How should individual schools make use of teacher pay flexibility?

- Schools are gaining more autonomy over level and structure of teacher pay
  - Each school in England must have its own teacher pay policy from 2013
  - Charter schools in US also have flexibility

- How can schools use this flexibility to improve teacher quality and student achievement?
  - Change level of pay? How to reward experience? Link to performance?

- And how can they do this within a fixed budget from government

- Focus here on the likely impact of an individual school raising the level of teacher pay given a fixed budget
How teacher pay can affect student achievement

1. **Occupational choice to become a teacher**
   - Career choices driven by overall levels of teacher pay and alternative wage opportunities

2. **Motivation effects for existing teachers**
   - Higher levels of teacher pay increase teacher effort

3. **Sorting of existing teachers across schools**
   - Schools offering higher salaries get more applications
   - If extra applicants are of higher quality, schools able to pick higher quality teachers
Existing empirical evidence on link between teacher pay and student achievement

- US evidence shows increases in teacher wages across states is associated with reduced high school drop out rates (*Loeb and Page, 2001*)
- Higher levels of outside wage opportunities in a region reduces pupil attainment in England (*Britton and Propper, 2016*)
- Higher levels of teacher pay or flatter wage profile can reduce teacher dropout (*Hendrick, 2014*)

- Largely relate to occupational choices and/or motivation mechanisms

- Know little about the effect of individual schools raising teacher pay on student achievement through sorting of teachers across schools
And not forgetting the budget constraint...

- Schools make decisions within fixed budget from government

- But existing evidence on variation in actual teacher pay implies schools compensated with higher budgets

- Over-estimates total effect which will include effects of changes in other resource margins

- Of interest to know how schools would go about adjusting other resources margins in order to pay higher salaries
  - Change numbers or mix of teachers
  - Change number of other staff
  - Change non-staff spending
Institutional Context

School System
- Focus on primary schools (age 4-11)
- Key Stage 2 tests at age 11 – English and Maths

School Funding

Teacher Labour Market
Institutional Context

School System

School Funding
- Central government provides grants to local authorities (to reflect need/costs)
- Local authorities allocate funds to schools using own formulae (pupils, chars, etc...)

Teacher Labour Market
Institutional Context

School System

School Funding

Teacher Labour Market

• Schools post vacancies and teachers apply to individual schools
• National pay and conditions
• Teacher pay scales over period of study (*M1-6, U1-3*)
• Examine period from 2006-2011, before new teacher pay flexibilities
Institutional Context

School System

School Funding

Teacher Labour Market

• Schools post vacancies and teachers apply to individual schools
• National pay and conditions
• Teacher pay scales over period of study (M1-6, U1-3)
• Higher Pay Scales in London Area to reflect higher cost of living
• Compare schools either side of pay boundaries to look at effects of teacher pay
Inner and outer London pay zones coincide with other relevant administrative boundaries.
Focus on Fringe Boundary
Pay differential between Fringe and Rest of England has remained at £1,000 throughout scale over time.
Resource choices and student achievement

- Interpret pay boundary as increase in minimum salary for teachers
  - Schools can pay more if they want to...

- What happens to school funding at boundary crucial for interpretation
  - No evidence of a difference in funding per pupil at boundary (see later)
  - Schools must pay higher teacher salaries from a fixed budget

- Potential resource choice effects
  - Reduction in teacher numbers; increase in other inputs
  - Quantity regulation and discrete nature of teacher numbers could limit such effects
  - Smoothing of differences in actual teacher pay levels through other means?
  - Change in mix of teachers

- Effect on student achievement represent combined effect of resource choices
Empirical Methodology

• Schools should be similar either side and close to Fringe Pay Boundary
  – Pupil characteristics are very similar

• Compare school-level resource choices and student achievement within 2 km of Fringe Boundary
  – Vary measure of closeness as robustness check
  – Estimate raw and conditional differences

• Data
  – National Pupil Database (2005-06 to 2010-11) for age 11 test results, pupil & school characteristics; exclude 2009-10 data due to SATs boycott
  – LEASIS/Edubase – School characteristics
  – School Workforce Census – Teacher Pay Levels and Characteristics
  – Section 251/CFR – Income and expenditure data for schools
Expenditure choices

Table 2: Difference in funding and expenditure across Fringe/Rest of England Boundary 2006 to 2011: various distances to pay boundary

<table>
<thead>
<tr>
<th>Outcome</th>
<th>(1) Within 1 km of boundary</th>
<th>(2) Within 2 km of boundary</th>
<th>(3) Within 3 km of boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant funding per pupil (£)</td>
<td>12.75</td>
<td>-14.68</td>
<td>-49.72</td>
</tr>
<tr>
<td></td>
<td>[42.42]</td>
<td>[30.76]</td>
<td>[27.24]</td>
</tr>
<tr>
<td>Total income per pupil (£)</td>
<td>-44.75</td>
<td>-38.94</td>
<td>-57.05</td>
</tr>
<tr>
<td></td>
<td>[46.71]</td>
<td>[34.42]</td>
<td>[30.05]</td>
</tr>
<tr>
<td>Total expenditure per pupil (£)</td>
<td>-74.17</td>
<td>-56.46</td>
<td>-65.75</td>
</tr>
<tr>
<td></td>
<td>[47.29]</td>
<td>[56.1]</td>
<td>[30.7]*</td>
</tr>
</tbody>
</table>

School and Year Controls

<table>
<thead>
<tr>
<th>Observations (Schools)</th>
<th>Yes</th>
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<td>Observations (Schools)</td>
<td>599 (120)</td>
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Note: OLS, FILM and Matching include detailed school-level controls for number of pupils, %FSM, %SEN, %EAL, %Non-white, IMD, IDACI, region of London and school-type.
Table 3: Difference in staffing and teacher pay across Fringe/Rest of England Boundary 2006 to 2011: various distances to pay boundary

Standard Errors: Clustered by Local Authority
Fully Interacted Linear Matching Estimates

<table>
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<tr>
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<tbody>
<tr>
<td>Teacher Remuneration (2011 only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Salary, £</td>
<td>639.99</td>
<td>950.26</td>
<td>758.66</td>
</tr>
<tr>
<td></td>
<td>[637.57]</td>
<td>[413.50]^*</td>
<td>[323.28]^*</td>
</tr>
<tr>
<td>Teacher Total Pay, £</td>
<td>995.14</td>
<td>1080.97</td>
<td>850.48</td>
</tr>
<tr>
<td></td>
<td>[903.39]</td>
<td>[518.19]^*</td>
<td>[386.21]^*</td>
</tr>
<tr>
<td>Average salary Scale Point (1-9)</td>
<td>-0.12</td>
<td>-0.01</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>[0.18]</td>
<td>[0.14]</td>
<td>[0.11]</td>
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School and Year Controls
Pooled observations (schools)
2011 Schools

599 (120) 1277 (256) 1831 (368)
115 243 349

Note: OLS, FILM and Matching include detailed school-level controls for number of pupils, %FSM, %SEN, %EAL, %Non-white, IMD, IDACI, region of London and school-type.
## Expenditure choices

### Table 2: Difference in funding and expenditure across Fringe/Rest of England Boundary 2006 to 2011: various distances to pay boundary

Standard Errors: Clustered by Local Authority
Fully Interacted Linear Matching Estimates

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**School and Year Controls**

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Note: OLS, FILM and Matching include detailed school-level controls for number of pupils, %FSM, %SEN, %EAL, %Non-white, IMD, IDACI, region of London and school-type.
### Differences in Student Achievement at Age 11

#### Table 4: Difference in student achievement across Fringe/Rest of England Boundary 2006 to 2011: various distances to pay boundary

Standard Errors: Clustered by Local Authority
Fully Interacted Linear Matching Estimates

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<th>(3) Within 3 km of boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>KS2 Fine Points Score (std)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>0.01</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>[0.03]</td>
<td>[0.02]</td>
<td>[0.02]</td>
</tr>
<tr>
<td>Maths</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>[0.03]</td>
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Summary and policy implications

- Schools must pay higher teacher salaries from within fixed budgets
- Actual teacher pay is in line with salary scale differences, despite opportunities for schools to smooth difference
- Schools reduce non-teaching expenditures to pay higher salaries
- No differences in student achievement resulting from resource shifts

- Using pay differentials to compete for high-quality teachers is unlikely to be an effective strategy for schools
  - Greater importance attached to non-pecuniary factors?
  - Unobservability of potential quality amongst applicants?
  - Outweighed by negative effects of reductions in other resources?

- More effective strategies could include providing better information on potential applicants or performance-related pay
Further challenges for public sector pay policy

- Relative public sector pay levels set to decline to lowest levels since at least mid-1990s
  - Clear implications for quality of workers entering public sector professions
  - Maybe sorting of teachers across schools will become more sensitive to pay differentials as relative pay declines and schools need to recruit more teachers

- Local pay variation would require consideration of funding systems
  - Fringe pay zone is relatively simple example of a local pay zone, yet funding system seems to fail to compensate schools for higher teacher salaries
  - More intricate set of pay zones might require intricate funding system to go with it