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# Workshop on Education Economics Maastricht University 23<sup>rd</sup> to 24<sup>th</sup> March 2016

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**HUDDERSFIELD**  
Inspiring tomorrow's professionals

## The effects of competition and collaboration on school efficiency: A bootstrapped two-stage DEA of the UK independent school sector

Jill Johnes



• Laura Lopez Torres



• Caroline Elliott



Inspiring tomorrow's professionals



# Introduction

## Independent schools (ISs)

1394: First school

2015: 1,267 schools in the UK  
517,113 pupils, of which:  
74% co-educational  
13.7% board  
29% from ethnic minority  
5% overseas  
8% means tested bursaries

## State schools

2015: 720000 schools in the UK  
7.7m pupils, of which:  
  
20% from ethnic minority  
  
13% free school meals

Annual average senior fee:  
£29,685 (boarding) and £14,001  
(day)

## Questions:

- How efficient is the IS sector in the UK?
- What factors affect efficiency in the IS sector?
  - Competitive pressures
  - Coalitions

- An analysis of efficiency and its determinants is of interest to the IS sector which has been adversely affected by the global financial crisis
- Governments have introduced 'competitive' pressures in the state school sector
- Government academies programme: Multi-academy trusts set up to encourage collaboration and sharing good practice
- Thus the research is also of interest to the state school sector

“The government's approach may create more choice. However, the cost is becoming clearer every week – greater instability, fractured partnerships, incoherent provision and less sharing of good practice. The best way to improve parental choice is to improve all schools, but competition of this kind will do little to make that a reality.”

*The Guardian, April 1<sup>st</sup>, 2013*

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## **Independent school sector:**

- Demand; examination success; wage benefits; determinants of school fees; Sevenoaks fee-setting cartel
- BUT: There has been no study on efficiency or its determinants in the IS sector

## State school sector:

Performance



Achievement rates



Competition has a positive  
effect

Dee (1998); Hoxby (2000); Belfield and Levin (2002); Woessmann (2003); Levačić (2004); Millimet and Collier (2008); Agasisti (2011a); Ponzio (2011); Agasisti and Murtinu (2012); Misra *et al.* (2012); Agasisti (2013a); Thapa (2013)

Efficiency



Outcomes related to  
resource used (value added)



Competition has a positive  
effect

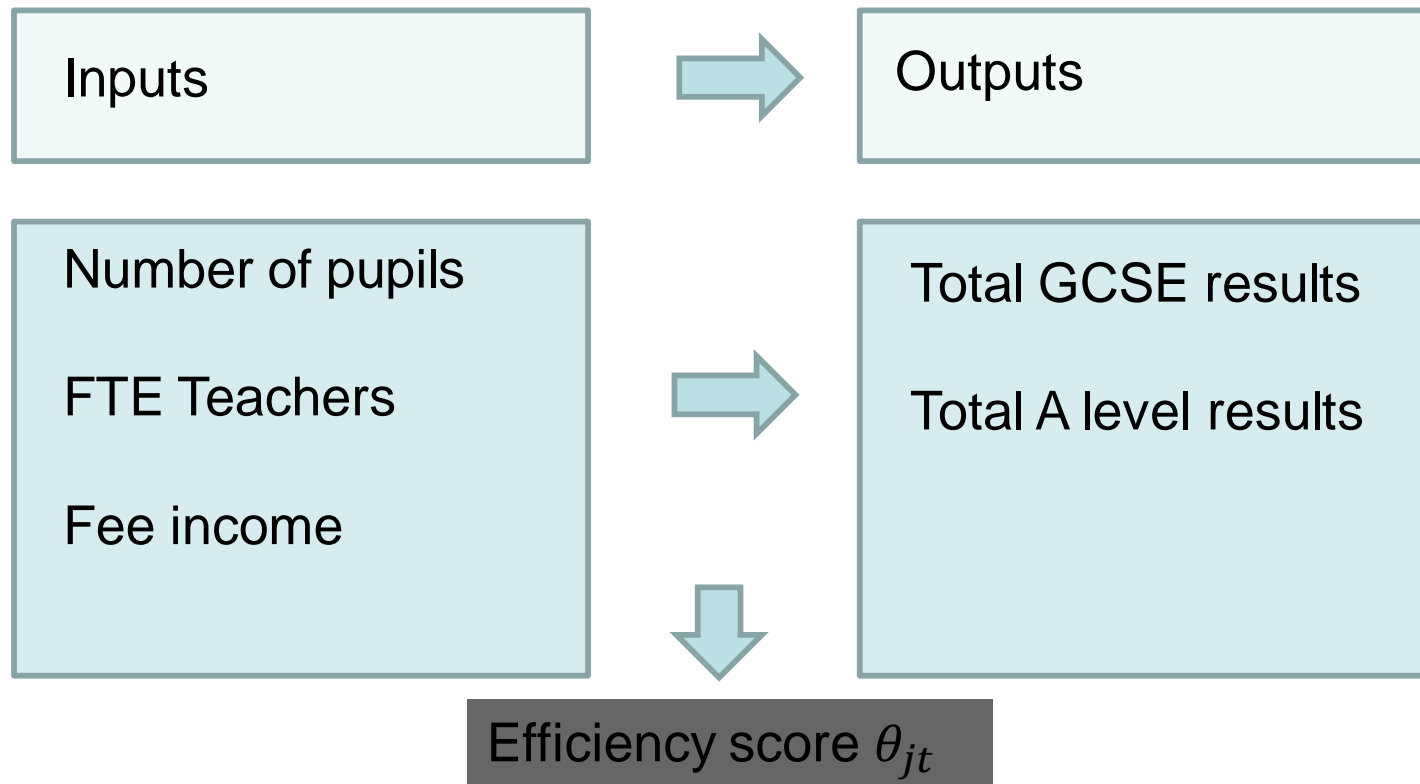
Bradley *et al.* (2001); Bradley and Taylor (2002); Agasisti (2011b; 2013b); Harrison and Rouse (2014)



## Some gaps

- Unobserved heterogeneity has not adequately been taken into account
  - There has been no investigation of the effect of collaboration on efficiency
-

## Stage 1: Bootstrapped DEA to estimate efficiency scores for each school



**Stage 2:** Random effects (GLS) regression with bootstrapped SEs to identify determinants of school efficiency score

$$\begin{aligned} &\theta_{jt} \\ &= \beta C'_{jt} + \partial A'_{jt} + \gamma R'_{jt} + \rho E'_{jt} + \varphi M'_{jt} + \omega L'_{jt} + \tau T'_{jt} + (\alpha_0 + u_j) \\ &+ \varepsilon_{jt} \end{aligned}$$

$C'_{jt}$  = vector of competition variables

$A'_{jt}$  = set of dummies indicating the school's affiliation to a coalition

$R'_{jt}$  = vector of reputation variables

$E'_{jt}$  = vector of school characteristics

$M'_{jt}$  = vector of variables about the county in which the school is located

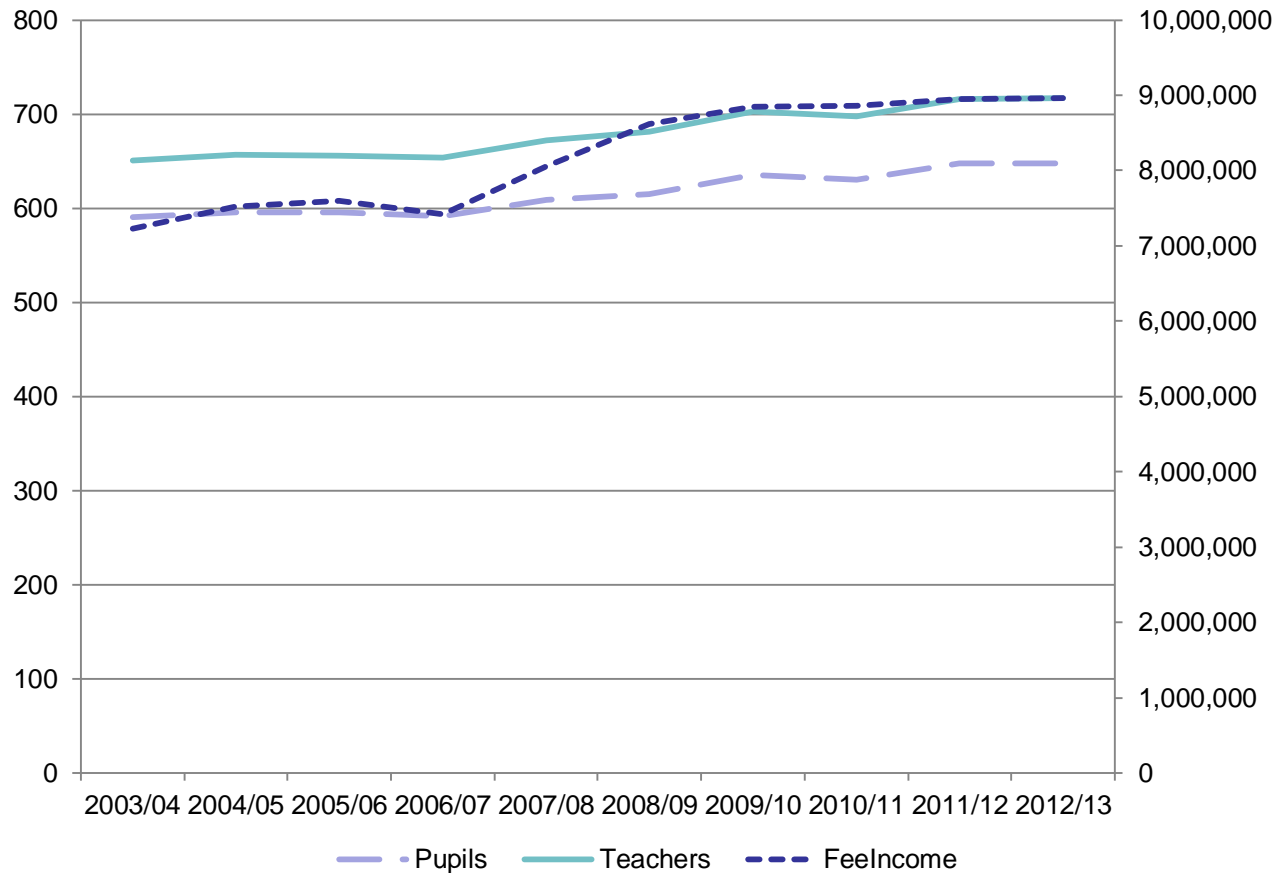
$L'_{jt}$  = set of location dummies

$T'_{jt}$  = set of time dummies.

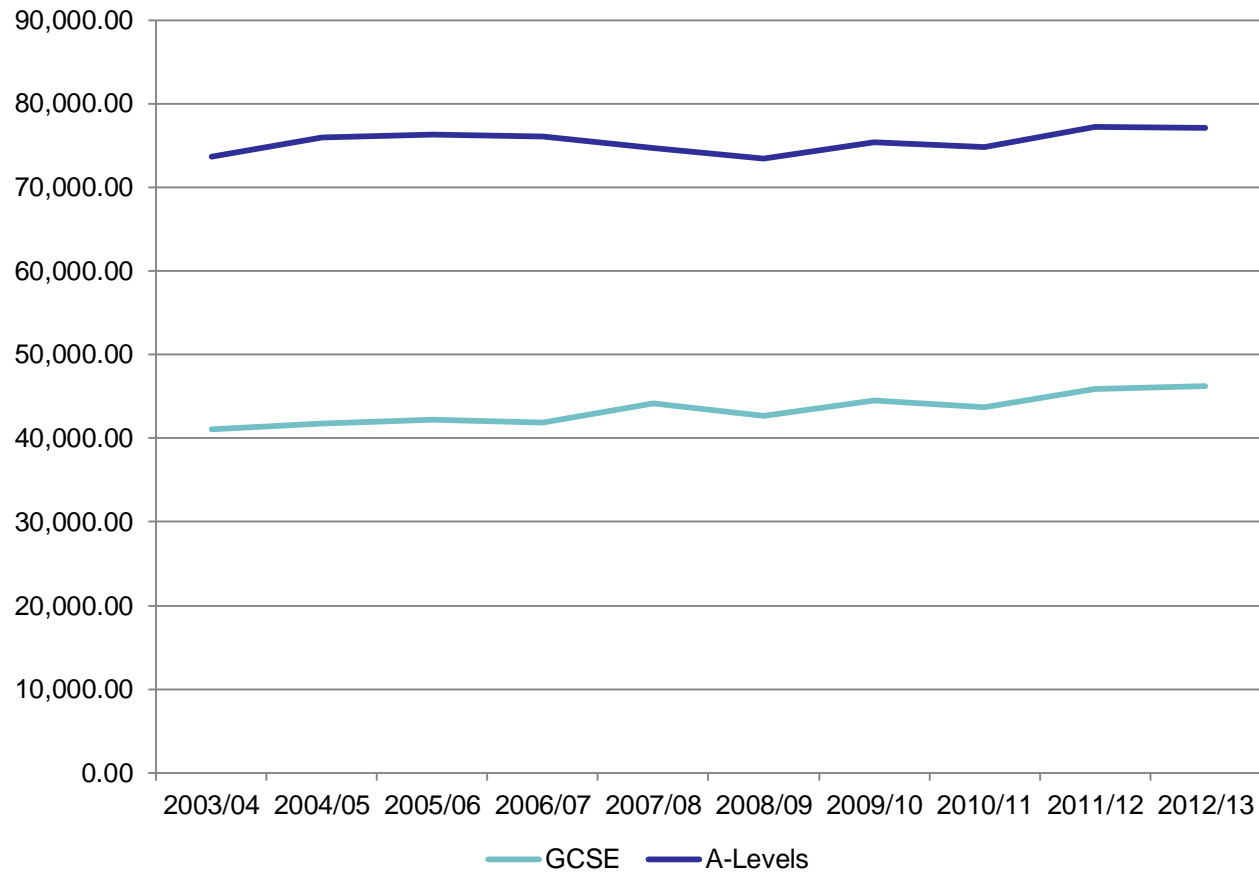
UK independent school level data from three sources:

- Independent Schools Council
- Annual Good Schools Guides
- Annual Financial Times rankings
  
- Time period: 2003/04 – 2012/13
- 328 UK independent schools covering post-11
- Unbalanced panel: 206 to 319 ISs per year
- 2524 observations

## Inputs



## Outputs

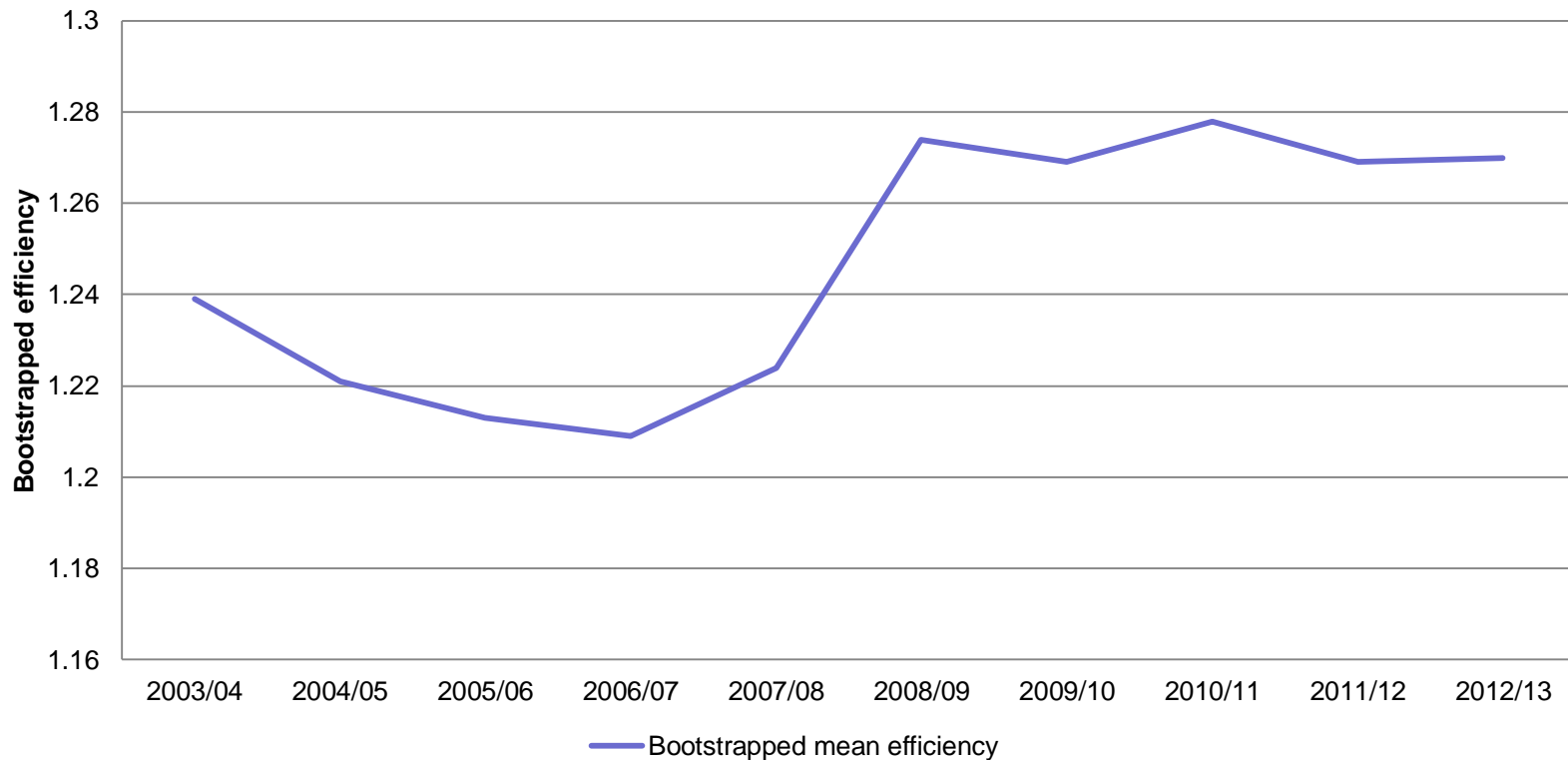


## Stage 2 variables:

- **Competition:** log market share all schools; log market share independent schools (also comparable Herfindahl indexes)
- **Coalitions:** Shared ownership; group member; cartel dummy variable
- **Reputation:** A-level points per core subject *and* A-level points per pupil entry
- **School characteristics:** Boarders; Gender; Religious affiliation; Pupil starting age; Year of foundation; Fee level; Teacher turnover; Specialist
- **Location:** Scotland; Wales; Inner London; Outer London
- **County:** Incomes; Population

# Empirical Results

## Stage 1: Bootstrapped mean efficiency





## Stage 2 results

- The Breusch-Pagan test rejects the pooled regression with  $p=0.000$ ; the null hypothesis of the Hausman test confirms RE approach ( $p=0.9895$ )

## Competition and Collaboration

- Log Market Share (state and independent schools) has positive effect on efficiency
- Herfindahl index has no relationship with efficiency score
- Coalition has no effect on efficiency

## Stage 2 results (additional variables)

- Significant positive effect on efficiency:  
Reputation variables; CoE and RC schools; County income
- Significant negative effect on efficiency:  
Fee level; year dummies 2008/09 onwards (exception of 2009/10) – financial crisis impact
- No effect:  
Gender; Starting age of pupils; School age; Teacher turnover; Specialist; County population
- Results robust to measure of competition and to robust or bootstrapped SEs

# Conclusions

- First paper to examine efficiency in the UK IS sector
- Accounts for unobserved heterogeneity by using a RE estimation in the second stage
- Schools with large market share (state and independent) enjoy greater efficiency
- Membership of a coalition has no effect on efficiency
- Reputation has a positive effect on efficiency
- Higher fee level is detrimental to efficiency
- The financial crisis has led to a more challenging environment