Labour supply at intensive margins**

- GMM estimates on absences
- UQR estimates on absences
- GMM & UQR estimates on hours worked

## Elasticities of Retention to Engagement

- Nurses' stability rates w.r.t. nurses' engagement: **0.1**
- Nurses' NHS leaving rates w.r.t. nurses' engagement: **-0.85**
- No significant effect of Sr Docs's engagement on their own retention

## Elasticities of Retention to Complementary workers' retention

- *No significant effect of Sr Docs' stability on Nurses' stability*
- *Sr Docs' stability w.r.t. Nurses' stability: **0.16***
- *Sr Docs' NHS leaving rates w.r.t. Nurses' NHS leaving rates: **0.2***

## *Main takeaways:*

- Engagement matters for retention of nurses, and also their absence rates
- Retention of nurses matters a lot for retention of Sr Docs (Consultants) too
- Improving engagement and retention of nurses in the first instance → +ve spillover effects on the retention of Sr Docs as well



**THANK  
YOU  
FOR  
YOUR  
ATTENTION**

**Any question?**



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