The Effects of Pay Decentralisation on Teachers' Pay and Teacher Retention

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Motivation

- Teachers matter for students' short-run test achievement, and maybe for longer run non-test outcomes as well
- So delivering good education means attracting and retaining good teachers (and incentivising them to perform well)
  - this has been a problem in a number of countries, e.g. UK
  - Due to centralised pay determination?
    - as it is unable to respond to workers' outside options in local labour markets (Britton and Propper 2016)
    - STRB: "The current pay system is rigid, complex and difficult to navigate and does not support schools to recruit the high-quality teachers or leaders" (DfE 2012)

=> **What is the effect of flexible pay on schools' ability to attract and retain effective teachers?**

Today's talk

- ▶ The project investigates how the 2013/14 pay reforms in England affected teachers' pay
- ▶ ... and the implications of this on retention and the quality of teaching workforce in schools.

Outline

Outline

Institutional background
Schooling in England

- Compulsory schooling age: 5-18
- School phases:
  1. **Primary school: age 5-11**
  2. **Secondary school: age 12-16**
  3. Sixth form or further education colleges: age 17-18
- Funding:
  - **state funded:** LA maintained schools, academies
  - independent (private)

($\rightarrow$ Number of schools)
($\rightarrow$ Number of pupils)
($\rightarrow$ Number of teachers)

Institutional background
## State-funded Schools in England

- **Local authority** (LA, $\sim$ school district) **maintained**
  - funding from LA
  - required to follow national curriculum, government regulations on school day and year, teacher pay and conditions
- Academies ($\sim$ charter schools)
  - funding straight from central government
  - accountable
  - flexibility on curriculum and instruction time, teacher pay and conditions and credentials
  - existing LA schools converting (rather than new schools opening up)

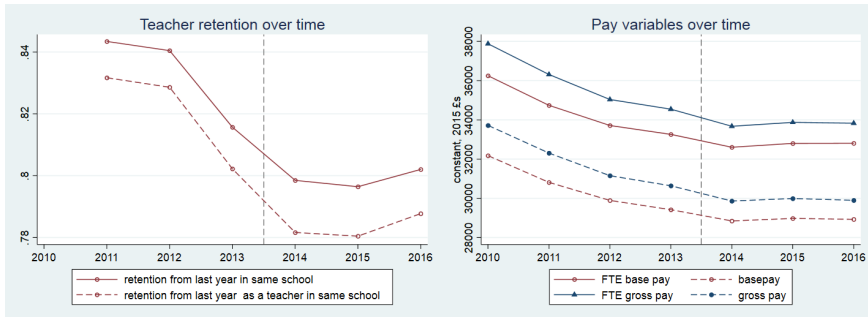($\rightarrow$ Share of LA maintained schools)
($\rightarrow$ Share of LA maintained school teachers)

The 2013/2014 Teacher Pay Reform

"to reduce the rigidity of the pay system such that it best supports the recruitment and retention of high quality teachers in all schools" (M. Gove, Secretary of State for Education)
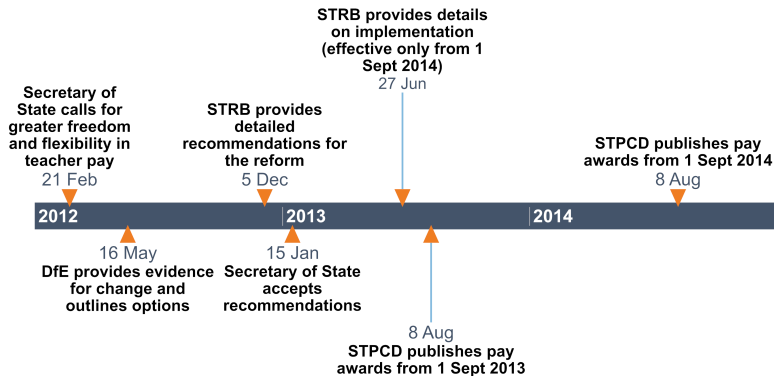
Environment: public sector pay freeze and low retention
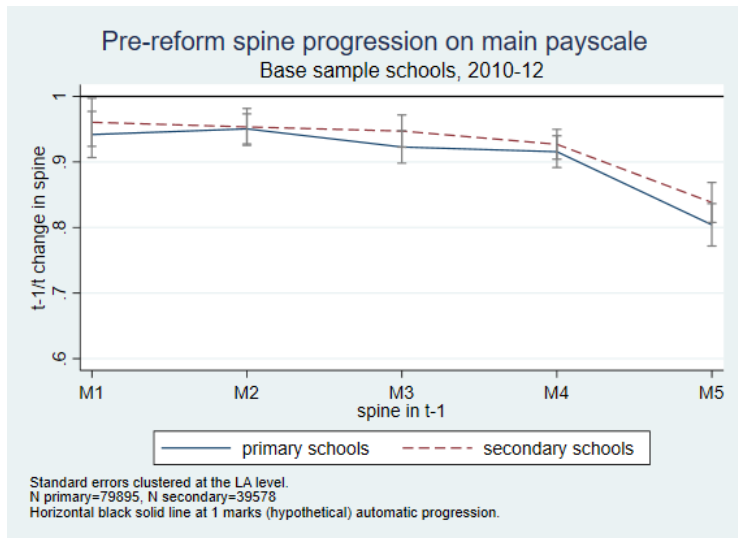
Before the Reform: Seniority Based Pay

- Until 2013: seniority based pay scales published every year by STRB, binding for LA maintained schools
  - Academies already had flexibility in the way they paid teachers

Pay Scale for Classroom Teachers (Main scale) 2012				
Scale point	Annual Salary England and Wales (excluding the London Area)	Annual Salary Inner London Area	Annual Salary Outer London Area	Annual Salary Fringe Area
	£	£	£	£
1	21,588	27,000	25,117	22,626
2	23,295	28,408	26,674	24,331
3	25,168	29,889	28,325	26,203
4	27,104	31,446	30,080	28,146
5	29,240	33,865	32,630	30,278
6	31,552	36,387	35,116	32,588

Source: DfE 2012

Before the Reform

Nearly automatic pay progression on the main pay scale

Pre-reform spine progression on main payscale
Base sample schools, 2010-12

Standard errors clustered at the LA level.
N primary=79895, N secondary=39578
Horizontal black solid line at 1 marks (hypothetical) automatic progression.

After the Reform: Flexibility Between Statutory Min/Max

- From 2014: STRB only publishes min and max pay
  - schools determine individual teacher salaries flexibly between min and max
  - salaries are meant to be linked to excellence and performance improvement, with higher rewards and more rapid progression for the most able teachers

Main Pay Range 2014				
	Annual Salary			
	England and Wales (excluding the London Area)	Inner London Area	Outer London Area	Fringe Area
	£	£	£	£
Minimum	22,023	27,543	25,623	23,082
Maximum	32,187	37,119	35,823	33,244

Source: DfE 2014

The Reform – Some Comments

- Reform offers an *opportunity* and NOT a new mandate for schools
  - Schools could continue to shadow old pay scales (offered by unions)
  - Or they could use any form of flexibility in pay and recruitment – no guidance
- Reform: opportunity both to respond to local labour market tightness AND to link pay to performance
  - P4P analysis may be limited by data => focus on the role local labour markets in propagating the effects of pay decentralisation (next steps)
- Reform kicked in in 2014, in 2013 there may have been anticipation effects

Today's talk – Research Questions

1. How did the reform impact teachers' pay?
2. Did schools use the freedoms to set pay?
3. Empirically, how can we measure the extent to which schools "adopted" flexibilities?
4. What predicts the intensity of adoption?
5. What are the implications of the pay impact on the teaching workforce?

Preview of Results

- Overall, there was a 1-2% decline in pay relative to counterfactual.
- Vast majority of schools departed from the seniority pay schedule
    - more than half let their pay drift down relative to counterfactual
- Schools that let their pay drift downwards by more, experienced:
    - a higher pay cut
    - a drop in their retention rate
    - a decline in the fraction of qualified teachers

Outline

Literature: Effect of teacher pay flexibility

1. ... on teacher salaries
   - positive in Sweden (Willén 2020); negative in England (Sharpe et al. 2017; Burgess et al. 2019); positive for high-VA teachers in Wisconsin (Biasi forthcoming)
   - heterogeneous effects by local labour market characteristics in Sweden and England
     - Burgess et al. (2019) exploit the heterogeneity in pre-reform local labour market wages to find that in high-wage markets the reform had positive effects on teacher pay, retention and pupil achievement.
2. ... on the composition of teachers
   - positive in Wisconsin, zero in Sweden
3. ... on student achievement
   - positive in Wisconsin and in England, zero in Sweden

Outline

Data: School Workforce Census (SWF)

- ▶ Snapshot of linked school-teacher data in each November
  - ▶ all state-funded schools
  - ▶ modules: contract, qualifications, curriculum, absences, school vacancies [low quality]
  - ▶ not allowed to link to pupil achievement at the teacher level
- ▶ Horizon: 2010-2016
  - ▶ 2010-12 = pre-period, 2014-16 = post-period (low quality data and potential anticipation effects in 2013)
- ▶ Sample:
  - ▶ schools that are LA maintained in 2012 but may switch to Academy status later
  - ▶ excluded schools that merged/split (<5%)
  - ▶ classroom teachers working at least 0.5 FTE in base sample schools
- ▶ Variables used: spine points, FTE base pay (in constant, 2015 £s), teacher demography and qualification
  ($\rightarrow$ Data issues in SWF)

Descriptive Statistics: Base Sample Schools in 2012

Variable	Primary schools	Secondary schools
N	15,313	1,611
years in data	6.97 (0.24)	6.90 (0.46)
academise after 2012	0.16	0.32
inner London	0.06	0.09
outer London	0.05	0.05
fringe London	0.06	0.06
rest of England	0.83	0.81
urban	0.70	0.85
FTE pupils	244 (136)	935 (374)
% free school meal	12.8 (10.4)	14.4 (9.1)
FTE teachers	10 (6)	55 (23)
frac on payscale M	0.47 (0.24)	0.36 (0.16)
frac on payscale U	0.46 (0.24)	0.54 (0.19)
retention rate	0.82 (0.16)	0.85 (0.09)
expenditure on teachers (2015 £s)	2070 (339)	3066 (524)
total exp per pupil (2015 £s)	4278 (1158)	5338 (1752)
exp ratio on teachers	0.49 (0.06)	0.54 (0.06)
% budget balance	0.8 (4.0)	1.5 (3.6)

Note: Schools that are LA maintained in 2012 but may have academised afterwards. Standard deviations in parentheses where applicable.

Other Datasets

- Consistent Financial Reporting (CFR)/Annual Accounts Returns (AAR): annual budget of state-funded schools (disaggregated to income/expenditure categories)
- STRB pay documents, union pay documents

Outline

Empirical Strategy – Part I: The Effect of the Pay Reforms

1. Construct counterfactual pay, i.e. pay if reform had not happened

    1.1 estimate pre-reform pay progression through the M payscale:

    $$\Delta \text{spine}_{it} = \alpha_{d,l} + u_{s,l} + \epsilon_{it}$$

    - ▶ $\alpha_{d,l}$ is district-lagged spine point fixed effects
    - ▶ $u_{s,l}$ is school-lagged spine point random effects
    - ▶ $\epsilon_{i,t}$ is idiosyncratic error

    → 3 comments

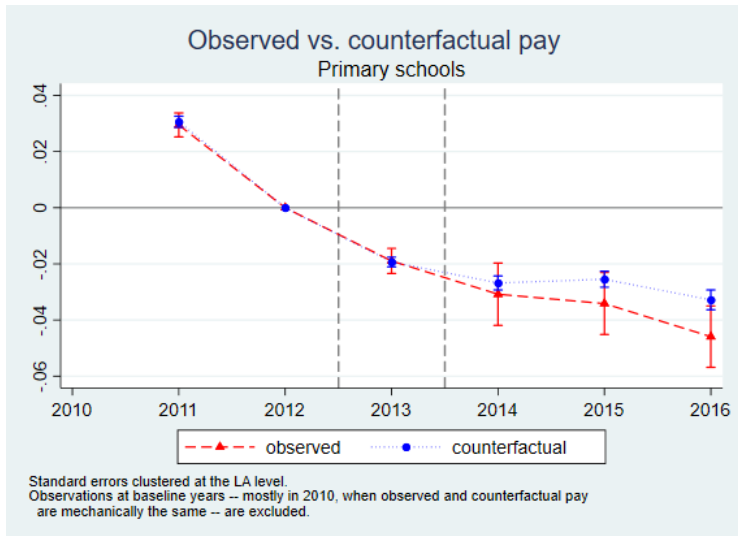   1.2 take BLUP of $\Delta \text{spine}_{s,l}$ to account for small schools
    1.3 using these estimates and one baseline spine point for each teacher, predict each teacher's sequence of counterfactual spine points pre- and post-reform by extrapolation
    1.4 merge in union-recommended pay schedule using counterfactual spine points

    => We now have both a "counterfactual" and an "observed" (full-time equivalent) base pay for every teacher.
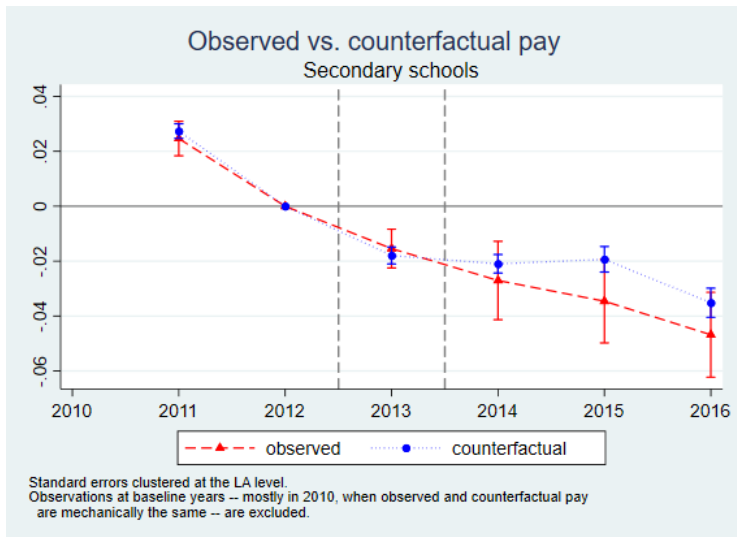
Result 1: The effect of the pay reforms

In primary schools, pay drifted downwards by 1% on average relative to what would have happened in absence of the reform

Observed vs. counterfactual pay
Primary schools

Standard errors clustered at the LA level.
Observations at baseline years -- mostly in 2010, when observed and counterfactual pay
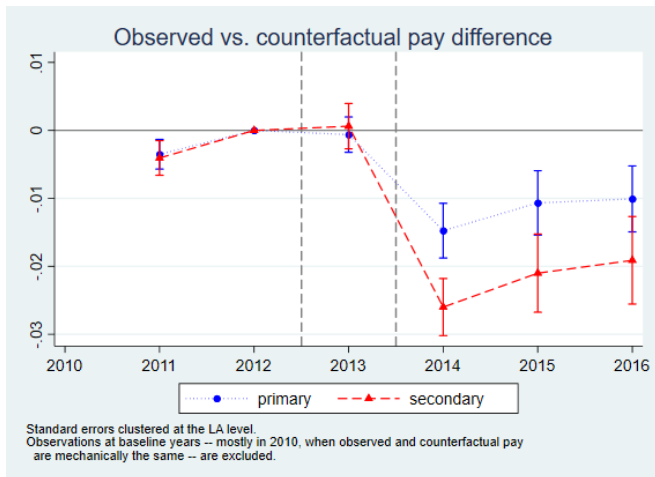 are mechanically the same -- are excluded.

Result 1: The effect of the pay reforms

In secondary schools, pay drifted downwards by 2% on average relative to what would have happened in absence of the reform

Observed vs. counterfactual pay
Secondary schools

Standard errors clustered at the LA level.
Observations at baseline years -- mostly in 2010, when observed and counterfactual pay are mechanically the same -- are excluded.

Result 1: The effect of the pay reforms

On average pay drifted downwards by 1-2% relative to what would have happened in absence of the reform

$$deviation_{it} = (\log \text{observed pay}_{it} - \log \text{counterfactual pay}_{it})$$

Observed vs. counterfactual pay difference

Standard errors clustered at the LA level.
Observations at baseline years -- mostly in 2010, when observed and counterfactual pay
  are mechanically the same -- are excluded.

Empirical Strategy – Part I: Did schools flex their pay?
Towards a measure of the intensity of adoption

1. Construct counterfactual pay ✓
2. Construct a metric for the intensity of adoption
   2.1 We use the deviations of log observed pay from log counterfactual pay for each teacher, and
   2.2 aggregate these deviations to the school level using the RMSE of predicting log observed pay with log counterfactual pay
 $\rightarrow$ More details

=> This RMSE measures the extent to which schools deviated on average from counterfactual pay schedule.

▶ RMSE = 0 for schools who continued with seniority pay (by following the union-recommended pay schedule)
▶ A higher RMSE means more departure (in either direction) from counterfactual, that is, a higher intensity to adopt pay flexibilities.

Result 2: Schools did use the freedom to flex their pay

Primary schools

RMSE of observed pay predicted by counterfactual pay
Phase 1 schools
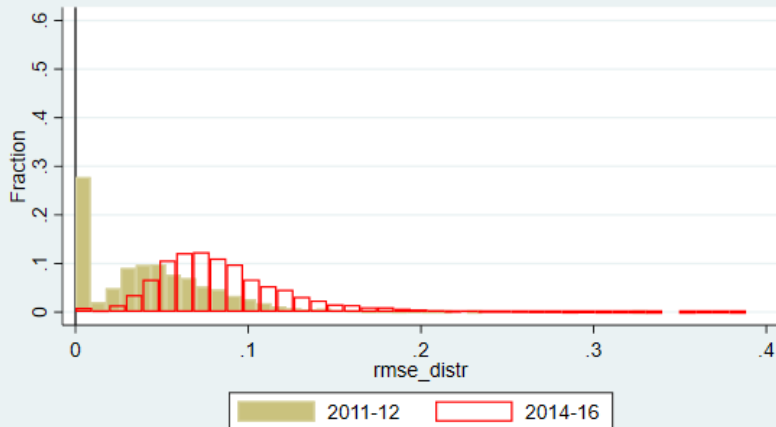
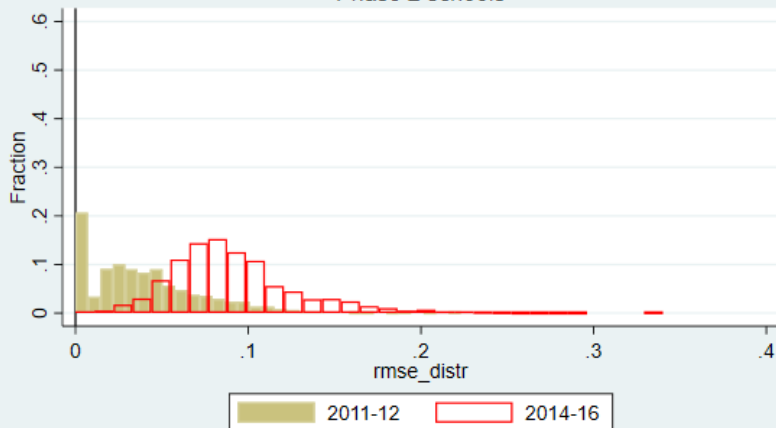Counterfactual pay: distr version.
Schools with at least 5 teachers per period. N0=7400, N1=10026
Vertical black solid line at 0 marks null hypothesis.

Result 2: Schools did use the freedom to flex their pay

Secondary schools

RMSE of observed pay predicted by counterfactual pay
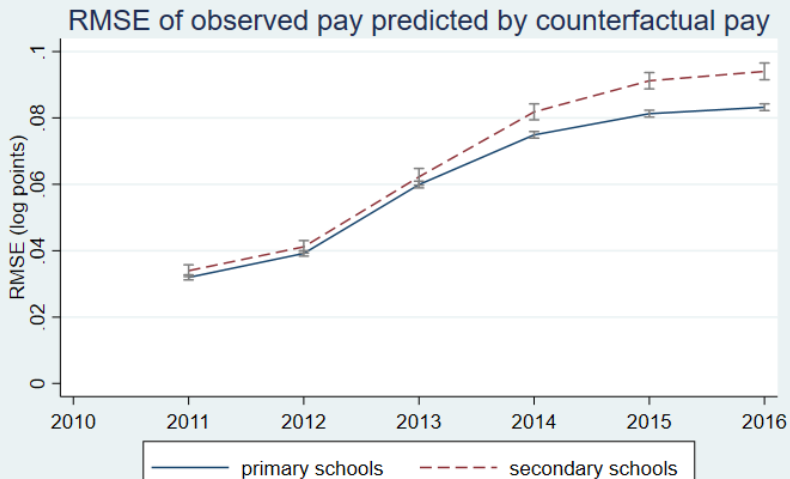
Phase 2 schools

Counterfactual pay: distr version.
Schools with at least 5 teachers per period. N0=1519, N1=1521
Vertical black solid line at 0 marks null hypothesis.

Result 2: Schools did use the freedom to flex their pay

RMSE of observed pay predicted by counterfactual pay

Counterfactual pay based on school-level distribution of spine progression.
Observations with fixed spine points excluded.

Modified RMSE as a metric of adoption intensity

▶ RMSE tells us about the degree of deviation from counterfactual pay – BUT not the direction!

▶ However, paying more than the counterfactual vs. letting pay drifting downwards may have very different effects that RMSE alone would not reveal.

=> Modify RMSE by interacting it with the *direction* of deviation:

1. positive deviation: the school *on average* paid higher wages than the counterfactual

2. negative deviation: the school *on average* paid higher wages than the counterfactual
   ($\rightarrow$ Distribution of school-level mean deviations)
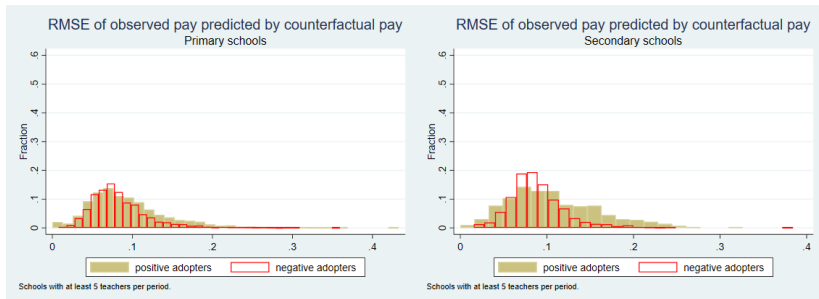
=> 2 measures of adoption intensity

1. **intensity of positive adoption** $= I\,(\text{mean deviation} \geq 0) \times RMSE$
2. **intensity of negative adoption** $= I\,(\text{mean deviation} < 0) \times RMSE$

Results – Adopter types and their intensity to adopt

More negative adopters, with about the same adoption intensity

	Primary	Secondary
Positive adopter	7,450 (2,790)	561 (428)
Negative adopter	8,160 (3,541)	1,100 (1,006)

Note: Number of schools with at least 5 teachers in 2011-2012 and 2014-16 in parentheses.

Results – What predicts the intensity of adoption?
A simple variable selection exercise

- ▶ Primary schools
  - ▶ pre-reform observed school characteristics explain 1-3% of the variation in adoption intensity
  - ▶ LA effects explain about 10%
- ▶ Secondary schools
  - ▶ pre-reform observed school characteristics explain 6-12% of the variation in adoption intensity:
    - ▶ religious character
    - ▶ higher male teacher share
    - ▶ higher qualified teacher share
    - ▶ lower white British teacher share
    - ▶ more academies within 3km
    - ▶ higher pay at closest academy

    are associated with higher (lower) intensity of positive (negative) adoption
  - ▶ LA effects explain about 20%

Outline

Empirical Strategy – Part II: Implications
A Difference-in-Differences style approach (non causal!)

▶ In a DiD-style framework comparing high vs. low intensity adopters, we now explore the implication of the reform's pay impact:

$$y_{st} = \alpha_s + \sum_{\tau \neq 2012} \beta_\tau + \sum_{\tau \neq 2012} \gamma_\tau \times PAI_s^{post}$$
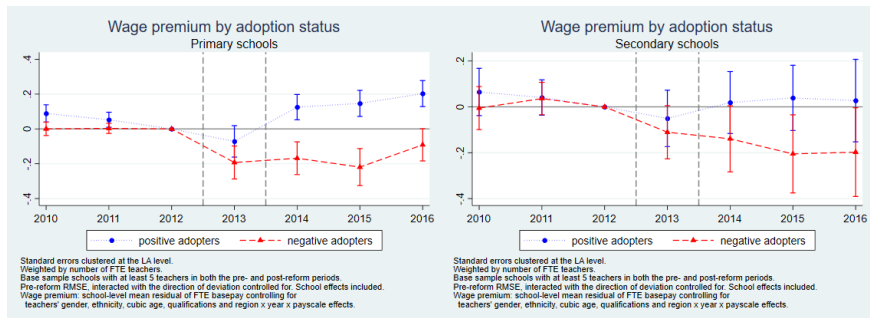$$+ \sum_{\tau \neq 2012} \delta_\tau \times NAI_s^{post} + \sum_{\tau \neq 2012} X_s^{'} \psi_\tau + \epsilon_{st},$$

where

- ▶ y_{st} is outcome of school s in year t (wage premium, retention rate, etc. – see later)
- ▶ PAI_s^{post} and NAI_s^{post} are the positive and negative adoption intensity measures post-reform
- ▶ $\sum_{\tau \neq 2012} X_s^{'} \psi_\tau = \sum_{\tau \neq 2012} \lambda_\tau \times PAI_s^{pre} + \sum_{\tau \neq 2012} \mu_\tau \times NAI_s^{pre}$ to control for potential time-varying effects of pre-reform pay deviation at the school

▶ Coefficients of interest: γ_τ's and δ_τ's (reference year: 2012)

▶ SEs clustered at the LA level

Results – Wage premium

$$\text{wage premium}_{st} = \alpha_s + \sum_{\tau \neq 2012} \beta_\tau + \sum_{\tau \neq 2012} \gamma_\tau \times PAI_s^{post}$$

$$+ \sum_{\tau \neq 2012} \delta_\tau \times NAI_s^{post} + \sum_{\tau \neq 2012} X_s^{'} \psi_\tau + \epsilon_{st},$$

where wage premium is the school-level mean residual of FTE base pay from the teacher-level regression on gender, ethnicity, cubic age, qualification status and region x year x payscale effects
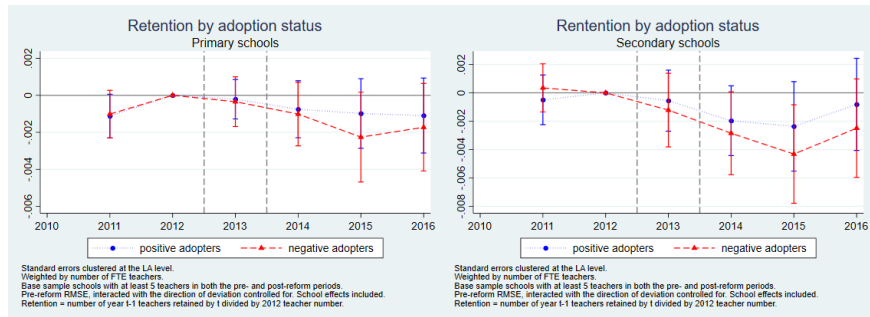
Results – Retention

$$\text{retention rate}_{st} = \alpha_s + \sum_{\tau \neq 2012} \beta_\tau + \sum_{\tau \neq 2012} \gamma_\tau \times PAI_s^{post}$$

$$+ \sum_{\tau \neq 2012} \delta_\tau \times NAI_s^{post} + \sum_{\tau \neq 2012} X_s^{'} \psi_\tau + \epsilon_{st},$$
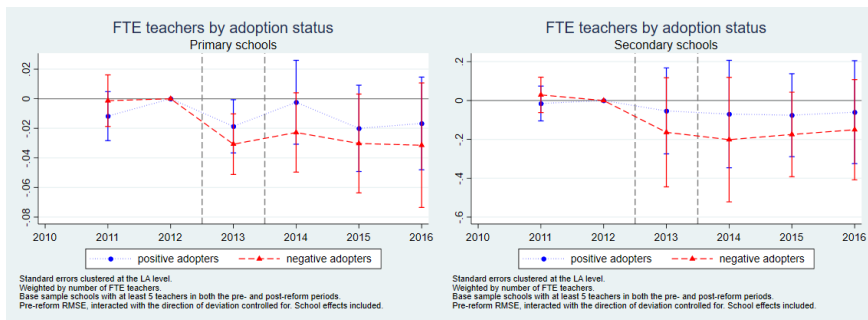
where retention rate is year $t-1$ teachers remaining in the same school for year t divided by 2012 teacher number

Results – Number of classroom teachers

$$\text{FTE number of teachers}_{st} = \alpha_s + \sum_{\tau \neq 2012} \beta_\tau + \sum_{\tau \neq 2012} \gamma_\tau \times PAI_s^{post}$$

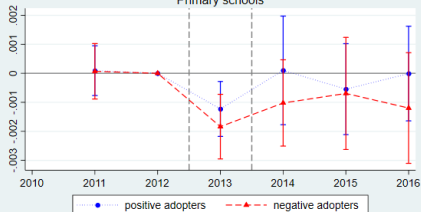$$+ \sum_{\tau \neq 2012} \delta_\tau \times NAI_s^{post} + \sum_{\tau \neq 2012} X_s^{'} \psi_\tau + \epsilon_{st},$$

Standard errors clustered at the LA level.
Weighted by number of FTE teachers.
Base sample schools with at least 5 teachers in both the pre- and post-reform periods.
Pre-reform RMSE, interacted with the direction of deviation controlled for. School effects included.

Standard errors clustered at the LA level.
Weighted by number of FTE teachers.
Base sample schools with at least 5 teachers in both the pre- and post-reform periods.
Pre-reform RMSE, interacted with the direction of deviation controlled for. School effects included.
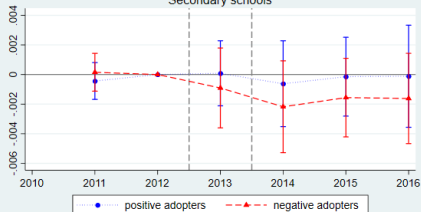
Results – Qualifications (quality)

$$\text{frac with qualified status}_{st} = \alpha_s + \sum_{\tau \neq 2012} \beta_\tau + \sum_{\tau \neq 2012} \gamma_\tau \times PAI_s^{post}$$

$$+ \sum_{\tau \neq 2012} \delta_\tau \times NAI_s^{post} + \sum_{\tau \neq 2012} X_s^{'} \psi_\tau + \epsilon_{st},$$

Share with qualified status by adoption status
Primary schools

Share with qualified status by adoption status
Secondary schools

positive adopters   negative adopters

Standard errors clustered at the LA level.
Weighted by number of FTE teachers.
Base sample schools with at least 5 teachers in both the pre- and post-reform periods.
Pre-reform RMSE, interacted with the direction of deviation controlled for. School effects included.
Dependent variable: teachers with qualified status divided by 2012 teacher number.

Standard errors clustered at the LA level.
Weighted by number of FTE teachers.
Base sample schools with at least 5 teachers in both the pre- and post-reform periods.
Pre-reform RMSE, interacted with the direction of deviation controlled for. School effects included.
Dependent variable: teachers with qualified status divided by 2012 teacher number.

Discussion – Teacher labour market structure
Labour supply elasticity to the schools

▶ Following Manning (2003), we can recover the labour supply elasticity to individual schools, a measure of labour market concentration. By back-of-the-envelope calculation using the estimates for negative adopters:

$$\hat{\epsilon}^{ssls} = -2\frac{-\hat{\delta}^{DID}_{\text{retention}}/\text{separation rate}}{\hat{\delta}^{DID}_{\log pay}} \approx \begin{cases} -2\frac{-0.001/0.2}{0.002} = 5 & \text{for primary schools} \\ -2\frac{-0.003/0.15}{0.002} = 20 & \text{for secondary schools} \end{cases}$$

▶ Due to noisily estimated point estimates, levels can vary within a wide range, but

  ▶ labour market for secondary school teachers is certainly more competitive than that of primary school teachers.

Next Steps

1. Explore the role of local teacher labour markets
    1.1 construct a measure of local teacher labour market competition and explore the heterogenous effects of the pay decentralisation reform (e.g. Azar et al. 2019)
    1.2 effects of LA pay policy recommendations (collected through FOIs, being processed)
2. Effect on other outcomes (additional pay components, pay for different groups of teacher, promotion rates, sorting across schools, pupil outcomes, budget items)

Conclusion

As a result of the 2013-14 teacher pay decentralisation in England, pay declined by 1-2% overall relative to what would have happened in absence of the reform.

- ▶ Vast majority of schools departed from the seniority pay schedule
    - ▶ more than half let their pay drift down relative to counterfactual
- ▶ Schools that let their pay drift downwards by more, experienced:
    - ▶ a higher pay cut
    - ▶ a drop in their retention rate
    - ▶ a decline in the fraction of qualified teachers

=> The policy backfired. Punchline: "Advisory" spine points were reinstated in 2020.
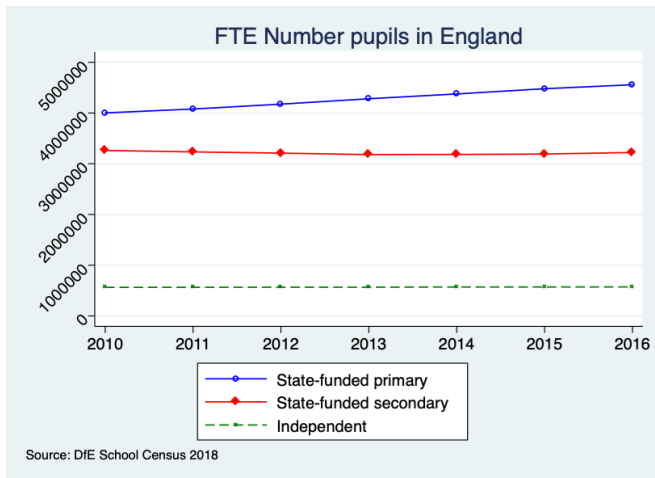
Institutional background

Number of schools in England over time, by funding type
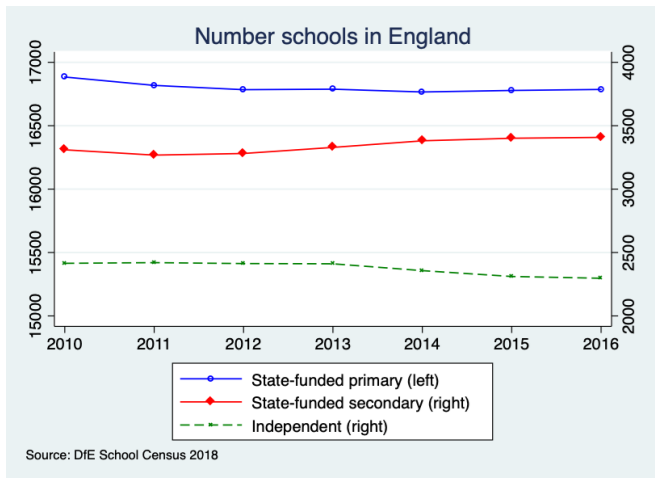
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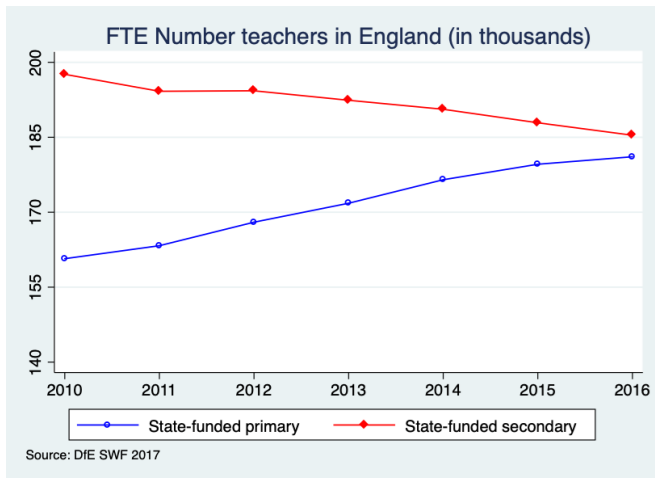# Institutional background

Number of FTE pupils in England over time, by funding type

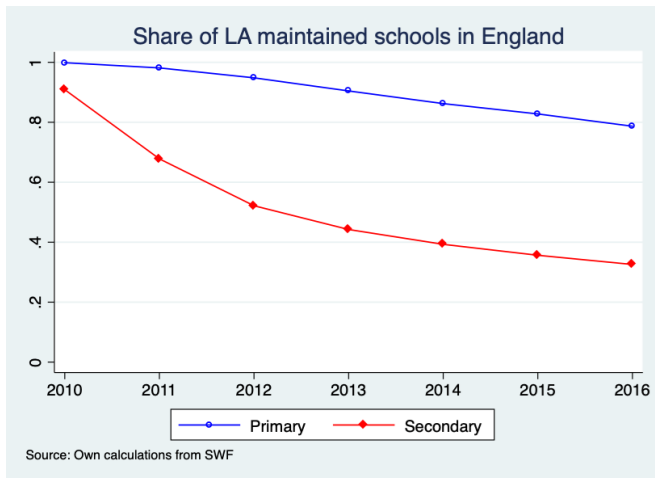(→ Back)

Institutional background

Number of FTE teachers in England over time, by funding type

FTE Number teachers in England (in thousands)

Legend:
- State-funded primary
- State-funded secondary

Source: DfE SWF 2017

($\rightarrow$ Back)

Institutional background

Share of LA maintained schools in England over time

Share of LA maintained schools in England

Source: Own calculations from SWF

(→ Back)

Institutional background

Share of LA maintained school teachers in England over time

Share of FTE teachers in LA maintained schools in England

Source: Own calculations from SWF
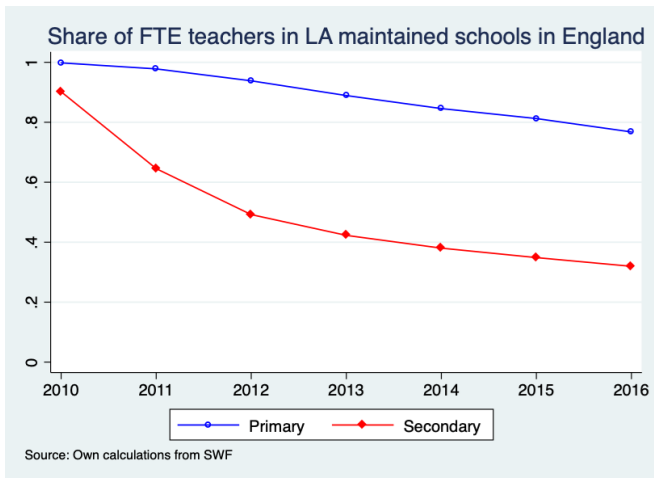
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Data Issues in SWF

1. Teacher records aggregated to main job per year

Data Issues in SWF

1. Teacher records aggregated to main job per year
2. Pay is available rounded to the nearest £1,000
   => Round scheduled pay similarly
   => Newer version includes unrounded data (in progress)

Data Issues in SWF
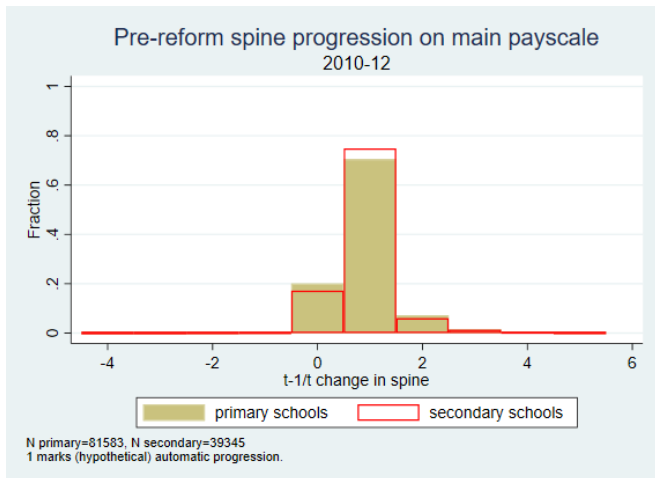
1. Teacher records aggregated to main job per year
2. Pay is available rounded to the nearest £1,000
3. What is reported to DfE by schools
   - changes with the reform
     - up until 2012, schools report spine points, DfE links base pay
     - in 2013, schools report both spine points and base pay
     - from 2014 onwards, schools report base pay
   - may differ by school
     - schools use different softwares for reporting
   - amount of measurement error will likely increase with the reform and this may correlate with adopting flexibility
   => Use 2013 to bound the role of measurement error

Data Issues in SWF

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   - may differ by school
     - schools use different softwares for reporting
   - amount of measurement error will likely increase with the reform and this may correlate with adopting flexibility
4. Number of teachers we see per school may be small
   => Use statistical procedures to account for that?
   Note: Positive but statistically and economically insignificant relationship between the number of teachers and the measure intensity adoption

(→ Back)

Estimating counterfactual spine progression – 3 comments

1. Spine progression pre-reform should have been fully automatic. However, it was not and there were large heterogeneities across LAs and schools in this.

Pre-reform spine progression on main payscale
2010-12

N primary=81583, N secondary=39345
1 marks (hypothetical) automatic progression.

Estimating counterfactual spine progression – 3 comments

1. Spine progression pre-reform should have been fully automatic. However, it was not and there were large heterogeneities across LAs and schools in this.

2. It is important to account for such pre-reform school-level heterogeneities, otherwise we overpredict counterfactual spine points and so counterfactual pay. This leads to estimating a larger pay impact of the reforms.

3. Once we account for pre-reform school-level heterogeneities, no observed teacher characteristics further explain variation in pre-reform spine progression.

($\rightarrow$ Back)

RMSE as a metric of adoption intensity
Construct a school-level measure of average difference between actual and counterfactual pay

We formalize this idea by computing the root mean squared error (RMSE) of log observed pay when predicted by log counterfactual pay in every school for the post-reform period (2014-16):
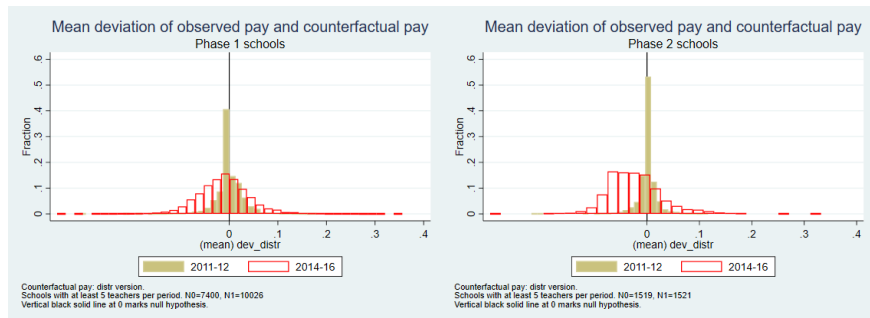
$$\text{RMSE}_s = \sqrt{\frac{\sum\limits_{i,t \text{ s.t. } t \in \{2014, 2015, 2016\} \text{ and } s \equiv S(i,t)} (\log \text{observed pay}_{it} - \log \text{counterfactual pay}_{it})^2}{n_s}}$$

▶ RMSE $= 0$ for schools who continued with seniority pay (by following the union-recommended pay schedule)

▶ RMSE is *undirected*, ie. does not tell if schools paid more or less, only that they paid differently from the seniority pay schedule

Distribution of school-level mean deviation

$$\text{mean deviation}_s = \frac{\displaystyle\sum_{i,t \text{ s.t. } t \in \{\mathbf{2014}, \mathbf{2015}, \mathbf{2016}\} \text{ and } s \equiv S(i,t)} (\log \text{observed pay}_{it} - \log \text{counterfactual pay}_{it})}{n_s}$$

($\rightarrow$ Back)