Are classroom internet use and academic performance higher after government broadband subsidies to primary schools?

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Motivation

- **DoES capital expenditure on ICT for schools was about €13m between 2005 and 2008. "Broadband for Schools"**

  "The Schools ICT Programme supports high quality teaching and learning and feeds into building a knowledge economy." (DoES Capital Investment Programme 2012–2016.)

- **Additional €92m investment in 2009-2010 re. computer hardware for schools. New programme to put 100mb/s broadband into secondary schools by 2014**

- **Quasi-experiment possible since initial programme overlapped with GUI data collection period**

Questions:

1. **Was the internet used more in primary school classrooms that received broadband for schools investment?**

2. **Do children in classes where the internet is used have higher academic performance?**

Much literature on general ICT investment in schools, e.g.

- Kirkpatrick and Cuban (1998): survey, evidence on effect of ICT in schools limited and mixed

- Machin et al. (2007): UK. ICT expenditure increased grades in English and Science, but not Maths

Less on broadband specifically:

- Underwood et al (2005): UK. No effect of broadband on primary school academic outcomes but positive at secondary level.

- Goolsbee and Guryan (2006): California. E-Rate programme, subsidies increased internet use, especially in low income areas, but not academic performance

- Belo et al. (2011): Portugal. Negative effects of internet use on academic performance for 1st years. Worse in schools that allow access to websites like Youtube. Effect may be declining over time.

The Broadband for Schools Scheme (BfS)

- **National scheme introduced in 2005 and largely completed in 2008**

  "The objective is to ensure that all schools are provided with a broadband service, and that this service delivers centrally managed network monitoring, firewall, content filtering and virus protection ... as well as access to online content; web hosting; and blog hosting for schools." (DoES Capital Investment Programme 2012–2016.)

- **Government contracted telecoms companies to deliver service to all primary schools; companies then dealt directly with individual schools**

Hypotheses

Step 1

- Hypothesis: better broadband service increases use of internet in schools, possibly with a lag
- Thus probability of observing internet use in the classroom will be positively affected by broadband availability, and this effect may increase with time since BB delivered
- Other factors may affect prob ability of internet use too, e.g. BB quality (+), density of computers in school (+) and quality of computing facilities (+)

Step 2

- Hypothesis: internet use in classroom improves academic performance
- Other possible confounding factors such as child's socioeconomic background, home computer use, gender and home reading need to be incorporated

The Data

- **Growing Up in Ireland 9 year old cohort**
- **Research microdata file contains 8,568 observations (cross sectional)**
- **The 9 year-old study:**
  - Home Based questionnaires
  - Principal's questionnaire
  - Teacher's questionnaire on self
  - Drumcondra test results for reading and maths
- **Extended to include data on when schools received service under Broadband for Schools scheme, what service received & some Census SAPS data**
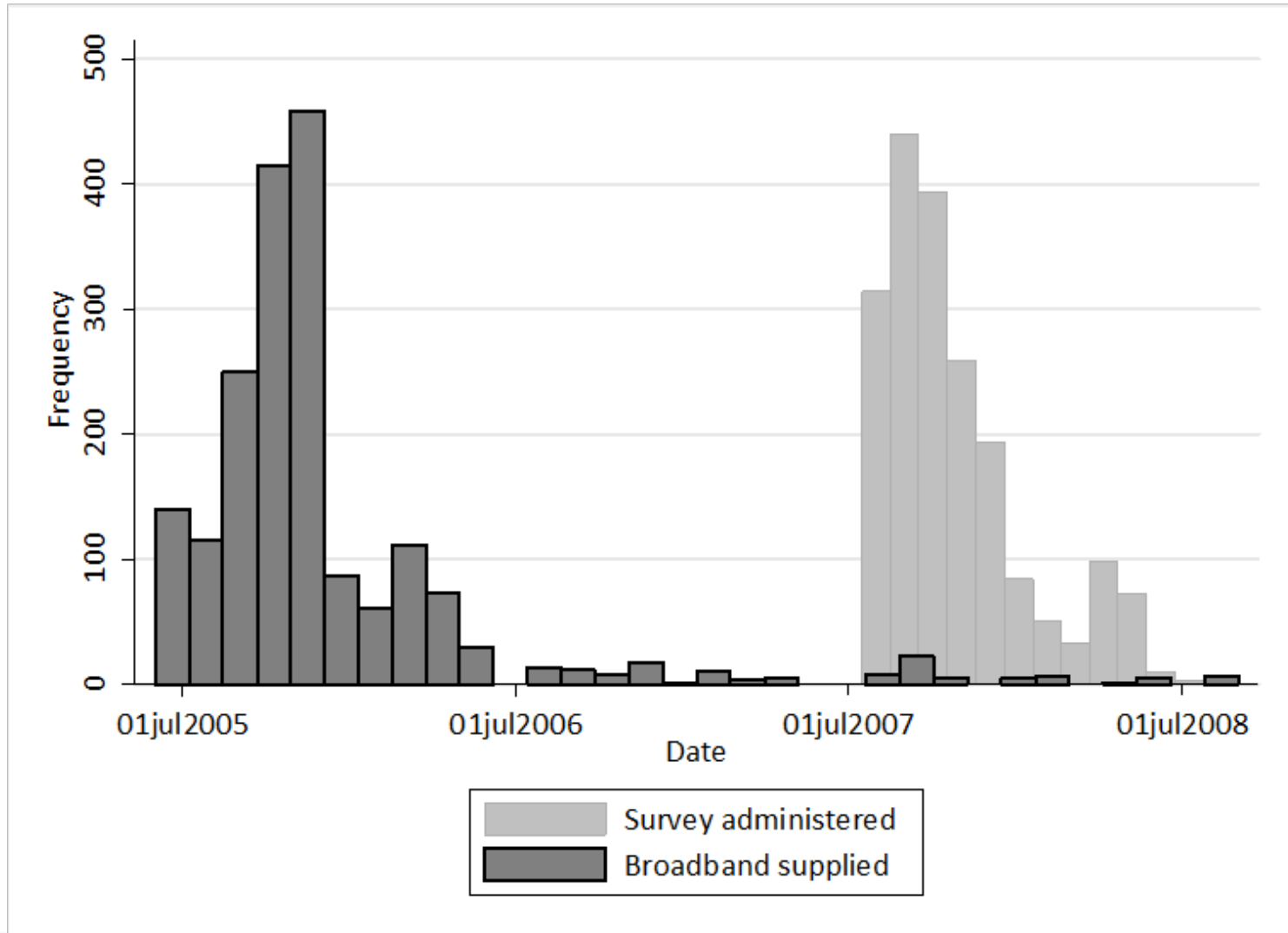
Estimate treatment effects using econometrics

Three survey-weighted regression models estimated with standard errors robust to clustering at school level:

1. Model of whether internet is used in class, including how long since BfS service delivered (logit)

2. Model of reading test results, including use of internet in class (OLS)

3. Model of mathematics test results, including use of internet in class (OLS)

and two exogeneity checks:

4. Determinants of time from start of scheme before each school got BfS service

5. Instrumental variable models with two stages: 1) internet use in class and 2) test performance conditional on stage 1

Internet use logit regression

DV: Do the children in the study child's class use a computer to access the internet?

Variables	Odds ratio	Robust S.E.
No broadband under BFS	**0.295**	0.169**
BFS broadband inst. 1-599 days ago	REF	
BFS broadband inst. 600-699 days ago	1.138	0.243
BFS broadband inst. 700-799 days ago	1.186	0.245
BFS broadband inst. 800+ days ago	**2.47**	0.725***
School computer facilities: poor	0.827	0.178
School computer facilities: fair	**0.695**	0.121**
School computer facilities: good	REF	
School computer facilities: excellent	0.996	0.205
Computer room in school	**1.469**	0.243**
Computers available in class	**1.775**	0.323***
Comp. use in class: never/almost never	**0.171**	0.0379***
Comp. use in class: some days	**0.639**	0.117**
Comp. use in class: most days	REF	
Comp. use in class: every day	0.849	0.218
Constant	2.1	1.18
Technology used	Not significant	
Broadband speed	Not significant	
Computers/pupil in school	Not significant	
Teacher experience	Not significant	
Teacher active teaching index	Not significant	
School DEIS status	Not significant	
Time index of survey, teacher level	Not significant	
N	1,412	

Reading test OLS regression

DV: Drumcondra Reading test logit score

Variables	β	S.E.
Internet used in class	**0.0833**	0.0362**
Broadband speed <=0.5 MBit/s	REF	
Broadband speed <=1 MBit/s	0.0907	0.065
Broadband speed <=2 MBit/s	0.0274	0.0552
Broadband speed <=3 MBit/s	-0.0375	0.0887
Broadband speed <=5 MBit/s	0.082	0.0712
Broadband speed other	**0.209**	0.104**
(Log) HH Net Equivalent Income	**0.123**	0.0376***
Child intellectual disability	**-1.04**	0.0475***
Time index of survey	**-0.00053**	0.000247**
Disadvantaged school (DEIS status)	**Yes**	
Primary carer level of education	**Yes**	
Secondary carer level of education	**Yes**	
Social class	**Yes**	
Child gender	**Yes**	
Child activity clusters	**Yes**	
School computer facilities	N.S.	
Computers/pupil	N.S.	
Teacher experience	N.S.	
Teacher active teaching index	N.S.	
Child chronic illness	N.S.	
Constant	-0.541	0.405
Sample	5,651	

Maths test OLS regression

DV: Drumcondra Maths test logit score

Variables	β	S.E.
Internet used in class	**0.134**	0.0385***
Broadband speed <=0.5 MB/s	REF	
Broadband speed <=1 MB/s	-0.0146	0.0595
Broadband speed <=2 MB/s	0.0636	0.0546
Broadband speed <=3 MB/s	-6.01E-05	0.0847
Broadband speed <=5 MB/s	-0.00843	0.0724
Broadband speed other	0.249	0.131*
Teacher experience	**0.00409**	0.00157***
Boy	**0.0743**	0.0329**
Girl	REF	
(Log) HH Net Equivalent Income	**0.0602**	0.0335*
Child intellectual disability	**-0.837**	0.0519***
Time index of survey	-0.000313	0.000231
Primary carer level of education	**Yes**	
Secondary carer level of education	**Yes**	
Social class	**Yes**	
Child activity clusters	**Yes**	
Child chronic illness	**Yes**	
Disadvantaged school (DEIS status)	N.S.	
School computer facilities	N.S.	
Computers/pupil	N.S.	
Teacher active teaching index	N.S.	
Constant	-1.06	0.362***
Sample	5,708	

Conclusions and further research

- **Having had Broadband for Schools service for at least 2 years was associated with more than doubling of classroom internet use**

- **Classroom internet use associated with 8% higher reading test logit score and 13% higher maths test logit score**
  - ➢ Scale of maths model coefficient roughly equal to primary carer getting degree rather than Leaving Cert

- **No robust associations with broadband speed or technology**

- **Paper forthcoming in *Economic & Social Review***

- **Future: panel study of teaching & learning in post-primary schools in 100 Mbps broadband programme, 2013-14**