Centre for Market and
Public Organisation

Teacher Turnover in England: Evidence from the Pilot SWC

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Work in progress

Introduction

- High teacher turnover:
  - Robust finding from the teacher effectiveness literature that novice teachers are less effective than those in the job for longer;
  - High teacher turnover is thought to be an important part of the poor performance of disadvantaged, urban schools.
- Teacher supply function:
  - How to attract effective teachers to disadvantaged schools
  - If quitting and joining are two sides of the same thing, bar transactions costs, then studying quits will help.

What we do

- Bring together SWC, CFR, NPD ..
- Good aspects of our data:
  - A lot of information about the school being left
  - Exact time since start of contract in that school
  - And also all the same data about all other local schools
  - Availability of data about more general local labour market opportunities (*to be used in our future work*)
  - Schools very rarely fire teachers so we can be reasonably confident that these separations are all quits or retirements.
- Bad aspects of the data
  - Don't know much about the individuals' home circumstances, nor (at least in our extract of the pilot data) that much about their professional characteristics.

What we do

- Our research questions:
  - What (if any) personal characteristics are associated with low or high tenure?
  - What (if any) school and neighbourhood characteristics are associated with teacher turnover?
  - Specifically, how does teacher turnover compare in disadvantaged and affluent schools?
  - Is it the case that disadvantaged/poor/urban schools suffer high turnover?

Existing evidence

- High teacher turnover:
  - Ingersoll (2001): high teacher turnover in the US; 13% not teaching in the school they were in year before; school factors and personal factors
  - Harris and Adams (2007): teacher turnover compared to other professions;
  - Dolton and van der Klaauw (1999): competing risks model
  - Watlington et al (2010): high cost of teacher turnover
  - Boyd, D., et al (2005): explaining short careers of successful teachers
  - Dolton and Newson (2003): high teacher turnover can have detrimental effects on pupil progress.

Plan

- Modelling Framework
  - Statistical framework – renewal theory
  - Economic model
- Data
  - SWC
  - Others
- Results
- Summary

Statistical framework

- Estimate the separation function from the tenure distribution:

  E(tenure) = 1/(separation rate) in steady state.

- We have distribution of elapsed tenure, but interested in distribution of completed tenure.
- Link is renewal theory (Lancaster, 1990)

- Suppose completed tenure, τ, has pdf g(τ) with mean μ.
- It follows:
  - The pdf of elapsed tenure, *u*, is

$$f(u) = \left[1 - G(u)\right] / \mu$$

  - For individuals for whom the process has been running a long time, the pdf of remaining tenure is the same as the pdf of elapsed tenure: so expected completed tenure is twice elapsed tenure.
  - In stock sampled data, probability of observing a spell in progress is proportional to its length. So mean completed tenure in stock sample exceeds mean completed tenure in an inflow sample. (SWC is a sample of people, not a sample of jobs).

Distribution of tenure and transition rates

- For one individual in a job, her tenure depends only on her separation probability.
- But comparing the distribution of tenure across organisations:
  - In general, the distribution of tenure depends on all transition rates, both the hiring and all tenure-specific separation rates, using a Semi-Markov approach.
- In steady-state, it depends only on the separation rates
- Out of steady-state, it depends on hiring too:
  - Growth in the organisation, burst of hiring, so a disproportionate increase in short tenure people.
  - (Broadly, average job tenure is counter-cyclical)

Modelling tenure distribution

- Model the probability of separation at *t* conditional on having remained employed up to *t*: hazard function approach
- With elapsed tenure this is difficult, so model the unconditional probability that individual has particular level of elapsed tenure.
- Suppose *T* has cdf *F(t):*
  - "probability of tenure no more than *t*"
- More useful here is the survivor function, *R(t) = 1 – F(t):*
  - "probability of remaining employed to at least *t*"
  - Hazard function is *h(t) = f(t)/R(t)*

Approximate discrete hazards

	Jan 2010	Jan 2011
0 -1 years	A	
1 -2 years		B

Fraction (B/A) stay

(A – B)/A is the separation rate

Approximate discrete hazards

	Jan 2010	Jan 2011
0 -1 years	A	
1 -2 years	B’	B

In a steady state, B = B’

So
(A – B’)/A is the separation rate

And we can measure this in our data.

For example, separation rate at two years is:
{(# tenure 0 – 2 years) – (# tenure 2 – 4 years)}/(# tenure 0 – 2 years)

Need to control for being out of steady state (schools growing or declining)

Economic model

- Separations: quits + retirements + layoffs
- Quits:
  - to other schools
  - to other professions or out of the labour force
- Factors:
  - Wages and promotion prospects
  - Non-pecuniary aspects:
    - Characteristics of the students, general “teach-ability”
    - Resources, TAs, ethos …

School employment dynamics

- Growing schools could:
  - Do more hiring, with quits about the same, so more short tenure people
  - Experience less quitting, perhaps because of more promotion opportunities, so more long tenure people
- Declining schools, likewise different patterns.
- Statistical framework shows we need to control for schools being out-of-steady state

Data

- Bring together:
  - School Workforce Census (SWC), pilot.
  - National Pupil Database (NPD)
  - Consistent Financial Reporting (CFR)
  - *(in future: TTWA vacancy data)*
- Merged on school id
- Geo variables matched in on postcodes

SWC, pilot

- Taken January 2010
- Survey of all staff employed by schools
- Includes contract information and personal characteristics
- 342000 Staff members, 9872 schools, 81 LAs
- All roles
- Is the pilot representative?

SWC FSM:	Primary – 16.4%	Secondary – 13.8%
Full NPD FSM:	Primary – 14.7%	Secondary – 14.0%

Teachers

- We define teachers as all members of staff who have a DfE teacher identifier
  - This correlates 98% with individuals who have “Teacher” as a role identifier.
  - This will not include TAs.
- Yields 218,915 teachers
- Data cleaning
  - Keep newest contract if teacher works FT at more than one school
  - Drop teachers who work less than half a day (3 hrs p/w)
  - Drop teachers if pay and hours worked are missing

Tenure

- Variables used are:
  - Teacher ID, contract start date
  - We do not know when started as a teacher
- Data issues:
  - ‘Heaping’ of the distribution, at 142 days, and multiples: 506 (= 142 + 364) days, …
  - Most new hires start on a specific date, 142 days from the Census date

Other variables used

- SWC:
  - Personal characteristics (age, gender, ethnicity etc.)
  - Contract information
  - Basis for estimation of school's propensity to pay high.
- CFR:
  - Teacher expenditure, for measures of school growth
- NPD:
  - School composition (% FSM, % SEN, …)
  - Teacher market density (no. of schools within 30km)

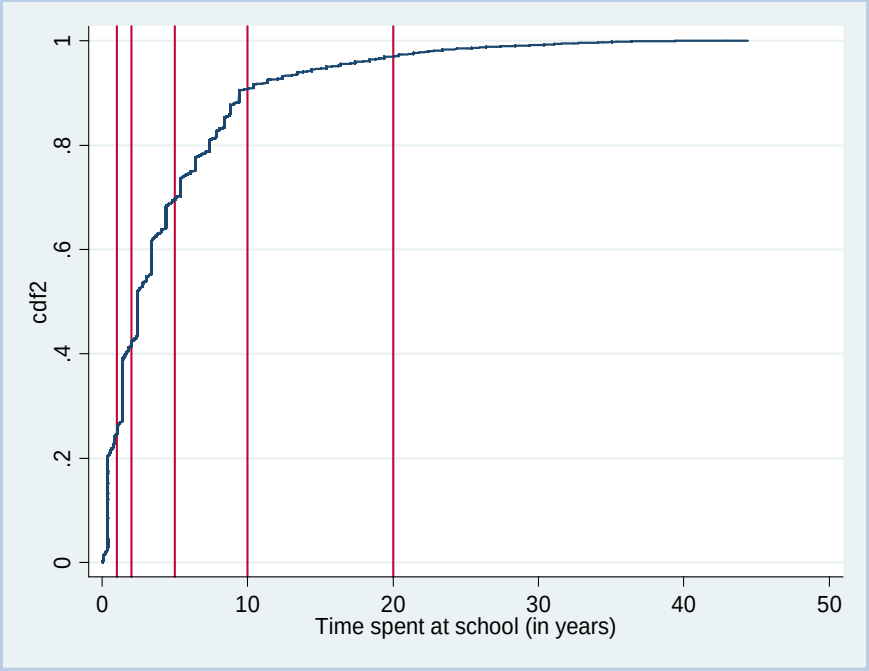
Results

- Tenure distribution
  - Overall
  - Individual heterogeneity
  - School heterogeneity
- Separation rate (approx discrete hazard)
  - School heterogeneity

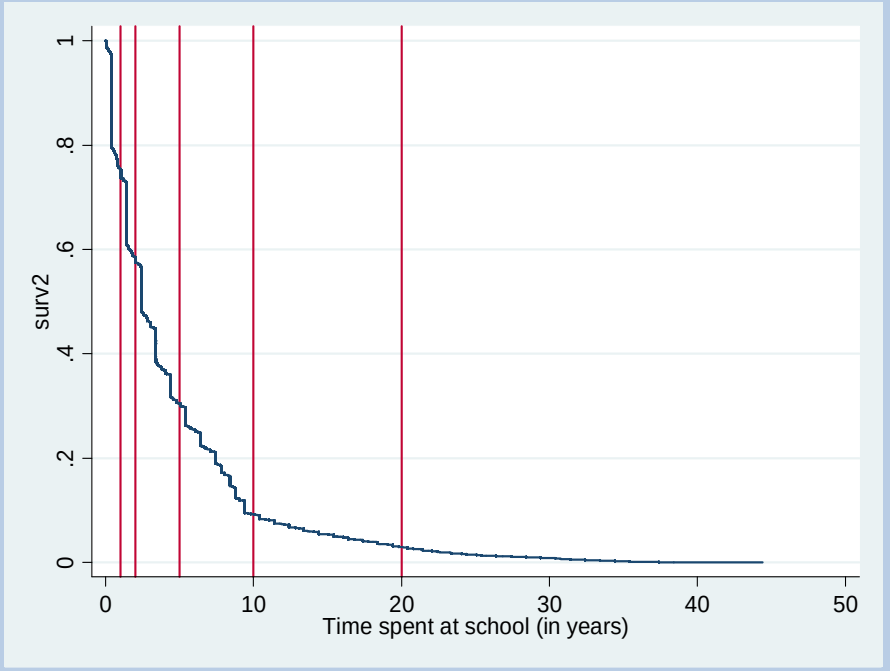
Tenure distribution

Tenure	Years	Days
Mean	4.22	1540
Median	2.39	873
5%	0.39	142
10%	0.39	142
25%	0.90	330
75%	5.39	1968
90%	9.39	3429
95%	14.40	5255
N	172698	

CDF and Survivor Functions



CDF: Probability of no more than *y* years



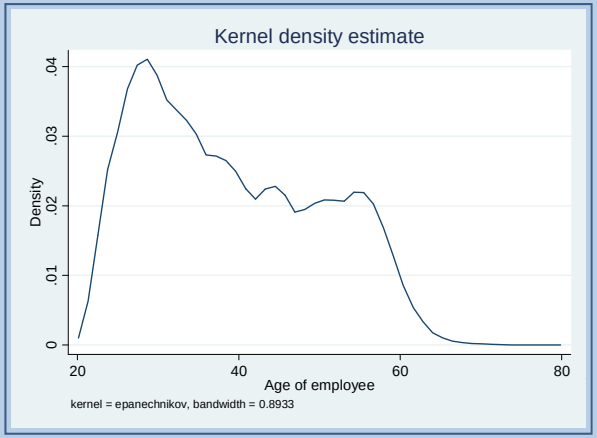
Survivor: Probability of at least *y* years

Teachers and others

Group:	% <= 1 year	1 yr < % <= 5 yr	5 yr < % <= 10 yr	10 yr < %
Teachers (SWC)	25.4	45.7	20.7	8.2
All (LFS)	14.7	34.1	22.8	28.3
Professionals and Managers (LFS)	10.5	31.0	23.9	34.6

Jan-Mar 2010; FT & PT. Thanks to Matt Dickson for the LFS calculations

Why so different? People employed as teachers are much younger than the overall employed population



Individual heterogeneity

	N	<= 1 yr	1 yr < <= 5 yr	5 yr < <= 10 yr	10 yr <
All teachers	172713	25.4	45.7	20.7	8.2
Female	134218	25.9	45.7	20.3	8.1
Male	38491	23.6	45.8	22.2	8.5
Full-time	122325	24.0	47.4	20.3	8.3
Part-time	34597	30.8	40.3	19.3	9.6
Primary	90647	26.1	45.5	19.9	8.4
Secondary	82066	24.5	45.9	21.6	7.9

Gender, Age and PoE

Gender		Phase of education	
		Primary School	Secondary School
Female	<= 1	26.0	25.6
	1 < <= 5	45.2	46.4
	5 < <= 10	20.2	20.6
	10 <	8.6	7.3
Male	<= 1	26.8	22.6
	1 < <= 5	48.4	44.9
	5 < <= 10	17.9	23.5
	10 <	6.9	9.0

Gender		Age		
		<=30	30 < <=50	> 50
Female	<= 1	35.3	24.0	16.7
	1 < <= 5	56.5	45.6	30.0
	5 < <= 10	8.1	22.5	32.7
	10 <	0.0	7.9	20.6
Male	<= 1	36.2	20.0	16.7
	1 < <= 5	56.9	47.5	28.5
	5 < <= 10	6.8	24.9	34.3
	10 <	0.0	7.6	20.5

Regression analysis

- Dependent variables:
  - (0, 1): Tenure less than 1 year
  - (0, 1): Tenure less than 2 years
  - (0, 1): Tenure more than 5 years
- Explanatory variables:
  - Gender, age, FT/PT, ethnicity.
  - *QTS: 99% have it*
  - *(don't have qualifications in this pilot)*

Results

	<= 1 year	<= 2 years	> 5 years
Female	0.000 (0.1)	0.001 (0.3)	0.001 (0.4)
30 – 50 yrs old	-0.149 (49.5)	-0.227 (68.1)	0.250 (75.2)
< 50 years old	-0.219 (60.4)	-0.356 (83.7)	0.475 (94.7)
Full-time	0.117 (27.4)	0.134 (27.9)	-0.094 (22.0)

Coefficient (t-statistic); standard errors clustered at school level
17 ethnicity categories also included but very few ever significantly different from zero.

School heterogeneity

- London
- Urban
- Disadvantage

School heterogeneity

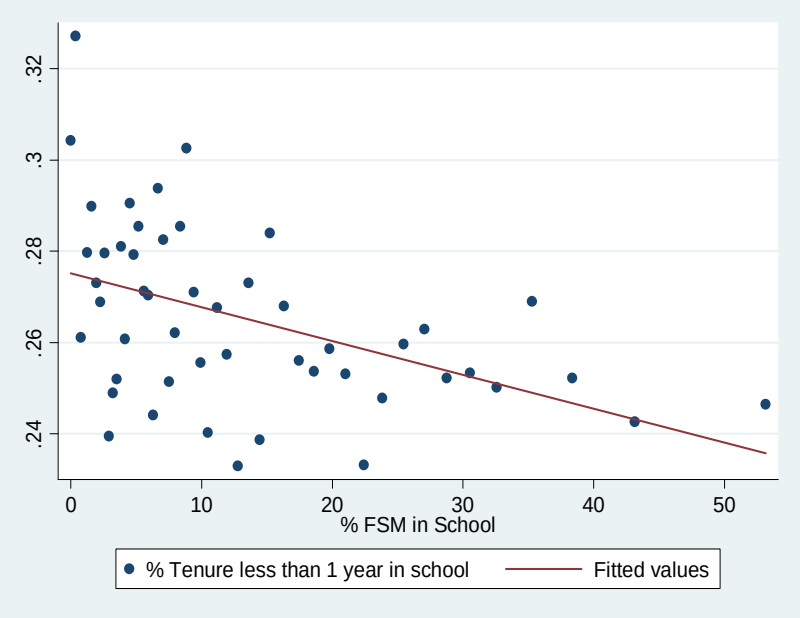
		London School	
		No	Yes
Primary School	Up to 1 year, %	26.6	22.9
	1 to 5 years, %	44.3	53.6
	5 to 10 years, %	20.4	16.6
	10 years or more, %	8.6	6.9
Secondary School	Up to 1 year, %	24.9	21.8
	1 to 5 years, %	45.0	52.8
	5 to 10 years, %	22.0	18.8
	10 years or more, %	8.1	6.6
	172,713	151,719	20,994

Urban School

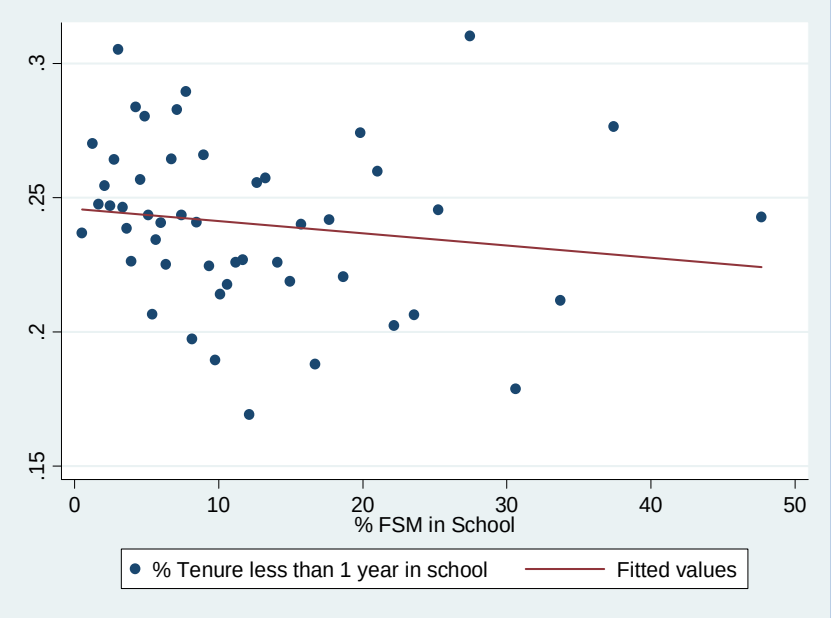
		Urban School	
		No	Yes
Primary School	Up to 1 year, %	30.9	25.6
	1 to 5 years, %	44.2	45.6
	5 to 10 years, %	19.0	20.0
	10 years or more, %	5.8	8.7
Secondary School	Up to 1 year, %	34.2	24.2
	1 to 5 years, %	37.6	46.2
	5 to 10 years, %	21.1	21.6
	10 years or more, %	7.1	8.0
	172,713	12,070	160,643

Disadvantaged schools

Primary Schools



Secondary Schools



School level regressions

	<= 1 year	<= 2 years	> 5 years
Secondary	0.029 (2.48)	0.052 (3.94)	-0.046 (-3.86)
London	-0.052 (-5.30)	-0.040 (-3.35)	-0.023 (-2.11)
Urban	-0.029 (-3.77)	-0.037 (-4.51)	0.037 (5.08)
No. of pupils	-0.000 (-4.10)	-0.000 (-5.71)	-0.000 (5.12)
Prop'n White	-0.000 (0.16)	-0.000 (-0.31)	0.000 (1.12)
Prop'n SEN	0.004 (2.74)	0.005 (2.73)	-0.005 (-3.56)
Prop'n EAL	0.001 (1.46)	0.001 (1.63)	-0.001 (-2.24)
School Idaci	-0.014 (-0.53)	-0.074 (-2.54)	0.119 (4.60)
Low Mkt Den	0.089 (9.78)	0.065 (7.29)	-0.046 (-6.41)
High Mkt Den	0.005 (0.60)	0.028 (3.20)	0.002 (0.19)

Coefficient (t-statistic), standard errors clustered at school level
No other control variables

School level regressions: including high pay propensity

	<= 1 year	<= 2 years	> 5 years
Secondary	0.008 (0.63)	0.014 (1.08)	-0.001 (-0.11)
London	-0.075 (-7.24)	-0.079 (-6.52)	0.024 (2.18)
Urban	-0.030 (-3.94)	-0.039 (-4.81)	0.039 (5.52)
No. of pupils	-0.000 (-3.84)	-0.000 (-5.36)	-0.000 (4.72)
Prop'n SEN	0.004 (2.50)	0.004 (2.35)	-0.005 (-2.99)
Prop'n EAL	0.001 (1.69)	0.001 (1.98)	-0.001 (-2.69)
School Idaci	-0.017 (-0.63)	-0.079 (-2.74)	0.125 (4.94)
Low Mkt Den	0.087 (9.64)	0.060 (6.95)	-0.041 (-5.89)
High Mkt Den	0.003 (0.42)	0.026 (2.98)	0.004 (0.57)
High Pay	0.052 (8.31)	0.091 (13.74)	-0.107 (-19.72)

Coefficient (t-statistic), standard errors clustered at school level
No other control variables

School and teacher controls

- School differences may be driven by:
  - the characteristics of the people they choose to hire (eg all young people)
  - or are restricted to hiring
- See whether the school differences change when we add (observed) teacher characteristics.

Teacher level regressions

	<= 1 year	<= 2 years	> 5 years
Secondary	0.019 (1.60)	0.043 (3.16)	-0.039 (-3.08)
London	-0.067 (-5.77)	-0.071 (-5.19)	0.012 (1.10)
Urban	-0.020 (-2.22)	-0.027 (-2.67)	0.020 (2.36)
No. of pupils	-0.000 (-2.86)	-0.000 (-4.21)	0.000 (3.54)
Prop'n White	-0.000 (-0.73)	-0.001 (-1.39)	0.000 (1.22)
Prop'n SEN	0.007 (3.55)	0.008 (3.75)	-0.007 (-3.97)
Prop'n EAL	0.000 (1.42)	0.000 (1.00)	-0.000 (-2.12)
School Idaci	-0.066 (-2.29)	-0.115 (-3.51)	0.154 (5.28)
Low Mkt Den	0.080 (8.30)	0.064 (6.61)	-0.051 (-6.32)
High Mkt Den	0.025 (2.66)	0.053 (4.85)	-0.025 (-2.79)

Coefficient (t-statistic), standard errors clustered at school level
Teacher control variables also included

Teacher level regressions: with market interactions

	<= 1 year	<= 2 years	> 5 years
Comp. Growth	0.022 (2.33)	0.034 (3.20)	-0.042 (-4.12)
London	-0.071 (-6.10)	-0.077(-5.61)	0.019 (1.71)
Urban	-0.020 (-2.15)	-0.026 (-2.55)	0.019 (2.20)
No. of pupils	-0.000 (-2.66)	-0.000 (-3.92)	-0.000 (3.17)
School Idaci	-0.059 (-2.06)	-0.105 (-3.23)	0.141 (4.96)
Low Mkt Den	0.080 (8.34)	0.064 (6.67)	-0.052 (-6.41)
High Mkt Den	0.019 (1.96)	0.043 (4.00)	-0.014 (1.55)

Coefficient (t-statistic), standard errors clustered at school level
Teacher control variables and previous school control variables also included

Separation rates

Separation rate

	(0-2)->(2-4)	(0-3)->(3-6)	(0-5)->(5-10)
Secondary	0.052 (2.63)	0.049 (2.60)	0.043 (2.43)
London	-0.104 (-5.66)	-0.063 (-3.74)	-0.025 (-1.66)
Urban	-0.044 (-3.56)	-0.029 (-2.51)	-0.046 (-4.49)
No. of pupils	-0.000 (-7.82)	-0.000 (-5.38)	-0.000 (-3.82)
School Idaci	0.058 (1.35)	-0.082 (-2.05)	-0.080 (-2.17)
Low Mkt Den	0.056 (4.47)	0.051 (4.42)	0.060 (5.82)
High Mkt Den	0.059 (4.51)	0.057 (4.87)	0.051 (4.76)

Coefficient (t-statistic), standard errors clustered at school level
No other control variables

Separation rate

	(0-2)->(2-4)	(0-3)->(3-6)	(0-5)->(5-10)
Comp. Growth	0.011 (0.86)	0.043 (3.59)	0.064 (5.78)
Secondary	0.051 (2.60)	0.046 (2.46)	0.039 (2.21)
London	-0.105 (-5.69)	-0.066 (-3.91)	-0.030 (-1.97)
Urban	-0.043 (-3.55)	-0.028 (-2.45)	-0.045 (-4.41)
No. of pupils	-0.000 (-7.72)	-0.000 (-5.03)	-0.000 (-3.23)
School Idaci	0.063 (1.44)	-0.065 (-1.62)	-0.054 (-1.46)
Low Mkt Den	0.057 (4.51)	0.053 (4.63)	0.063 (6.18)
High Mkt Den	0.056 (4.15)	0.046 (3.77)	0.034 (3.09)

Coefficient (t-statistic), standard errors clustered at school level
No other control variables

Summary

- **(All provisional!!)**
- A view that disadvantaged inner city schools suffer from high teacher turnover;
- Either because of a dense labour market with many alternative job offers, or challenging working conditions;

- In the first dataset that we can look at this in a systematic way, we see no evidence of this.
- In fact, evidence of the contrary.
- Speculations:
  - Maybe problems those schools face is more to do with teacher absence, rather than turnover?
  - Or perhaps not enough people quitting, and the wrong people staying?