Does funding targeted at improving the management of schools increase school performance over the long term?

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Abstract

There is a large literature that links school expenditures to student outcomes. However much of this research focusses on general funding increases rather on the purposes to which additional expenditures are allocated. This research considers the effect of a policy in England that ran from 2003-2006 that provided additional funding to low performing schools specifically targeted at improving the middle and senior management capabilities of the school. Using a sharp regression discontinuity design, this study finds that the funding did increase school performance, suggesting that targeted, time limited funding to improve school management can increase school performance over the longer term. The analysis also shows that it took 4 years from the start of the programme for these positive effects to arise (one year after the funding ended). Thus underlining the importance of allowing school improvement programmes sufficient time to demonstrate effectiveness.

Keywords: school expenditure, school management, school improvement

JEL: I20, I21, I22

1 Introduction

1.1 Overview

Targeting resources at underperforming schools is a commonly adopted education policy. Despite a significant body work estimating the effect of school resources on school performance there exists a lack of understanding as to what are the most effective uses of additional school resources (Jackson 2018). Though more effective management practices in schools are *associated* with improved pupil outcomes (Bloom et al. 2015, Bryson, Stokes and Wilkinson 2020), there is limited causal evidence as to whether funding to improve the management of schools results in increased performance. This study evaluates, using regression discontinuity (RD) methods, the effect of a policy (the "Leadership Incentive Grant", "LIG") that provided increased funding to improve the management of a group of English secondary schools between 2003 and 2006.

1.2 Institutional background

The specified objective of the LIG policy was to improve the quality of management in low performing schools with the ultimate aim of increasing pupil attainment. Schools were required to use the grant to improve the management of the school through expenditure on: professional development training for senior staff; recruitment and retention bonuses; consultancy, and; collaboration activities with successful schools. Central government agreed and monitored the

plans for the use of the funds with schools. A review of the first year of the programme[1] found that schools were using the grant for the intended purpose, to improve school management, rather than simply being treated as a general budget increase.

Eligibility for the grant was based on whether a school met one or more of the following criteria:

i) Whether a school was part of the "Excellence in Cities" initiative ("EiC") [2], a major area based initiative to improve urban schools – see (Machin, McNally and Meghir 2010);

ii) Whether the percentage of pupils gaining at least 5 A*-C grades in the terminal age 16 examinations, GCSEs, was below 30% in either 2001 or 2002 (the "GCSE rule"), and;

iii) Whether the percentage of pupils eligible for free school meals (FSM) was greater than 35% in January 2002 (the "FSM rule").

For reasons stated below, this study focuses on those schools who were eligible for the funding based on the GCSE rule. The grant amounted to £125,000 per annum for 3 years for all eligible schools. However, those schools outside of the EiC initiative were allocated an additional £50,000 per year to recognize the fact that they had less opportunities to collaborate with other schools (these schools were typically located in rural areas). The total amount for these schools was approximately equal to a 5% increase in per pupil expenditure. The policy began in the 2003/04 school year and the funding was withdrawn at the end of the 2005/06 year.

[1]Leadership Incentive Grant 2004/05: Information and Guidance for Leadership Collaboratives https://webarchive.nationalarchives.gov.uk/20110506114438/https:/consumption.education.gov.uk/publications/eOrderingDownload/DfES%200673%20200MIG1549.pdf

[2] A small number of schools outside of EiC areas were also eligible if they had been part of other initiatives for urban schools, (Education Action Zones or Excellence Clusters), however for brevity, all schools that were eligible for these purposes will be referred to as "EiC" schools.

2 Data

The data used consists of publically available school level data on annual school performance and pupil characteristics from 2003-2009[3], matched with the list of schools that were awarded the grant and the values for the variables that determined the eligibility for the grant[4].

To isolate the effect of the grant using the sharp regression discontinuity method it is necessary to restrict the sample. First, the main analysis excludes EiC schools; this is because the LIG grant was paid to this group regardless of any other factor. This group does however provide a useful 'placebo' sample, as there should be no discontinuity in the outcomes for the EiC schools around the 30% GCSE threshold. Second, just two schools met the criteria for the LIG based on the FSM rule only. Therefore the analysis estimates sharp 'frontier' RD models (Reardon and Robinson 2012) along the cut-off based on the GCSE rule only, by excluding all schools with % FSM > 35%. The analytic sample is further restricted to those schools that remained open over the period of analysis (2003-2009). The analysis and associated robustness checks are mainly conducted over the sample of schools pooled over i) the 2004-2006 'policy' period and ii) the 2007-2009 'post policy' period. Summary statistics for the analytic sample are shown in Table 1 and the distribution of the outcome variable (the percentage of pupils gaining 5A*-C GCSE grades including English and Maths) is shown in Figure 1

[3] After this point, there were a number of changes that inhibit the ability to track the effect of the policy further. First, a major funding programme 'The National Challenge' was implemented to raise the performance of schools with low GCSE pass rates. Second there was a change in government: alongside major curriculum and accountability reforms (see Parameshwaran & Thomson,2015) the majority of secondary schools were closed and reopened under different governance arrangements.

[4] Obtained via a Freedom of Information request to the Department for Education.

Table 1. Summary statistics

Policy years (2004-2006)

	LIG schools		Non-LIG schools	
	Mean	*S.D.*	*Mean*	*S.D.*
%5A*-C	24.05	8.09	50.20	18.08
%5A*-C (2003:pre-policy year)	20.53	6.85	47.65	18.13
%FSM	12.47	4.84	5.83	4.18
School Size	862.85	332.02	1081.70	337.88
N(Obs.)	486	486	4668	4668
N(Schools)	162	162	1556	1556

Post-policy years (2007-2009)

	LIG schools		Non-LIG schools	
	Mean	*S.D.*	*Mean*	*S.D.*
%5A*-C	31.84	9.14	55.30	17.30
%5A*-C (2003:pre-policy year)	20.53	6.85	47.65	18.13
%FSM	13.52	5.72	6.46	4.93
School Size	834.18	330.14	1074.67	348.31
N(Obs.)	486	486	4668	4668
N(Schools)	162	162	1556	1556

Notes: %5A*-C refers to the percentage of pupils obtaining 5 or more GCSE or equivalent qualifications graded A*-C including English and Maths.

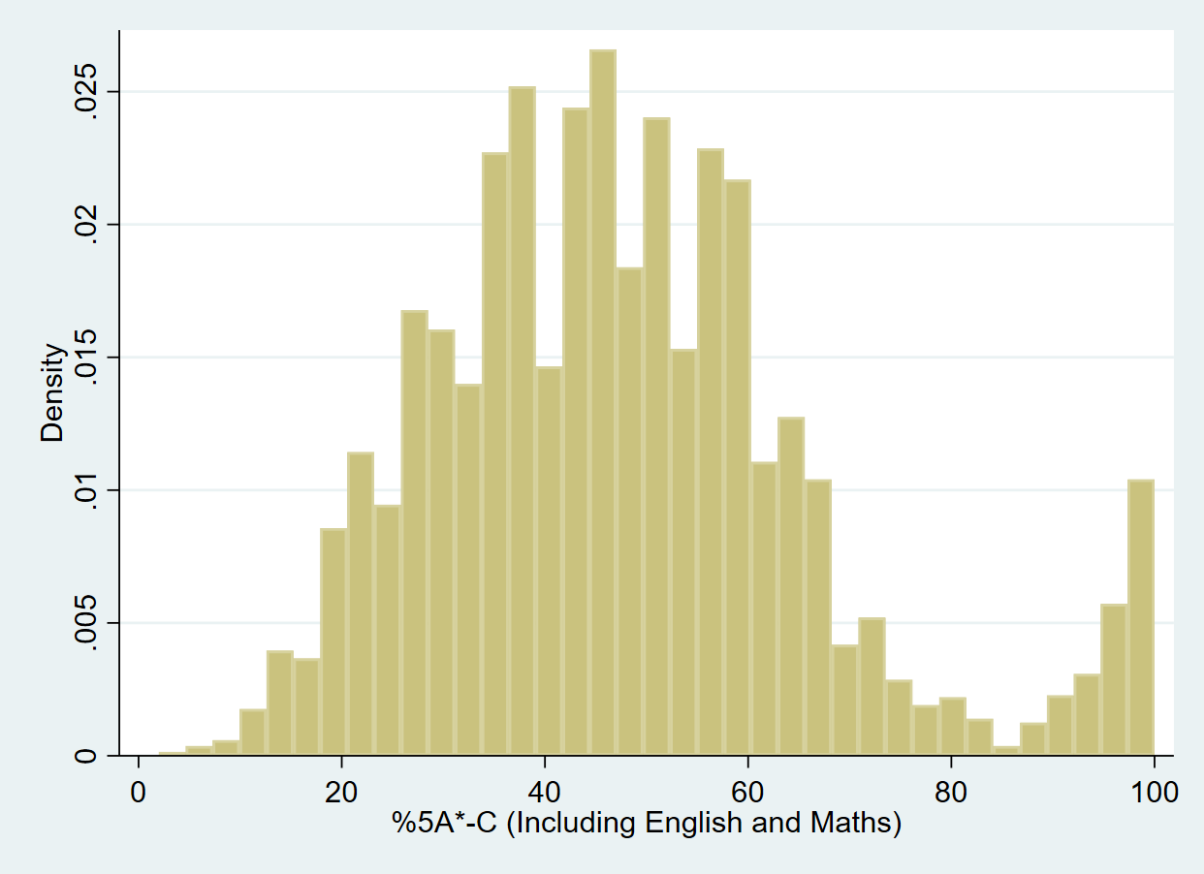

Figure 1. Distribution of % 5A*-C including English and maths

3 Method

3.1 Model

The effect of the policy is estimated using a sharp regression discontinuity design, based on the model:

$$y_{st} = \alpha + \gamma LIG_s + \delta(m_s - 30) + \theta LIG_s(m_s - 30) + \tau_t + \epsilon_{st} \qquad (1)$$

Estimation uses local linear regression with bias correction and optimal bandwidths as described in (Calonico, Cattaneo and Titiunik 2014b) and (Calonico, Cattaneo and Titiunik 2014a). The outcome measure y_{st} is the percentage of pupils obtaining 5 or more A*-C GCSE grades including English and Maths for school *s* in year *t*. This was the main accountability measure for schools over this period. As per the GCSE rule, the running variable m_s is the

minimum of a school's GCSE performance (as measured by the % of pupils gaining 5A*-C GCSE grades) in the years 2001 and 2002 with the cutoff being where this variable is equal to 30%; LIG_s is a binary indicator whether a school was awarded the LIG, and; τ_t are year fixed effects. Parameter γ is the effect of the LIG policy.

3.2 Validity of RD design

The policy was announced after the data on the variables that determined eligibility had been published so there is no concern regarding possible manipulation of results to obtain funding. However, the RD strategy may be compromised if receiving the LIG changed the probability (either way) that a poorly performing school would be closed. To test for such a possibility three checks are employed: i) tests for the continuity of the density around the threshold (see Figure 2 and Figure 3); ii) tests of the continuity of covariates around the cutoff (Table 2, panel A), and; iii) a test for the continuity of the rate of school closures around the cutoff (Table 2, panel B). All these checks reveal no evidence that schools differentially closed either side of the eligibility cutoff.

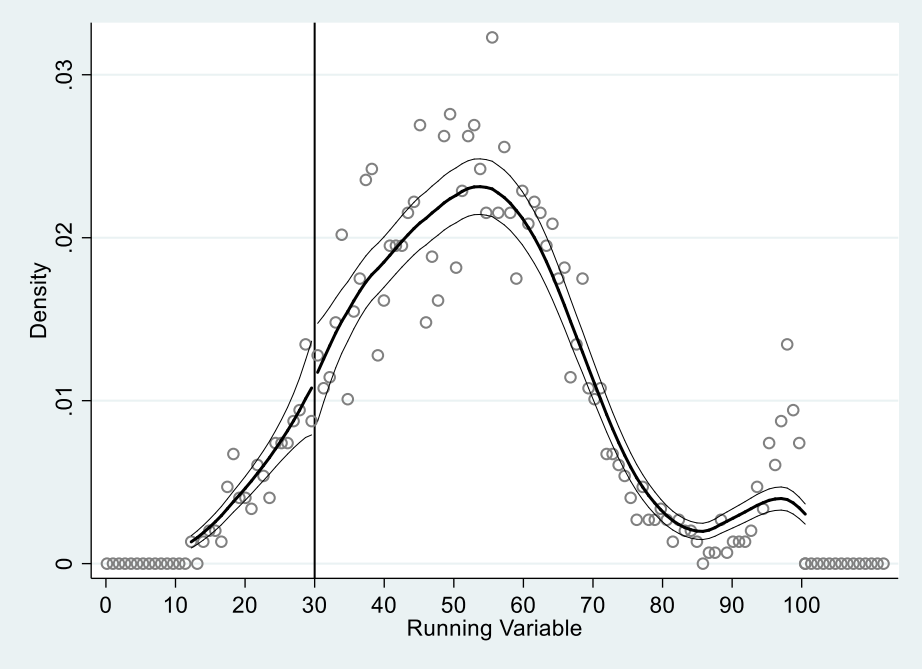

Figure 2 – Density test (McCrary 2008). Test of the null of no discontinuity in density at the cutoff: p=0.968

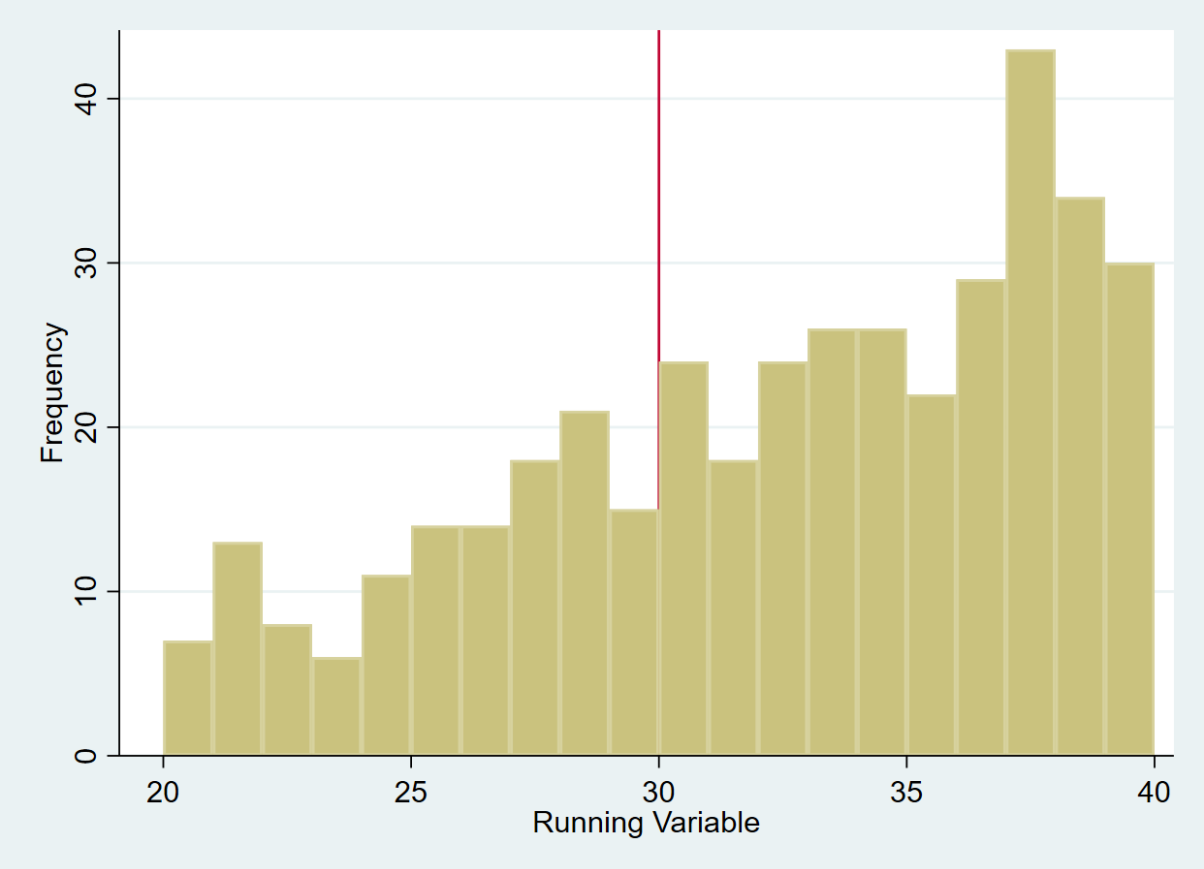

Figure 3 – Frequency histogram of school density around the cutoff (+/- 10 percentage points)

Table 2. Test for discontinuities in covariates, pre-policy outcomes and school closures at the treatment cutoff (local linear regression estimates)

Panel A		**Policy Period (2004-06)**	**Post Policy (2007-09)**
% of pupils eligible for Free School Meals (FSM)	Coefficient (S.E)	-0.045 (2.542)	1.068 (3.044)
	Bandwidth	3.549	3.177
	N	5154	5154
	N^-/N^+	183/234	168/207
Number of pupils in school	Coefficient (S.E)	-218.960 (133.590)	-114.100 (128.970)
	Bandwidth	3.726	4.380
	N	5154	5154
	N^-/N^+	192/249	216/312
% of pupils gaining 5A*-C grades in 2003 (Pre-Policy)	Coefficient (S.E)	-2.283 (2.304)	-2.109 (2.186)
	Bandwidth	6.496	6.923
	N	5154	5154
	N^-/N^+	294/471	297/504
Panel B		**All schools open in 2002**	
School status in 2009 (open=0; closed=1)	Coefficient (S.E)	-0.052 (0.101)	
	Bandwidth	6.876	
	N	1870	
	N^-/N^+	120/185	

Notes: Robust standard errors clustered by school in parentheses. p values: *=p<0.1; **=p<0.05; ***=p<0.01; N^- and N^+ denote the number of cases within the bandwidth below and above the threshold respectively. Estimates are weighted by i) the number of pupils in each school-cohort and ii) a triangular kernel weighting function.

4 Results

4.1 Estimated effect of the LIG policy

Figures 4A and 4B show local linear regression fits either side of the cutoff for the analytic sample. There is a clear discontinuity at the cutoff in the post-policy period, indicating a positive effect of the LIG policy. Figure 5A and 5B display the corresponding charts for the EiC only sample. Recall that this group of schools received the LIG regardless of the value of the running variable. For this group of schools there is no visible discontinuity and thus this supports the view that the discontinuity observed in Figure 4B is not due to some artefact of the data or a common effect for all low performing schools during this era. These findings are reflected in the model (1) estimates in Table 3: the LIG funding had a positive effect on school performance in the years after the funding ended, but not initially. The estimated size of the effect is a +9.124 percentage point increase in the %5A*-C measure, approximately 0.43 of an SD unit increase in performance.

Table 3. Local linear regression estimates of the effect of the LIG policy

		Policy Period (2004-06)	**Post Policy (2007-09)**
Panel A- Main estimates (GCSE rule sample)			
	Coefficient (S.E)	2.262 (1.853)	9.124 (2.869)***
	Bandwidth	5.482	3.127
	N	5154	5154
	N^-/N^+	261/378	168/201
Panel B- EiC schools (placebo)			
	Coefficient (S.E)	0.499 (1.258)	-1.268 (2.016)
	Bandwidth	6.529	5.442
	N	3120	3120
	N^-/N^+	549/492	462/429

Notes: As per Table 2. Controls included for %FSM, the number of pupils in the school and the % 5A*-C in 2003.

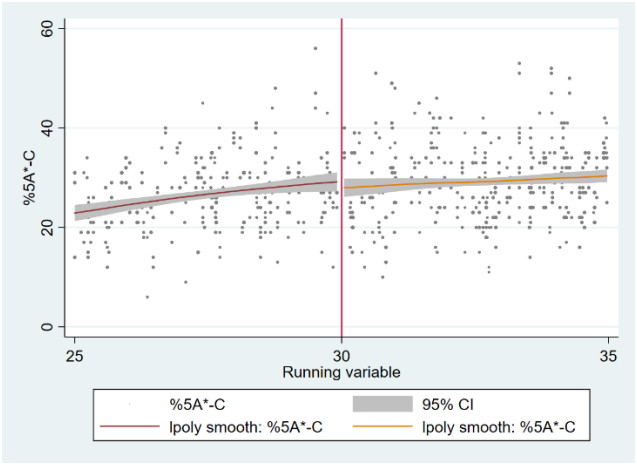

Figure 4A: Local linear regression fit: analytic sample, policy period

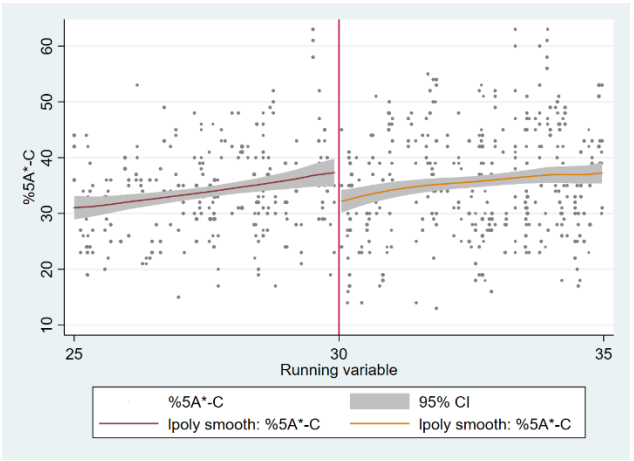

Figure 4B: Local linear regression fit: analytic sample, post-policy period

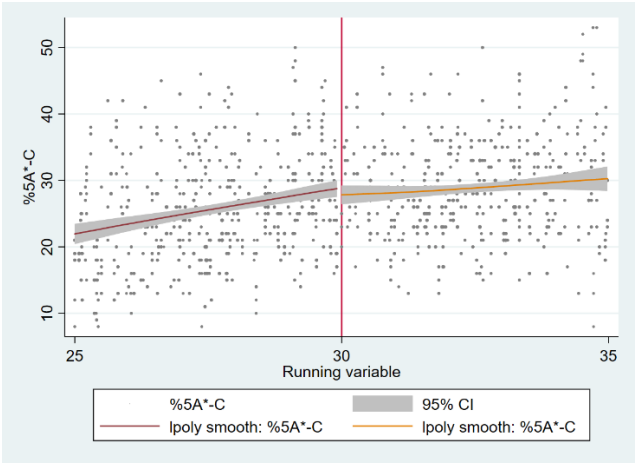

Figure 5A: Local linear regression fit: EiC sample, policy period

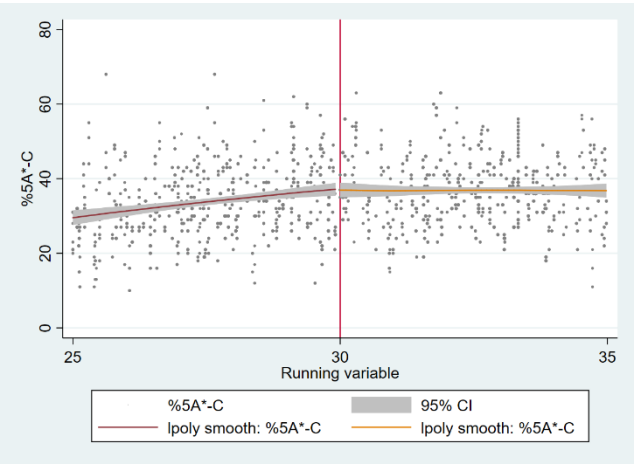

Figure 5B: Local linear regression fit: EiC sample, post-policy period

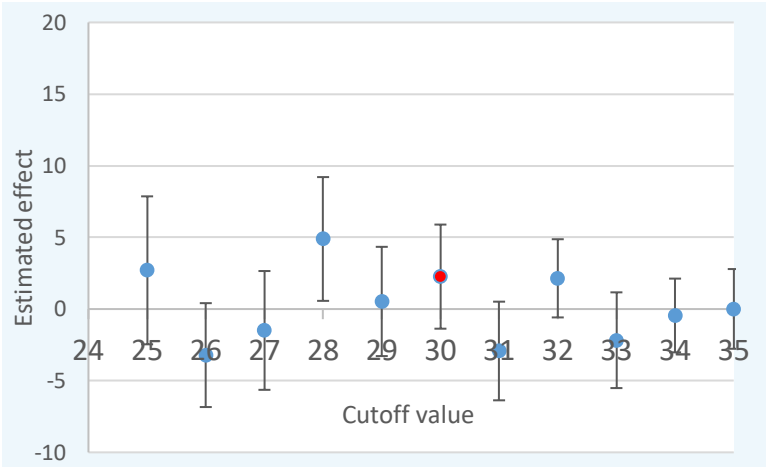

Figure 6A. Placebo cutoffs (true cutoff=30), policy period

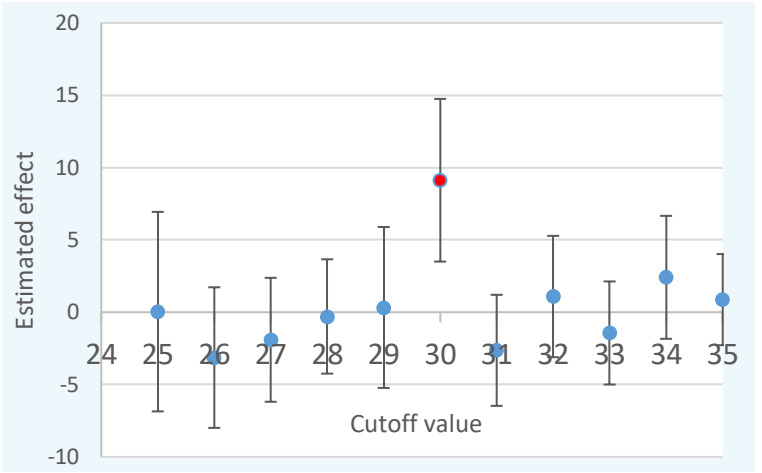

Figure 6B. Placebo cutoffs (true cutoff=30), post-policy period

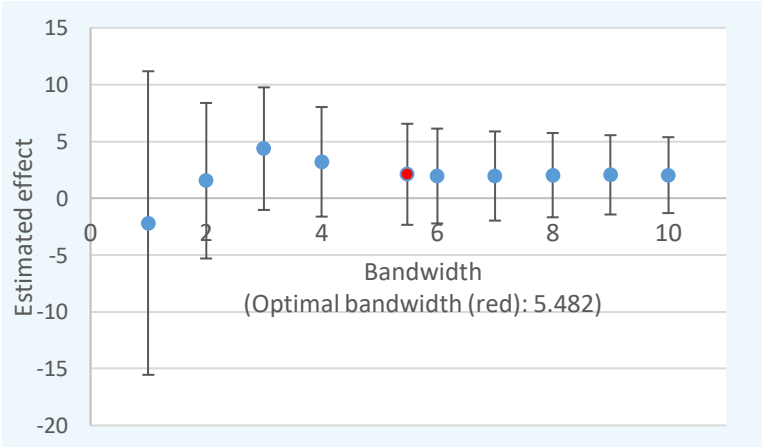

Figure 7A.Bandwidth variation, policy period

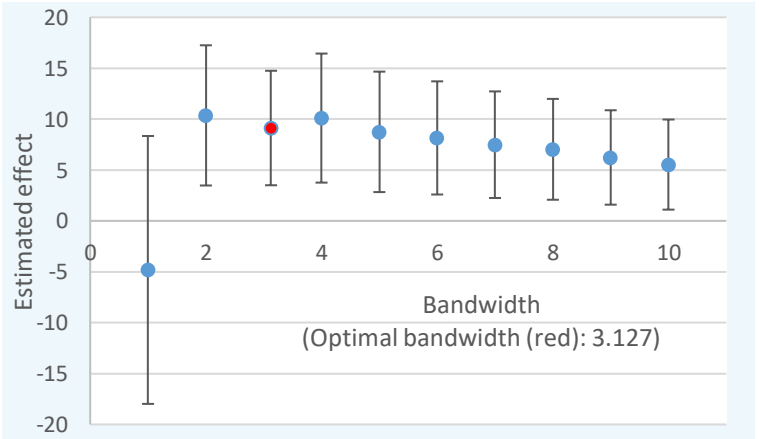

Figure 7B. Bandwidth variation, post-policy period

4.2 Robustness checks

Figures 6A and 6B report 'placebo' cutoffs to test whether significant discontinuities are a feature of the data. For the post policy period, none are statistically significant nor close in magnitude to the estimated discontinuity at the true cutoff. The policy period estimates are consistent with a zero effect during this time. Figures 7A and 7B display the estimated effect by varying the bandwidth; the estimated effects remain positive and statistically significant for the post policy period, regardless of the bandwidth. Table 4 reports the estimated effect of the LIG on an alternative outcome measure – the contextual valued added (CVA) score of the school[5]. Note that this metric is only available for the final year of the policy, 2006, onwards. The results support the main finding that the LIG policy substantially raised pupil performance at the cutoff (the estimate for the post-policy period corresponds to a +1.1 S.D. effect). The CVA measure is also accompanied by a measure of the 'coverage', that is, the percentage of pupils at the end of compulsory education in each school who were included in the calculation of the measure. The lack of discontinuity in this coverage measure (Table 4, panel C) provides some assurance that the positive results of the policy were not due to manipulation of pupil entry into GCSE exams.

[5] This is a measure of average pupil value added by school, based on calculating the difference between each individual pupils' GCSE performance over their best 8 subjects and that predicted by their age 11 test scores and personal characteristics, aggregated up to the school level.

Table 4. Alternative outcome measure – Contextual Value Added

		Policy Period (2006)	Post Policy (2007-09)
Panel A- Main estimates (GCSE rule sample)			
Local linear regression	Coefficient (S.E)	11.438 (7.037)	16.839 (7.558)**
	Bandwidth	4.481	5.264
	N	1718	5154
	N^-/N^+	74/106	246/363
Panel B- EiC schools (placebo)			
Local linear regression	Coefficient (S.E)	-2.237 (4.188)	-0.1688 (5.518)
	Bandwidth	9.219	5.618
	N	1040	3118
	N^-/N^+	236/213	483/444
Panel C- % of pupils at the end of KS4 included in value added measure (Coverage)			
Local linear regression	Coefficient (S.E)	-0.423 (1.250)	-0.286 (1.642)
	Bandwidth	5.260	5.586
	N	1718	5154
	N^-/N^+	82/121	264/384

Notes: As per Table 3.

5 Conclusion

This study makes two contributions. First, that targeted funding to improve school management increases school performance in the long term. The findings therefore concur with (Woo, Lee and Kim 2015) in that school improvement need not necessarily require the threat of sanctions against underperforming schools, such as the replacement of school management, as is common in school 'turnaround' approaches. The estimated lifetime benefits of gaining 5A*-C

GCSEs (including English and Maths) is £104,000 (Hayward, Hunt and Lord 2014)and as the cost per treated school was £525,000, this would imply that the policy would break even if just an additional 6 pupils in each treated school gained 5A*-C (including English and Maths) due to the policy[6]. A +9.124 percentage point increase in the % 5A*-C measure would imply an additional 15 pupils *per cohort*[7] gaining these qualifications, suggesting a large net benefit. However, it should be borne in mind that the RD estimates (and therefore the suggested net benefits) are only applicable to schools in the region of the cutoff and as such, it is not possible to make a cost-benefit comparison of the policy as a whole.

Second, the results suggest that it takes time for the improvements in school management to be reflected in schools' results. This finding provides empirical evidence to support claims that sustained school improvement cannot be achieved immediately and that the transformation of schools should be seen as a long term endeavour (Peurach and Neumerski 2015). An implication of this is that school improvement policies run the risk of being evaluated too soon.

[6] This calculation is based on adjusting the £104,000 lifetime benefit and the total per school £525,000 cost of the policy into 2006 prices (£89,664 and £538,606 respectively), then dividing the cost per school by the individual lifetime benefit ~ 6 pupils,

[7] The average school-cohort in the sample is 161 pupils; 9.124% of 161 = 14.69 ~ 15 pupils.

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