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Heterogeneous Effects of School Autonomy in England*

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Abstract

A 2010 education reform gave English schools the option to become academies, autonomous but state-funded schools. Academies can opt for two different models of governance by choosing to remain standalone schools or join an academy chain. We investigate whether the governance model affects student achievement, exploiting administrative records on primary school-age students and using a grandfathering instrument for attending a converted school. We find that students in academy chains have higher end-of-primary school test scores. Effects are stronger for disadvantaged students. Survey data suggest that chains favor management changes, whereas standalone academies make changes related to educational practices.

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1 Introduction

Over the past two decades, many countries have increasingly seen in school autonomy the way forward to raise student achievement. The main rationale for increasing autonomy is to transfer more power in the hands of those who are likely to have better information on how to run their school, such as school principals or local governing bodies. Indeed, US-based studies generally find positive effects of autonomous - or 'charter' - schools on student achievement (Hoxby and Murarka, 2009; Angrist et al., 2010; Abdulkadiroglu et al., 2011; Dobbie and Fryer, 2011, 2015; Abdulkadiroglu et al., 2016; Dynarski et al., 2018; Walters, 2018), as do Bohlmark and Lindahl (2015) for Swedish 'free schools' and Eyles and Machin (2015) and Eyles et al. (2016) for English secondary academy schools.[1]

The specific channels through which school autonomy works are still debated. Teachers' feedback, tutoring, longer school time, a culture of high expectations and *ad hoc* practices targeting disadvantaged pupils seem to be the most successful practices in charter schools (Dobbie and Fryer, 2013; Fryer, 2014). Angrist et al. (2013) link charter schools' success to the use of the 'No Excuses' approach. Other recent papers, however, suggest that management practices, such as changes in the management structure (Eyles and Machin, 2015) and stronger accountability and high quality school leadership (Bloom et al., 2015), can play an important role in explaining autonomous schools' success.

In this paper, we look at the role of governance and study the impact of different governance models in primary autonomous schools on student achievement. In England, following a 2010 reform, all state-funded schools can voluntarily become 'academies' - publicly funded but autonomous schools. Schools can decide to convert as standalone academies, also called single-academy trusts (SATs), or join a school chain (multi-academy trusts, or MATs). This choice results in two distinct models of governance with different degrees of centralisation. On the one hand, standalone academies are now responsible for all managerial functions. On the other hand, MATs' managerial activities are coordinated by a centralised trust, with a clear separation of roles between members of the trust and head-teachers, whose main role is to run their school.

The majority of academies are represented by pre-existing schools that decide to become academies. In this respect, they are similar to US public schools that become charters fol-

[1] More recent works also look at long-term outcomes, such as college attendance, and find positive effects on students who attended charter schools compared to those who did not (Dobbie and Fryer, 2015; Angrist et al., 2016).

lowing a school takeover. However, while US charter schools often serve a large fraction of disadvantaged students, academies include a large number of good and outstanding schools. In addition, unlike charters and free schools in Sweden - that together with the US was a forerunner of school autonomy - academies represent a unique case study, since England is progressively moving towards a fully decentralised system, with an increasing number of schools that every year decide to become academies.

We focus on early Converter primary academies, defined as those schools converted between 2010 and 2012.[2] As more schools become academies, the funds available to Local Authorities (LAs) - the local government units in charge of education - are expected to decrease, as they are proportional to the number of students enrolled in state-funded schools maintained by them. This may affect the quality of the services provided, thus leading more schools to convert. Hence, we focus on schools whose decision to convert was not felt as a judgment call, as incentives to become academies may have changed over time. These early Converters are largely represented by high-achieving schools, and the vast majority were rated either outstanding or good by Ofsted inspections.[3] We exploit within-school variation in attainment across cohorts differentially exposed to academisation, and estimate the effects of exposure to a MAT or SAT on student achievement at the end of primary school. We further exploit availability of detailed data on children's block of residence to control for fixed unobserved attributes at this level.

In this setting, both the school's governance model choice and individual students' enrolment decisions are endogenous. Although we do not have an instrument for the school's choice, we show that it is not predicted by any observable school characteristic. Additionally, we perform a falsification test to show that our results are not confounded by pre-treatment trends. As for student self-selection into and out of academies, we adopt an Instrumental Variable (IV) approach that exploits the fact that students who were enrolled in a school before its conversion are guaranteed a school place (see, e.g., Abdulkadiroglu et al., 2016). Since it is hard for parents to anticipate the future conversion into academy, early enrolment decisions can be considered orthogonal to the school's conversion decision.

We find that schools belonging to chains improve student performance at the end of primary

[2]Similar to Eyles et al. (2017), we exclude from the sample 'sponsor led' academies. These are represented by underperforming schools that often become academies following a government intervention, and are supported by a sponsor (a person or organisation).

[3]Ofsted is the Office for Standards in Education, Children's Services and Skills and regularly carries out inspections in schools. Following an inspection, a school is rated from outstanding to inadequate. Inspections are carried out on a rolling basis depending on the outcome of the previous inspection.

school relative to SAT academies. On average, one extra year of exposure to MATs with respect to SATs increases math and language test scores by about $0.036 - 0.032$ standard deviation (σ), which corresponds to 0.71 and 0.3 points (about 1% of the average) respectively. Since in the most complete specifications we control student baseline achievement, these estimates can be interpreted in terms of value-added, or progress made by the children. These positive effects seem to fade out after four years from conversion. We show that this is mainly due to an increase in achievement effects over time for students attending SATs, suggesting that handling autonomy may be harder for standalone schools at the beginning but they eventually catch up.

In addition, we find differential effects by student socio-economic status and baseline achievement. Schools belonging to MATs are particularly effective at raising math test scores for more disadvantaged students. After three years of exposure, their test scores are about 0.16σ (3.5 points, or 6% of the average) higher than those enroled in SAT schools, with respect to a smaller 0.079σ increase for other students. The effect on language scores is slightly higher during the first two years after conversion, but similar after that. In terms of baseline achievement, we show that the positive effects found for MAT schools are mainly driven by students who were in the middle of the achievement distribution and, to a less extent, by top achievers. Our results are robust to a falsification test that moves each school's conversion year before the actual conversion event.

Finally, we exploit new and highly detailed data on academies income and expenditures and unique survey data on changes introduced by academies to shed light on the potential mechanisms underpinning our findings. This analysis shows that MAT schools seem to benefit from economies of scale and spend less than SATs on ICT and learning resources. At the same time, they spend more on additional support staff (e.g. laboratory technicians), which may indicate larger investments in activities (e.g. labs) that can further support the students. Additionally, survey data on MATs and SAT schools' practices show that, after conversion, SAT schools are more likely to implement school level changes, such as changing the curriculum and increasing the number of pupils, while MATs favour organisational level changes, such as replacing school leaders, reconstituting the governing body and changing the performance management system for teachers. Even though these figures should be considered with caution given the limited coverage of the survey, they seem to suggest that managerial practices play a key role in boosting pupils' achievement.

Why should the fact that different governance models affect student achievement be of interest to researchers and policy-makers? Following the introduction of academies, the public debate on school governance has emphasised the potential risks faced by standalone academies, mostly related to their lack of expertise in managerial functions. The main concern is that autonomy requires a body of expertise in managerial fields that traditional representatives of local schools' governing bodies may not be endowed with. Indeed, as the program developed, policy-makers have supported chains as an efficient way to foster schools' collaboration and reduce the educational gap between advantaged and disadvantaged students (Francis et al., 2016). Along with it, the White Paper *Educational Excellence Everywhere* published by the Department for Education in 2016 states that MAT is the preferred model as collaboration allows schools to benefit from the most successful leaders and their expertise.

This study represents the first empirical contribution that investigates models of governance in autonomous schools in England. Over the recent years, the academic literature has mostly attempted to test the effectiveness of school autonomy by focusing on the impact of autonomy *per se* on student achievement. Conversely, very little has been said on the role played by different governance models in autonomous schools. This is gaining greater importance as recent academisation trends show that, although the number of academies has massively increased, by 2016 the vast majority of schools becoming academies were joining MATs (Figure 1). Hence, it is crucial to understand whether and how they affect student outcomes.

Studies on autonomous schools have also often focused on low-performing schools, with very few exceptions (e.g. Eyles et al., 2017; Dynarski et al., 2018). We contribute to this growing, albeit relatively limited, literature by focusing on high-achieving autonomous schools. Our paper is closely related to the paper by Eyles et al. (2017), which looks at the effect of primary academy schools on student performance using future academies as control group, and finds no achievement gains. In our paper, we show that their results mask substantial heterogeneity that depends on the governance model chosen by the academy. We also propose an alternative empirical strategy that takes into account the change in schools' incentives to convert over time, and therefore the potential endogeneity in the timing of conversion.

Finally, we contribute to the growing literature looking at the role management practices play in shaping student outcomes. Eyles and Machin (2015) find that changes in the management structure, together with changes in the curriculum, are the main factors underpinning pupils' improvement in secondary academies. Similarly, Bloom et al. (2015) explore the determinants of autonomous schools' success in several countries, and suggest that management practices can be crucial to foster school performance and explain disparities in the quality of education across schools. Using new survey data collected by the Department for Education, we investigate how the implementation of educational vis-a-vis managerial practices can explain our results.

The paper is organised as follows: Section 2 presents the academy reform and discusses the different models of governance; Section 3 lays down the empirical strategy and possible threats to identification; Section 4 presents the results; in Section 5 we evaluate possible mechanisms behind our results; Section 6 concludes.

2 Institutional Setting

The English School System and the Academy Reform

Primary education in England is organised in two phases, Key Stage 1 (KS1) and Key Stage 2 (KS2). Children enter primary school in Reception year, when they are aged 5. KS1 runs from Year 1 to Year 2, when students are aged 7. KS2 runs from Year 3, when students are aged 8, to Year 6, when students are aged 11. State-funded schools are the majority and enrol about 95% of all students (Department for Education, 2016a). The majority of students attend 'community' schools, which are managed by the LAs. LAs recruit teachers and staff, provide schools with all the services they need and administer the school budget set by the central government. The other most common state-funded schools are faith schools, which enjoy some degree of autonomy from the LA (e.g. on admission criteria).

The Labour government introduced secondary school academies in 2000 through the Learning and Skills Act 2000, with the aim of improving performance by providing head teachers with direct control over their schools. Similarly to US charter schools, for the first 10 years the reform targeted only low performing secondary schools classified as inadequate by Ofsted inspections. The reform was then expanded to all primary and secondary schools by the coalition government in July 2010. Beside sponsor led academies, which are underperforming schools often forced to convert following government intervention, converter academies, for which the conversion is voluntary, appeared. Since 2010 the academisation process grew dramatically, and as of April 2020 5,951 out of 16,766 primary schools have already become academies (Department for Education).[4]

[4]Last update available at: https://www.gov.uk/government/publications/open-academies-and-academy-

Academies are independent from local and central government and are non-profit charitable trusts. Similar to state-funded schools, they are entirely funded by the central government through the Department for Education (DfE). However, they are autonomous in aspects such as staffing (recruiting and paying teachers and staff, staffing structures, career development, discipline and performance management), provision of services (e.g. maintenance, HR, audit, legal services), and setting the curriculum (with the exclusion of a few subjects they are free to diverge from the traditional curriculum). Academies are free to set their own admission criteria, but they are subject to the guidelines stated in the Admission Code, and cannot select students based on ability.[5] Unlike state-funded schools, academies have a board of directors that acts as a Trust and the trustees are legally, though not financially, accountable.

A significant number of studies have been conducted in the US, where, since the late 1990s, the government has targeted low performing schools in deprived areas and forced them to become autonomous with the aim of implementing *ad hoc* policies to boost pupils' results, and consequently reducing the achievement gap among students. Similar to English academies, 'charter schools' are publicly funded and tuition-free, but enjoy substantial operational autonomy from local and central government on the decisions concerning school curriculum, staffing, and the educational approach (e.g. school day length, school philosophy). However, charter schools are often located in deprived areas and serve a large fraction of low performing or minority students, while English academies include a substantial number of high achieving schools. Additionally, while academies can only be nonprofit organisations, US charter schools can be run for profit.

Table 1, columns (1) to (4), shows the main characteristics of academies and state-funded primary schools. Panel A shows that academies enrol, on average, less students eligible for free school meals (FSM), black students and students with special educational needs (SEN). As expected, early converter academies tend to perform better compared to traditional state-funded schools, with students enrolled in academies obtaining better results in both KS1 and KS2 tests (Panel B). Finally, academies are significantly bigger and tend to have a higher pupil-to-teacher ratio (Panel C).

projects-in-development. Official data regarding April 2020 are available upon request.

[5]A recent paper by Machin and Sandi (2018) investigates the exclusion of poorly performing pupils in academies. They find that the exclusion rate is higher in schools converted before 2010 compared to those converted in the second phase of the program (post-2010). However, they argue that such exclusion does not aim at boosting schools' performance but it is, instead, the result of enforcing rigorous discipline codes.

Multi-Academy and Single-Academy Trusts

Besides sponsor led and converter academies, another important distinction arose after 2010. Together with the decision of converting, converter academies can choose between converting as a standalone academy or joining a chain of academies. Such distinction resulted in two different models of governance. Standalone schools become SATs and the governing body - that now no longer requires LA governors - takes on all of the responsibilities. MATs have instead a single governing body that runs all the schools belonging to the chain - in our sample, on average, they manage about 7.4 schools.[6]

Hence, the main distinction between MATs and SATs concerns the governance structure (Figure 2). The trust running the MAT is responsible for all the academies in the chain. Schools belonging to the MAT share the same board of governors, which takes up most of the tasks previously performed by the local governing bodies of the single schools. The foundation members of the trust have ultimate control over the schools and appoint the board of governors (also called directors or trustees), which set the direction of the MAT, hold head-teachers accountable, and ensure financial probity. The presence of governors therefore creates an additional tier of governance between foundation members and the local governing bodies of the schools.[7] Trustees can delegate a number of functions to the local governing body of single schools, whose functions are now limited compared to local governing bodies of SATs. Indeed, the model introduced by MATs aims at removing pressures on local governing bodies and avoiding the recruitment of high skill governors for each single school (Grotberg and Lobb, 2015).

The 2010 reform has therefore explicitly allowed for two different models. SATs stand for a decentralised system in which each single school is responsible for all the decisions and services, while MATs are based on a centralised system in which functions and operations are attributed to different actors along the 'governance chain'. In particular, managerial functions are carried out by the governors, whose knowledge of business practices can be expected to be better than that of school head-teachers. Indeed, as shown in Table 2, trust boards handle financial and legal compliance, senior appointments, and risk management, while schools

[6]MATs can be made up of only primary or secondary schools, or include a mix of them. They do not face any geographical constraint, and although in our sample the majority of schools belonging to a given MAT are located in the same LA, over time the number of schools joining MATs has increase and so has their geographical spread.

[7]The board is made up of at least three signatory members, the CEO, and two elected parents. No more than 20% of trustees can be persons associated to a LA (e.g. head-teachers of community schools, LA officers). The average size of boards is 8 members, and more than half of MATs have between 7 and 10 members.

mostly handle operational functions (e.g. school development plans, strategies, school staffing structures design), which in few cases are also carried out at regional level.[8]

The choice of the governance structure for converter academies ultimately rests on the schools, which may opt for the preferred model. A survey conducted by the Department for Education (Cirin, 2014) reveals very different reasons for converting between MAT and SAT schools. The former were more likely to convert to create opportunities for collaboration with other schools and raise educational standards - in the survey, these are mentioned as the top reason by 28% and 22% of MAT schools respectively. The latter instead decided to become academies mainly to obtain more funds (28%) and use them as they see fit (26%). Additionally, only 13% of MAT schools mention independence from the LA as main reason, in contrast to 18% of SAT schools.

As discussed in the Introduction, the choice of the governance model itself seems to have changed over time, as shown in Figure 1. Although right after the reform converter academies were more likely to convert into standalone academies, in recent years the proportion of schools belonging to MATs has substantially increased. Finally, MAT and SAT schools are different in terms of student composition. Table 1, columns (5) to (8), shows that MATs enrol more FSM eligible, black origin and SEN students (Panel A) and less high-performing students (Panel B). Schools belonging to MATs also tend to be smaller and have a lower pupil-teacher ratio (Panel C).

3 Empirical Methodology and Identification

Data

We use data from the National Pupil Database (NPD), a unique and rich dataset containing information at pupil and school level in England and covering all students attending publicly funded schools. The dataset contains detailed student demographics such as gender, ethnicity, language spoken at home, eligibility for FSM and SEN status, pupils' block of residence, and school attended.[9] The main source of information on academies is Edubase (now called 'Get

[8] Regional clusters represent an further tier of Governance between schools and the Trust. As they grow in size, trusts may choose to decentralise some functions to regional hubs whose proximity to schools makes the management more efficient.

[9] Blocks are Lower Layer Super Output Areas (LSOAs), a geographical unit created by the Office for National Statistics (ONS) for census reporting purposes containing 800 households on average.

information about schools'), a DfE-maintained dataset that contains school level data on single and multi-academy trusts (e.g. time of conversion, date in which the school has joined a chain, type of support, trust's size).

The NPD includes information on student achievements at the end of KS1 and KS2. Although at the end of KS1 students are assessed by their own teachers, these assessments are low-stake evaluations and teachers have no incentive other than that of providing a fair evaluation of their students. Hence, KS1 attainment can be considered a good proxy for pupils' performance at year 2. KS2 tests are instead national standardised tests in math and language taken at the end of primary school (year 6) and marked by external markers. At both stages students are also awarded a Level of attainment depending on the score they obtain - from Level 2 to Level 4 at KS1 and from Level 3 to Level 5 at KS2.[10]

We complement individual-level NPD data with a number of additional sources. We use the School Census and School Workforce Census (SWC) to obtain data on teacher characteristics, such as pupil-to-teacher ratio and teachers' qualification. We then use publicly available data on academies funding to obtain detailed information on school funding by category (e.g. funding for development and training, learning resources, SEN students).[11] Finally, we link the NPD to Ofsted inspection reports from 2005 onwards, which are publicly available on the UK government website.[12]

We keep converter academies whose conversion is between July 2010 (the month in which the academy reform took effect) and December 2012. We retain only schools that remain continuously in the sample over time. The number of schools becoming (converter) academies in 2010, 2011 and 2012 is 15, 258 and 327 respectively. The final sample therefore includes 600 schools and $273,987$ students over $2005-2016$. Statistics on students attending traditional state-funded schools are obtained considering all state-funded schools and their students located in an LA with at least 1 converter academy over $2010-2012$.

[10]These levels are meant to capture the position of the student in the achievement distribution. Students awarded the lowest Level (2 and 3 at KS1 and KS2 respectively) are students performing below expectations; those awarded the middle Level (3 and 4 at KS1 and KS2 respectively) are students working at the expected level; those awarded the top Level (4 and 5 at KS1 and KS2 respectively) are students performing above the average.

[11]The School Census is available yearly from 2006 as part of the NPD. More recent data from the SWC and on academies funding are publicly available at https://www.gov.uk/government/collections/statistics-school-workforce and https://www.gov.uk/government/collections/statistics-local-authority-school-finance-data respectively.

[12]Ofsted reports can be accessed at https://www.gov.uk/government/statistical-data-sets/monthly-management-information-ofsteds-school-inspections-outcomes.

Empirical Specifications

We investigate heterogeneous effects of conversion between standalone academies and academies in chains. In particular, we are interested in estimating the effects of exposure to MATs or SATs on KS2 test scores in math and language. We consider up to four years of exposure to an academy, which represent the length of the KS2 phase. This approach has the advantage that we can control for student baseline attainment, measured at the end of KS1. Our estimates of the impact of governance on student achievement can therefore be interpreted in terms of progress made by the student or value-added provided by the treatment.

In order to avoid comparing schools whose unobservable characteristics may lead to ambiguous conclusions, we exclude non-academies from the sample and limit our analysis to students attending academies. However, the timing of conversion can also potentially be endogenous since, as outlined in the Introduction, incentives to become academies may have changed over time. Consistent with this intuition, Figure 1 shows that the governance model chosen by academies was substantially different between early and late converters. Additionally, Table 3 shows that also in our sample of early converters, 2012 converters are different from 2011 converters, enrolling more FSM eligible students, less black origin and native students, and less high-performing students. Hence, we compare schools that decide to convert in the same year to account for the potential endogeneity in the timing of conversion.

We exploit variation within schools and across cohorts of students and compare students within the same school who take KS2 tests after conversion with students who took KS2 tests before conversion. In all regressions we include LA-specific time trends to account for general trends in test scores that may have differed across LAs. In the most complete specification we also include block fixed effects, which control for fixed unobserved attributes of students' residence. We begin by estimating the following regression:

$$Y_{ibsat} = \alpha_0 + \alpha_1 D_{ibsat} + \alpha_2 D_{ibsat} \cdot MAT_s + \theta_1 X_{ibsat} + \delta_s + \eta_b + \gamma_t + e_{at} + v_{ibsat} \qquad (1)$$

where Y_{ibsat} is the KS2 score of student i living in block b, enrolled in school s located in LA a and taking the test in year t. Test scores are standardised by subject and year. D_{ibsat} is the number of years spent by each pupil in the academy. For all cohorts of pupils taking the test before the conversion year D_{ibsat} takes value 0. MAT_s is an indicator taking value one if the academy belongs to a chain and 0 otherwise. The coefficient of interest is α_2, representing the impact of being exposed to one additional year to an academy that joined a MAT with respect to a SAT. X_{ibsat} is a vector of pupil characteristics including gender, ethnicity, language spoken at home, FSM eligibility, SEN status and pupil attainment at KS1 in the relevant subject. e_{at} indicates LA-specific time trends. Finally, we add school, block and year fixed effects (δ_s, η_b and γ_t respectively). The time index t runs across cohorts of exam takers, with $t = 2005, \ldots, 2016$.

We then allow for the MAT effect to vary depending on the specific number of years of exposure. One may indeed worry that academies 'teach to the test' that is, teachers train students attending the last year by focusing on KS2 test's subjects.[13] If that was the case, we would not expect different effects for different years of exposure. We therefore consider the following regression:

$$Y_{ibsat} = \beta_0 + \beta_1 D_{ibsat} + \sum_{k=1}^{4} \beta_{2k} \mathbb{1}(D_{ibsat} = k) \cdot MAT_s + \theta_2 X_{ibsat} + \delta_s + \eta_b + \gamma_t + e_{at} + \varepsilon_{ibsat} \quad (2)$$

where we allow the returns to MAT exposure to vary depending on the total number of years a child spends in a MAT. These are captured by $\mathbb{1}(D_{ibsat} = k)$, which represents a set of indicator variables taking value 1 when the number of years a student has spent in an academy is equal to k, with $k = 1, 2, 3, 4$. Other variables follow the notation defined above.

Since both MAT_s and D_{ibsat} are endogenous choice variables, one should still be cautious in interpreting estimates of β_1 and β_{2k} from equation (2). On the one hand, the choice of the school to join a MAT may be correlated to school observables or unobservables, such as trends in the strength and composition of student cohorts. On the other hand, D_{ibsat} can be correlated to parents' decisions and timing of enrolment in an academy. We address these issues in the following two sections.

School Decisions and Intake

We begin by addressing the school's decision concerning the model of governance. In our context the determinants - observable and unobservable - of the conversion decision are irrelevant since we condition on schools that have already become academies. However, the decision to

[13] In the US for instance the establishment of accountability policies aimed at measuring school performance and improving student achievement led teachers and schools to focus specifically on high-stakes subjects, as documented by Klein et al. (2000) and Jacob (2005).

convert as SAT or join a MAT could be correlated to pre-existing trends in school performance, characteristics, and intake.

We first test for the presence of pre-conversion trends by plotting the evolution of school and student characteristics over time by type of school. Figure 3 shows the share of students eligible for FSM (Panel A), natives (Panel B), SEN students (Panel C) and school enrolment (Panel D) for MATs, SATs and traditional state-funded schools.[14] The characteristics follow a similar and parallel trend across different types of schools, so that we can rule out the presence of different pre-trends in student and school observables.

One may still worry that schools intentionally choose the year of conversion depending on the strength of the cohort taking KS2 tests in the conversion year. This would then boost KS2 results of the school independently on the year of exposure. We check for this by looking at each cohort's results at KS1. Figure 3 plots the evolution of KS1 teacher assessments over time in panels E and F, showing the share of students working above the average in math and language.[15] As before, the share of top students in MATs, SATs, and other schools follow a similar pattern, pointing to the absence of different pre-trends in school performance.

We then perform an additional test for the absence of pre-trends, focusing specifically on the school's decision to join a MAT after conversion. We estimate the following regression, at school level:

$$MAT_s = \eta_0 + \eta_1 \Delta M_s + \eta_2 \Delta W_s + \psi_s \qquad (3)$$

where MAT is a dummy taking value 1 if school s belongs a MAT and 0 if it is a SAT. ΔM_s is a vector of pre-conversion changes in school performance: it includes KS2 test scores and KS1 assessments by school teachers in math and language, as well as KS1 average point score. ΔW_s is a vector of changes in cohort composition before conversion and includes controls for gender, FSM eligibility, ethnicity, language spoken at home, SEN status, and grade enrolment.

The equation is estimated over the period $2009-2005$, using differences between 2009 and 2005 (Table 4, column (1)) as well as 2009 and 2007 (Table 4, column (2)) in school performance and composition.[16] Results show that none of the coefficients predict the decision

[14]In the figures the time of conversion is standardised to zero. As outlined in the Data Section, we include in the sample of state-funded schools only those located in LAs where there is at least one academy of our sample.

[15]Results obtained using the school level average point score in each subject are similar and are available upon request.

[16]Since 2010 is the last year before the reform took effect, one could also estimate the same regressions over $2010-2005$. However, in 2010 part of schools boycotted the KS2 tests, and therefore we would not be able to

to join a MAT (only enrolment in column (1) and black origin in column (2) are significant, and only at 10% level).

Parental Decisions and Students' Selection

The second concern in this setting is the endogenous sorting of students across MATs and SATs. School mobility is relatively high and tends to grow the closer we get to the last year of primary school. In the period we consider about 19% of students have changed school after entering the KS2 phase. Since students can change school at any point in time, every year the fraction of students who spent all previous years in the school will be mechanically lower. This implies that any estimate one would get with a simple OLS regression would not reflect the true impact of MATs. Indeed, one would not take into account that not all students taking KS2 tests have spent the same number of years in the school.

Additionally, schools that decide to become academies may attract better students, so that the effects of being exposed to a MAT would be the result of self-selection of good students into a MAT or SAT school. If selection is correlated with pupils' unobservable characteristics, equation (1) would provide biased estimates of the effect of exposure to a MAT.

In order to deal with endogenous self-selection of pupils into academies we exploit the fact that the enrolment decisions made by parents usually happens years before the conversion. Additionally, both the 2010 reform and subsequent single schools' conversion decisions could hardly be anticipated by parents.[17] Hence, we can safely assume that enrolment in a MAT or SAT school before the actual year of conversion is orthogonal to the school's decision of becoming an academy.

We exploit the same grandfathering instrument used by Abdulkadiroglu et al. (2016). Similar to their identification strategy for US charter schools, we instrument student enrolment in an academy at the time of KS2 tests with a variable indicating whether the student was enroled in an academy in the year before the conversion. As school conversion could not be anticipated by parents, enrolment in a MAT or SAT school after conversion of students who were already enroled before conversion can essentially be considered passive.

estimate this regression for our final sample. Results considering this time window are similar and are available upon request.

[17] As argued by Eyles et al. (2017), the reform proposal was first presented in April 2010 and implemented shortly afterwards.

4 Results

Governance and student achievement

We begin by studying how the different governance models affect student achievement. Panel A of Table 5 shows OLS estimates obtained from regression (1) for math and language test scores. The first row reports coefficients for the impact of one additional year of exposure to an academy. The second row shows instead the marginal gain for pupils exposed to one extra year of MATs compared to those in SATs. For both math (column(3)) and language (column (6)) there seems to be a negative effect of SATs on student achievement and a positive effect of MAT exposure. These columns, presenting the most complete specification, suggest that one extra year of exposure to MATs improves pupils' test scores by 0.027σ and 0.017σ (about $0.55 - 0.15$ points, or 0.8 to 0.5% of the average) in math and language respectively, with the two coefficients significant at 1% level.

It is worth noting that in this context if we considered SAT and MAT estimates together that is, without taking into account the heterogeneity in governance models, we would find very small effects - and no effect at all for math - on a student achievement. Despite the different sample and empirical strategy considered, this is consistent with the findings of Eyles et al. (2017), who find no overall effect of primary academies on students achievement.

Panel B shows OLS estimates obtained from regression (2), highlighting slightly different patterns for math and language. The gain in math test scores (Column (3)) is 0.046σ (about 1 point) after one year of exposure, peaks at three years (0.1σ) and after four years is about 0.08σ (1.6 points). These estimates suggest that the improvement is increasing over time (ie, the more the years of exposure to a MAT, the higher the achievement compared to SAT students) but tend to stabilise after three years. A different pattern can be observed for language test scores (column (6)), which increase immediately after one year of exposure (about a 0.069σ, or 0.6 points, increase) and then stabilise, with test score gains being about 0.057σ (0.55 points) after four years.

These estimates do not take into account that students can endogenously sort across SAT and MAT schools. Hence, we use the Instrumental Variable (IV) strategy outlined in the previous Section and estimate regressions (1) and (2) using a 'grandfathering' instrument for the years of exposure. In regression (1) we instrument D_{ibsat} with an indicator variable for students who were enrolled in a school before its conversion into an academy. We further instrument the interaction term ($D_{ibsat} \cdot MAT_s$) with the grandfathering indicator interacted with the MAT indicator. We replicate the same logic in regression (2), where each $k = 1, 2, 3, 4$ indicator variables is instrumented with a grandfathering indicator individuating whether the student was enrolled in an academy school k years before.

2SLS estimates of the impact of different governance models on student achievement are similar to OLS estimates presented in Table 5. Table 6 shows 2SLS estimates of regressions (1) and (2) and related first stage estimates. Panel A shows the estimates of the marginal gain of attending a MAT compared to a SAT school. Columns (3) and (6) suggest that one extra year of exposure to a MAT school raises test scores in math and language by $0.036 - 0.032\sigma$, or 0.71 and 0.3 points respectively (about $0.9 - 1\%$ of the average). Panel B breaks down the effects by years of exposure. As columns (3) and (6) suggest, the improvement in math scores increases with years of exposure (reaching 0.1σ after three years), whereas improvements in language scores tends to slightly decrease in the years of exposure. Importantly, after four years the magnitude of the effect substantially decreases (in particular for math) and it is not statistically significant (except for language at 10%).

The pattern of 2SLS and OLS estimates is consistent with the first stage estimates presented in columns (4) and (8). Focusing on Panel B, the first stage coefficients can be interpreted as the fraction of students who have spent the full number of available years in the MAT (i.e. students who have not changed school) in each year after conversion. To exemplify, if all students taking KS2 tests after one year had been in the MAT before conversion, the 1 year coefficient would be equal to one.[18] The coefficient is instead 0.976, implying that 97.6% of students remain in their MAT school after conversion for the last year of primary school. After four years - when OLS and 2SLS estimates diverge more - the same number drops to 0.841, implying that 85.1% of students remain in the academy post conversion for the last four years of primary school. Our estimates imply that within the sub-group of academies, student mobility is relatively high, with around 15% of students failing to spend the entire Key Stage 2 phase in the same school.[19]

These results support the notion that MATs are more effective than SATs in raising student achievement. The improvement in KS2 test scores happens across the board, as the magnitude of the coefficients is similar for math and language. Since in the main specification (columns

[18]Panel A's coefficients have a different interpretation. They represent the predicted number of years that a child who was already enroled before conversion spends in an academy with respect to those who enrol into an academy or MAT after conversion.

[19]These estimates are in line with those obtained by Eyles et al. (2017), and follow the same pattern. They estimate a coefficient of about 96% after one year, and 87% after four years.

(3) and (6)) we also control for student's baseline achievement (proxied with KS1 scores), the effects can be interpreted in terms of progress made by the children (or value-added). Additionally, the mild gradient for math in the years of exposure shows that newly converted schools do not seem to 'teach to the test', but rather the longer a child is exposed to an academy (up to three years), the larger the gain.

Despite the overall positive impact of MAT school on student achievement, the effects seem to fade out by the fourth year. We investigate what drives this pattern in Figure 4, which breaks down the specific effect of MAT and SAT schools on student achievement. In the figure we plot 2SLS coefficient estimates obtained using a specification similar to regression (2) where we replace D_{ibsat} with four interactions of D_{ibsat} with an indicator for being a SAT school. Although the estimates of the specific MAT and SAT effects obtained this way are more imprecise, they highlight that the decrease in coefficients' magnitude observed in Table 6 are not due to a decrease in MAT effectiveness over time, but rather to an increase in SAT effectiveness. This pattern is consistent with the intuition that SAT schools may find it hard at first to handle the burden of autonomy, but they slowly adjust to the new status and eventually catch up.

Heterogeneous effects

In Figure 5 we investigate heterogeneous effects focusing on student socio-economic status (SES), baseline (KS1) achievement and school's conversion wave. As the 2010 academy reform primarily aimed at reducing the educational gap between students with different socio-economic backgrounds, it is particularly important to focus on this aspect. We define disadvantaged students as those qualifying for free school meals or eligible for special educational needs support (Panel A). While FSM eligibility is a good proxy for family income, SEN status refers to students with learning difficulties, physical disabilities, and behavioural problems.

MAT schools seem to be particularly effective at raising achievement for disadvantaged students. Over the first three years of exposure, math score estimates for the latter, although not statistically different - are sizeably larger than those obtained for other students. Results for language are similar, although the difference across the two groups is less pronounced. In terms of baseline achievement, the estimates presented in Panel B suggest that MAT schools are particularly effective in raising the achievement of students in the middle of the distribution (ie, those awarded Level 2 at KS1) and, to a less extent, those at the top (Level 3 students). Gains for the low-achievers are estimated very imprecisely but the magnitude of the estimates is almost always lower than that of the other students.

Finally, we look at the 'wave' of conversion (Figure 5, Panel C). We split the main sample in two different 'waves': the first wave includes the 15 2010 converters and 2011 converters; the second wave includes 2012 converters. Table 3 presents summary statistics for MAT and SAT schools belonging to the two waves. First wave converters are slightly better in terms of student composition (e.g. they enrolled less FSM and more natives) and student achievement at both KS1 and KS2, and first wave's MAT (SAT) schools were more (less) likely to be community schools. Additionally, first wave's schools were more likely to be rated as 'outstanding' on a large number of characteristics by the Ofsted with respect to second wave's (see Table 7), whereas the latter are more likely to be rated as 'good' with respect to the former. It is therefore worth asking whether governance had a differential impact for schools converting at different points in time. Our estimates do not seem to support this hypothesis - there aren't clear patterns in terms of test scores improvement across the two waves, although second wave's schools seem to slightly outperform first wave's in terms of language test score effects.

Falsification test

In our setting we do not have an instrument for the school's governance model choice. However, we perform a falsification test to test whether our results may be driven by school unobservables or other pre-existing differences between MATs and SATs. We create a 'fake' conversion event for our main sample, assuming that schools have become academies before the actual time of conversion. Since we consider four years of exposure, we set the 'fake' policy event in 2006, 2007 and 2008 for schools that become academies in 2010, 2011 and 2012 respectively. This timing is chosen to avoid overlap between the 'fake' and 'true' treatment.

In this framework we consider the reduced-form version of regression (2) and add the correspondent of D_{ibsat} and $\mathbb{1}(D_{ibsat} = k) \cdot MAT_s$ for the 'fake' policy events. Figure 6 plots the series of estimates for KS2 math test scores (Panel A) and language test scores (Panel B). For both subjects coefficients estimated for the placebo event are never statistically different from zero, and either small or well below the 'true' estimates (except for one language test scores' estimate) for the first three years of exposure, the time window over which we observe the positive effects (see Table 6). After four years the 'true' magnitude decreases and it is not statistically different from zero - similar to the placebo and, again, consistent with 2SLS estimates shown in Table 6. Overall, this leads us to exclude the existence of any pre-existing trends for schools in MATs that might have confounded our estimates.

5 Mechanisms

Our results suggest that MATs have a positive impact on student achievement compared to SATs. This finding highlights that policies aimed at increasing school autonomy may require particular organisational arrangements to be effective and a one-size-fits-all approach is instead not likely to work. In this section we explore possible mechanisms that may explain the success of MATs, focusing on the role played by managerial practices. We exploit highly detailed data on school funding allocation and a unique survey recently conducted by the DfE (Cirin, 2017).

We begin by looking at how the use of funding differs across MATs and SATs. Table 8 shows school-level *per-pupil* revenues and expenditures by category as well as time of conversion. On average, SAT schools tend to receive less grant funding from the government and have higher per-pupil self-generated income. This finding is consistent with survey evidence presented in Table 9 showing that 44% of SAT schools mention the introduction or increase of revenue-generating activities among the top 5 most important changes introduced after conversion. This pattern may suggest that a number of SAT schools may struggle to cope with all the new responsibilities in terms of funding and therefore try to raise additional funds.

Panel B of Table 8 further shows how MAT and SAT schools allocate their funds. MAT schools spend more than SATs for educational support staff (e.g. ICT technicians, teaching assistants) and slightly more for premises (e.g. security staff) and development and training. SAT schools spend more than MATs on ICT and learning resources and premise maintenance, while back-office costs are remarkably similar. A possible interpretation of this pattern is that on one side, MATs benefit from economies of scale and can therefore be more efficient in the provision of teaching resources. On the other side, they tend to spend more on teachers (perhaps consistently with the lower pupil-teacher ration shown in Table 1), development and training and additional support staff. This latter category, for which the difference is particularly striking (about £70 more per-pupil), may indicate larger investments in activities (e.g. labs) that may benefit the students and in additional staff that can further support them (e.g. learning support or foreign language assistants).

In addition to these average differences in funding allocation, the Table shows that there is some heterogeneity in funding usage across different waves of conversion (Panel B, column

(3) - (6)). Teaching staff spending across MAT and SAT schools is substantially higher for first wave MATs and slightly lower for second wave SATs. Back-office costs, which happens to be very similar on average, are substantially higher for first wave MAT and second wave SAT schools. Spending for development and training (learning resources) is also closer for second wave MAT and SAT schools, whereas it is higher (lower) for first wave's. These findings suggest that schools converting across years, which are different in terms of incentives (see Introduction and Section 2), observables (Table 3) and Ofsted evaluations (Table 7), differentially adjust their funding and cost patterns depending on their (different) needs.

Finally, we focus on the role of management practices across MATs and SATs and exploit a unique survey recently conducted by the DfE (Cirin, 2017) that contains schools converted into academies before February 2016. This is the first available information on MATs and SAT schools' practices since their introduction. The survey was conducted on 326 MATs and 542 SATs, both primary and secondary schools. We consider the subset of respondents that includes all MATs with at least two schools and one primary schools (237) and primary SATs (167). We also consider an additional subset of respondents represented by the 129 schools that became SAT academies between 2010 and 2013. Although we cannot link the respondent schools to those in our sample, the former sample can be considered an approximation of the latter. We cannot distinguish MATs by date of conversion in the survey data.

For the purpose of our study, we focus on the changes implemented by trusts after conversion. Table 9 shows that school chains and standalone academies differ quite significantly in terms of the changes they put in place. In particular, while SAT schools are more likely to make changes at school level, MATs are more likely to make organizational-level changes, mostly related to the reconstitution of the governing body.

When asked to rank the 5 most important changes made after conversion (Table 9, columns (1) to (3)), 61% and 62% of MATs mentioned changes in school leadership and reconstituting the governing body respectively, compared to 25% and 34% of SATs (28% and 36% in the 2010 – 2013 subsample). 27% of MATs also mentioned changes in the performance management system for teachers, compared to 14% of SAT schools (12% in the 2010 – 2013 subsample). More than 60% of SAT schools, instead, mentioned changing the curriculum as one of the most important changes available, compared to 36% of MATs. Interestingly, SAT schools also mention to have introduced or increased revenue-generating activities more than MATs (44% and 27% respectively).

Columns (4) to (6) show the most important change implemented after conversion. Once again MATs are more likely to mention changing school leadership (24%) and reconstituting the governing body (14%) as the most important change. SAT schools, instead, mention changing the curriculum (29%, or 30% for the $2010-2013$ subsample) and the procurement of services previously provided by the LA (26%, or 29% for the $2010-2013$ subsample).

Overall, these figures show that academy chains prioritised changes at the managerial level rather than focusing on traditional school level changes, such as changing the curriculum offered or school day length. This suggests that the implementation of different managerial practices between MATs and SATs may explain the difference in performance after conversion. Similarly, Angrist et al. (2013) and Dobbie and Fryer (2013), after surveying a sample of charter schools in the US, find that traditional input measures, such as pupil to teacher ratio, per pupil expenditure, and hiring of high-qualified teachers are not correlated with school effectiveness. More recently, Bloom et al. (2015) compare autonomous schools across countries to explore the most successful practices. Consistent with the descriptive evidence presented in Table 9, they find that the success of autonomous schools is not linked to autonomy *per se*, but rather to school management, such as strong leadership and the presence of external governing bodies exercising strong accountability on schools' head-teachers.

6 Conclusion

While most of the previous literature has focused on the effectiveness of autonomous schools, this paper sheds light on potential mechanisms underpinning their success. We exploit a recent reform introduced in England that gave the possibility to all primary and secondary schools to become autonomous. Following the reform, the rapid expansion of chains of independent schools, the so called MATs, brought in a new model of governance characterised by the separation of roles and responsibilities along the governance chain. Focusing on primary schools, we explore whether schools belonging to chains have a positive impact on student achievement compared to single academies.

We deal with the potential endogeneity of students' self-selection into schools by exploiting the fact that enrolment occurred prior to the decision of the school to convert and become a SAT or join a MAT. Hence, we can safely argue that school conversion could not be anticipated by parents. We then compare math and language scores of students taking the test before and after the conversion within the same school.

Baseline results show that pupils exposed to schools belonging to chains perform better in both math and language. In particular, one extra year of exposure to a MAT compared to a SAT increases test scores by $0.036 - 0.032\sigma$, which corresponds to about 0.7 and 0.3 points respectively. Effects are stronger for disadvantaged students - in particular for math test scores - but not differential by school's wave of conversion.

While our results suggest that students enrolled in chains do improve their performance, less obvious is the mechanism underpinning our findings. Using recent survey data collected by the DfE, we show that while SATs are more likely to make changes at the school level (e.g. changing the curriculum offered, introducing revenue generating activities, adding non-teaching positions), MATs are more likely to make changes related to managerial practices (e.g. reconstituting the governing body, changing the school leadership, creating formal networks between schools). The survey evidence, coupled with the results on achievement, suggest that interventions at the managerial level might improve school effectiveness and thereby student outcomes.

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Table 1. Descriptives

	All schools		Academies		MAT	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Students						
Male	0.51	0.50	0.51	0.50	0.51	0.50
Eligible for free school meals (FSM)	0.16	0.37	0.12	0.32	0.14	0.34
White	0.81	0.39	0.85	0.36	0.85	0.36
Black	0.04	0.20	0.03	0.17	0.03	0.18
Native	0.87	0.33	0.91	0.29	0.90	0.29
With special educational needs (SEN)	0.22	0.41	0.19	0.39	0.20	0.40
Panel B. Scores						
KS1 math Level 3	0.23	0.42	0.27	0.45	0.25	0.44
KS1 reading Level 3	0.27	0.45	0.32	0.46	0.30	0.46
KS2 math Level 5	0.37	0.48	0.43	0.50	0.41	0.49
KS2 reading Level 5	0.48	0.50	0.54	0.50	0.52	0.50
KS2 math score	68.60	21.02	71.09	20.21	70.02	20.66
KS2 math score (FSM and SEN)	55.30	22.11	56.69	21.86	56.11	22.17
KS2 reading score	30.37	9.38	31.71	9.07	31.23	9.20
KS2 reading score (FSM and SEN)	24.42	9.67	25.26	9.62	25.11	9.73
Panel C. Schools						
Community	0.57	0.49	0.60	0.49	0.67	0.47
Voluntary Controlled	0.17	0.37	0.09	0.29	0.08	0.27
Voluntary Aided	0.24	0.43	0.20	0.40	0.19	0.39
KS2 grade enrolment	33.27	19.45	42.90	24.30	41.26	24.61
Pupil-teacher ratio	20.99	2.70	22.06	2.45	21.77	2.48
Percent qualified teachers	0.97	0.04	0.96	0.05	0.96	0.04
Percent non-qualified teachers	0.02	0.03	0.03	0.04	0.03	0.04
Number of schools	10,414		600		312	
Number of FSM and SEN students	1,186,053		72,663		39,314	
Number of students	4,025,860		273,987		136,899	

Note. The table presents summary statistics for non-academy schools (columns (1) and (2)), converter academies (columns ((columns (5) and (6)) and SATs (columns (7) and (8)). Schools considered in columns (1) and (2) include all state-funded school was at least one academy between 2010 and 2012. Means and standard deviations are computed over the period 2005-2015.

Table 2. Location of responsibility within MATs

	Regional/Cluster level (1)	Trust Board (2)	School level (3)
Financial compliance	5%	94%	1%
Legal compliance	5%	92%	3%
Appointing headteachers/principals	5%	90%	5%
Managing risks	5%	88%	7%
Holding individual headteachers/principals to account	8%	82%	10%
Monitoring the performance of individual schools	14%	73%	14%
Human resources	10%	73%	17%
Allocating school budgets	6%	69%	25%
Directing school improvement support	18%	62%	20%
Setting academic targets	13%	44%	43%
Designing school staffing structures	15%	29%	57%
Setting individual school strategy/objectives	8%	29%	62%
School development action plans	14%	8%	78%

Note. The table presents the location of responsibility in multi-academy trusts (MATs) at Region/Cluster (column (1)), Trust Board (column (2)) and School (column (3)) level. Source: Academy trust survey 2017. The sample of MAT respondents includes 237 MATs with at least 2 schools and 1 primary school.

Table 3. Academy characteristics by year of conversion

	MAT		SAT	
	First wave	Second wave	First wave	Second wave
	(1)	(2)	(3)	(4)
Panel A. Students				
Male	0.51	0.51	0.50	0.51
Eligible for free school meals (FSM)	0.13	0.14	0.09	0.12
White	0.87	0.83	0.88	0.82
Black	0.04	0.03	0.02	0.03
Native	0.94	0.88	0.92	0.90
With special educational needs (SEN)	0.20	0.20	0.17	0.18
Panel B. Scores				
KS1 math Level 3	0.26	0.25	0.31	0.27
KS1 reading Level 3	0.31	0.29	0.35	0.32
KS2 math Level 5	0.45	0.39	0.48	0.43
KS2 reading Level 5	0.56	0.49	0.59	0.53
KS2 math score	71.20	69.24	72.73	71.52
KS2 math score (FSM and SEN)	57.48	55.23	57.73	57.02
KS2 reading score	32.18	30.60	32.82	31.50
KS2 reading score (FSM and SEN)	26.15	24.45	25.84	25.02
Panel C. Schools				
Community	0.72	0.63	0.49	0.56
Voluntary Controlled	0.11	0.05	0.09	0.12
Voluntary Aided	0.07	0.27	0.21	0.22
KS2 grade enrolment	43.40	39.82	47.25	41.98
Pupil-teacher ratio	21.68	21.83	22.45	22.29
Percent qualified teachers	0.96	0.96	0.96	0.97
Percent non-qualified teachers	0.03	0.03	0.03	0.02
Number of schools	125	187	148	140
Number of FSM and SEN students	15,321	23,993	16,251	17,098
Number of students	54,707	82,192	71,297	65,791

Note. The table presents characteristics of schools converted as MATs in 2010/2011 or 2012 (columns (1) and (2)) and schools converted as SATs in 2010/2011 or 2012 (columns (3) and (4)). Means are computed over the period 2005-2016.

Table 4. Probability of joining a MAT

	4-year lag (1)	2-year lag (2)
KS2 English scores	0.025	0.025
	(0.026)	(0.026)
KS2 math scores	-0.005	0.011
	(0.026)	(0.027)
KS1 English points	0.051	0.005
	(0.048)	(0.046)
KS1 math points	0.002	0.007
	(0.043)	(0.040)
KS1 Average Point Score	-0.097	-0.063
	(0.066)	(0.062)
Male students	-0.029	-0.027
	(0.021)	(0.022)
Students eligible for free school meals	-0.004	0.000
	(0.021)	(0.021)
White students	0.018	-0.003
	(0.022)	(0.023)
Black students	-0.001	-0.033*
	(0.023)	(0.019)
Native students	0.010	0.011
	(0.023)	(0.022)
Students with special educational needs	0.001	-0.004
	(0.022)	(0.024)
KS2 grade enrolment	-0.037*	-0.007
	(0.020)	(0.020)
Number of schools	600	600
Observations	600	600

Note. The table shows regressions of an indicator variable taking value one for schools that have joined a MAT on changes in student and school characteristics. All independent variables are standardised to have zero mean and unit variance. The time period considered is 2009-2005. In column (1) changes are computed over 4 years (2009-2005), and in column (2) over 2 years (2009-2007). Results obtained for the period 2010-2005 are similar and are available upon request. Standard errors, shown in brackets, are clustered on schools. *** p<0.01, ** p<0.05, * p<0.1

Table 5. OLS regressions

	Math points			Language points		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Marginal gain						
Years of Exposure	0.005	-0.029**	-0.031***	-0.004	-0.030***	-0.031***
	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.010)
Years of Exposure to MAT	0.019***	0.026***	0.027***	0.016**	0.016***	0.017***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)
Panel B. Gain by years of exposure						
Years of Exposure	0.010	-0.023**	-0.026**	0.004	-0.021**	-0.023**
	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.011)
Years of Exposure to MAT:						
1 year	0.032*	0.049***	0.046**	0.063***	0.070***	0.069***
	(0.019)	(0.018)	(0.018)	(0.017)	(0.016)	(0.016)
2 years	0.069***	0.085***	0.085***	0.079***	0.075***	0.072***
	(0.022)	(0.022)	(0.022)	(0.020)	(0.019)	(0.020)
3 years	0.068***	0.098***	0.101***	0.038*	0.050**	0.052**
	(0.024)	(0.024)	(0.024)	(0.022)	(0.020)	(0.021)
4 years	0.061**	0.080***	0.081***	0.056**	0.052**	0.057**
	(0.029)	(0.028)	(0.028)	(0.026)	(0.024)	(0.025)
Observations	273,987	273,987	273,987	273,872	273,872	273,872
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Baseline score	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Block FE	No	No	Yes	No	No	Yes

Note. The table shows OLS regressions of KS2 math scores (columns (1) to (3)) and language scores (columns (4) to (6)) on years of exposure (Panel A) and years of exposure and four indicator variables for years of exposure to a MAT (Panel B). KS2 outcome are standardised to have zero mean and unit variance. Columns (1) and (4) control for gender, free school meals eligibility, ethnicity, language spoken at home, special educational need status, a quadratic polynomial in school enrolment, an LA-specific time trend, and year and school fixed effects. Columns (2) and (5) add student's standardised point score at KS1 in the relevant subject; columns (3) and (6) add block of residence fixed effects. Standard errors, shown in brackets, are clustered on schools.

Table 6. 2SLS regressions

	Math points				Language points			
	2SLS			First Stage	2SLS			First Stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Marginal gain								
Years of Exposure	0.095***	0.033	0.030	0.403***	0.043	-0.004	-0.002	0.403***
	(0.028)	(0.028)	(0.029)	(0.026)	(0.029)	(0.027)	(0.028)	(0.026)
Years of Exposure to MAT	0.030***	0.036***	0.036***	1.852***	0.031***	0.031***	0.032***	1.854***
	(0.010)	(0.010)	(0.010)	(0.048)	(0.009)	(0.009)	(0.009)	(0.048)
Panel B. Gain by years of exposure								
Years of Exposure	0.085***	0.025	0.023	0.400***	0.030	-0.015	-0.014	0.400***
	(0.028)	(0.027)	(0.029)	(0.026)	(0.027)	(0.026)	(0.027)	(0.026)
Years of Exposure to MAT:								
1 year	0.062***	0.065***	0.061***	0.976***	0.073***	0.072***	0.072***	0.976***
	(0.021)	(0.021)	(0.021)	(0.002)	(0.019)	(0.019)	(0.018)	(0.002)
2 years	0.089***	0.094***	0.093***	0.955***	0.084***	0.076***	0.073***	0.956***
	(0.024)	(0.025)	(0.025)	(0.003)	(0.022)	(0.022)	(0.022)	(0.003)
3 years	0.060**	0.096***	0.100***	0.905***	0.040	0.062**	0.063**	0.905***
	(0.028)	(0.029)	(0.029)	(0.008)	(0.025)	(0.025)	(0.025)	(0.008)
4 years	0.028	0.054	0.056	0.841***	0.045	0.051*	0.055*	0.841***
	(0.036)	(0.035)	(0.036)	(0.016)	(0.032)	(0.030)	(0.031)	(0.016)
Observations	273,987	273,987	273,987	273,987	273,872	273,872	273,872	273,872
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline score	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Block FE	No	No	Yes	Yes	No	No	Yes	Yes

Note. The table shows 2SLS regressions of KS2 math scores (columns (1) to (3)) and language scores (columns (5) to (7)) on years of exposure (Panel A) and years of exposure and four indicator variables for years of exposure to a MAT (Panel B). Columns (4) and (8) show the related first stage coefficients, obtained as described in the text. KS2 outcomes are standardised to have zero mean and unit variance. Columns (1) and (5) control for gender, free school meals eligibility, ethnicity, language spoken at home, special educational need status, a quadratic polynomial in school enrolment, an LA-specific time trend, and year and school fixed effects. Columns (2) and (6) add student's standardised point score at KS1 in the relevant subject; columns (3) and (7) add block of residence fixed effects. Standard errors, shown in brackets, are clustered on schools.

Table 7. Fraction of schools by Ofsted judgement and year of conversion

	Outstanding		Good		Satisfactory	
	First wave	Second wave	First wave	Second wave	First wave	Second wave
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Multi-academy trusts (MAT)						
Overall grade	0.37	0.25	0.43	0.55	0.20	0.19
Behaviour and safety of pupils	0.53	0.36	0.43	0.60	0.04	0.04
Quality of teaching	0.31	0.17	0.50	0.64	0.18	0.19
Quality of pupils' learning	0.33	0.19	0.48	0.60	0.19	0.20
Quality of SEN pupils' learning	0.35	0.21	0.48	0.62	0.17	0.17
Pupils' attendance	0.14	0.18	0.52	0.43	0.30	0.36
Leadership and management	0.40	0.27	0.44	0.58	0.16	0.14
Effectiveness of Governing Body	0.38	0.19	0.47	0.59	0.15	0.21
Leadership and management of teaching	0.28	0.15	0.47	0.63	0.25	0.21
Panel B. Single-academy trusts (SAT)						
Overall grade	0.57	0.25	0.37	0.65	0.06	0.10
Behaviour and safety of pupils	0.71	0.50	0.29	0.49	0.00	0.01
Quality of teaching	0.47	0.18	0.47	0.72	0.05	0.10
Quality of pupils' learning	0.49	0.22	0.45	0.68	0.06	0.10
Quality of SEN pupils' learning	0.52	0.24	0.43	0.66	0.05	0.10
Pupils' attendance	0.30	0.24	0.52	0.46	0.18	0.28
Leadership and management	0.59	0.30	0.36	0.62	0.05	0.08
Effectiveness of Governing Body	0.48	0.22	0.43	0.60	0.09	0.17
Leadership and management of teaching	0.32	0.17	0.65	0.72	0.03	0.10
Number of schools	273	327	273	327	273	327

Note. The table shows the fraction of schools by Ofsted judgement and wave of conversion. The sample includes schools that became academies between July 2010 and December 2012. Only Converter academies are considered. Panel A presents grades for multi-academy trusts (MATs) and Panel B for single-academy trusts (SATs). Columns (1) and (2) show the fraction of schools judged outstanding; columns (3) and (4) show the fraction of schools judged good; columns (5) and (6) show the fraction of schools judged satisfactory or inadequate. The table uses the last available Ofsted ranking before the conversion took place.

Table 8. Funding allocation within MATs and SATs

	All academies		First wave		Second wave	
	MAT	SAT	MAT	SAT	MAT	SAT
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Revenues						
Total grant funding	4,891.35	4,628.29	4,898.35	4,526.19	4,885.81	4,765.46
Total self-generated income	258.17	299.86	268.69	320.48	249.85	272.17
From facilities and services	45.53	60.88	46.87	72.39	44.46	45.41
From donations	74.84	92.90	69.04	104.54	79.42	77.26
Panel B. Expenditures						
Teaching staff	2,250.67	2,250.36	2,267.82	2,242.95	2,237.23	2,260.28
Educational support staff	810.66	742.12	800.99	715.68	818.30	777.32
Total premises costs	342.42	340.75	343.50	337.58	341.56	345.00
Back-office costs	565.51	552.58	566.42	531.13	564.80	581.41
Due to administrative staff	276.62	280.11	273.98	274.31	278.66	287.33
Development and training	37.98	33.45	39.10	30.82	37.14	36.64
ICT resources	27.75	31.59	28.02	32.90	27.53	29.84
Learning resources	243.49	258.92	239.58	262.60	246.59	253.99
Premise maintenance	150.28	160.03	147.73	160.19	152.07	159.85
Observations	2,483		1,243		1,240	

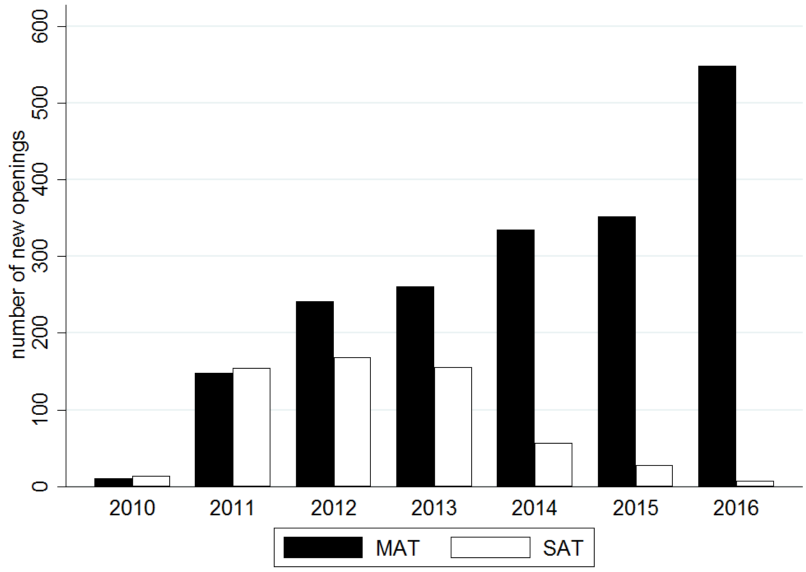
Note. The table shows average per-pupil revenues (Panel A) and expenditures (Panel B) of academies from 2011/2012 to 2015/2016. Total grant funding includes the annual grant received by the Education Funding Authority and other types of government funding (e.g. other grants, SEN funding). Total self-generated income includes income sources such as the sale of school uniforms, hire of premises, donations, etc. Educational support staff includes all staff who are not teachers (e.g. teaching assistants, laboratory technician); premises costs include cleaners, security staff, etc; back-office costs include administrative staff, supplies and legal and professional services. The sample is at school/year level. Only academies with at least 12 months of income and expenditure recorded in their accounts are included in the data published by DfE; this limits the number of academies for the first year (2011/2012) to 170. The further discrepancy between this sample and the main sample is that in the former not all the academies are consistently present in every year (e.g. because they miss the accounts deadline). After 2012, the yearly number of academies in this sample varies between 553 and 588.

Table 9. Most important changes introduced by MATs and SATs

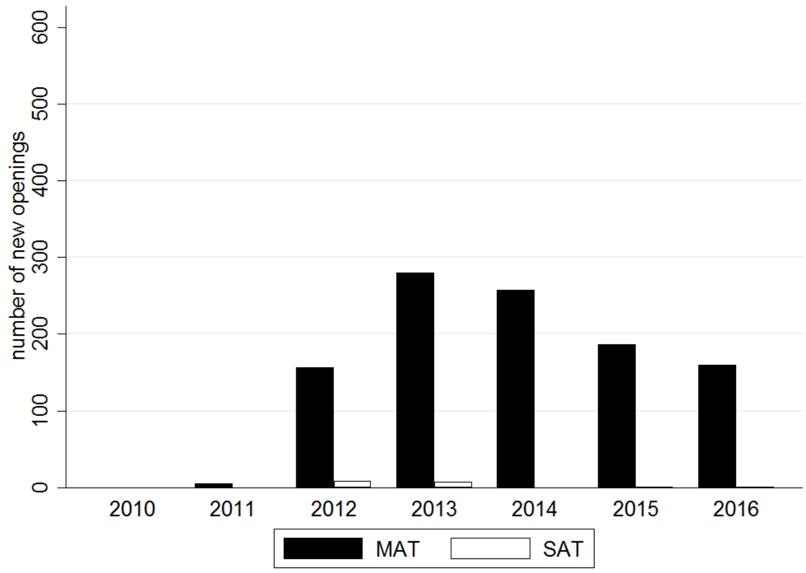
	Top 5 most important changes			**Mos**
	Multi-Academy	Single-Academy Trusts		Multi-Academy
	Trusts	2010-2015	2010-2013	Trusts
	(1)	(2)	(3)	(4)
Procuring services that were previously provided by the LA	68%	77%	82%	11%
Changing the curriculum you offer	36%	62%	62%	10%
Introducing savings in back-office functions (e.g. human resources, ICT, payroll)	78%	60%	63%	27%
Introducing or increasing revenue-generating activities	27%	44%	44%	1%
Changing the pattern of capital expenditure	31%	43%	47%	3%
Reconstituting the governing body	62%	34%	36%	14%
Changing school leadership	61%	25%	28%	24%
Adding non-teaching positions	12%	19%	19%	0%
Changing staff pay structures	19%	17%	17%	2%
Changing the admission criteria	11%	17%	16%	1%
Increasing the number of pupils on roll	18%	16%	16%	10%
Changing the length of school terms	7%	15%	13%	0%
Changing the performance management system for teachers	27%	14%	12%	3%
Hiring teachers without qualified teacher status (QTS)	8%	8%	6%	1%
Seeking to attract pupils from a different geographical area	3%	6%	4%	0%
Changing the length of the school day	5%	4%	4%	n/a
Number of respondents	237	140	103	237

Note. The table presents the proportion of MATs and SATs that endorse a change as being one of the five most important (columns (1) to (3)) and the most important (colu
conversion. The sample of respondents includes 237 MATs with at least two schools and one primary school and 140 primary SAT schools. Other changes includes pay sta
teachers without qualified teacher status (QTS), and seeking pupils from a different geographical area. Data source: Academy trust survey 2017.

Figure 1. Yearly openings of academies



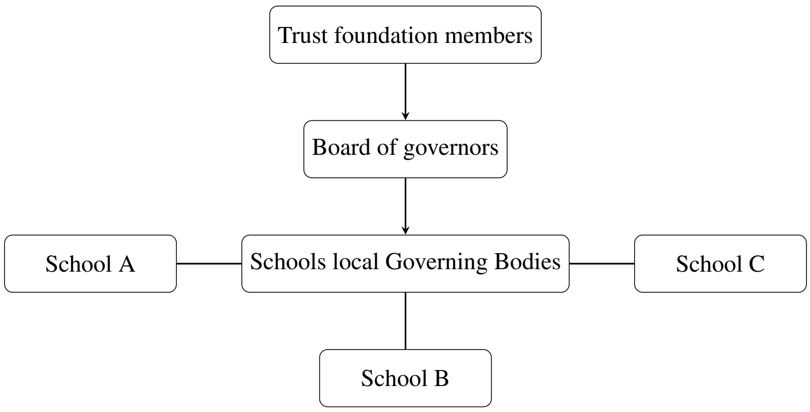
Panel A. Converter Academies



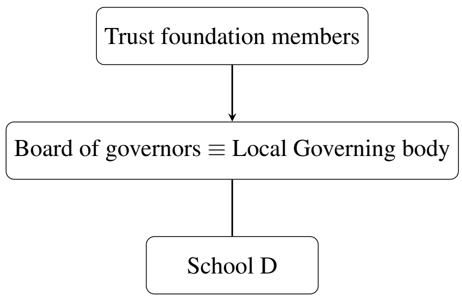
Panel B. Sponsor Led Academies

Note. The figure shows the number of openings of Converter (Panel A) and Sponsor Led (Panel B) academies by year of opening and academy status (MAT or SAT).

Figure 2. Governance in SATs and MATs



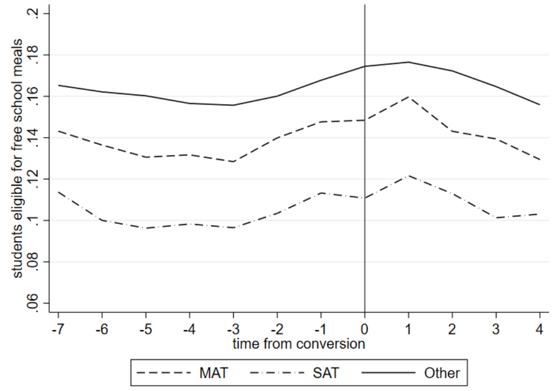
Panel A. Multi-Academy Trusts (MATs)



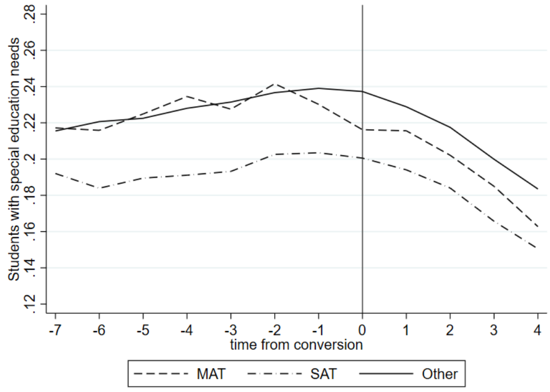
Panel B. Single Academy Trusts (SATs)

Note. The figure shows the governance structure in Multi-Academy Trusts (Panel A) and Single Academy Trusts (Panel B).

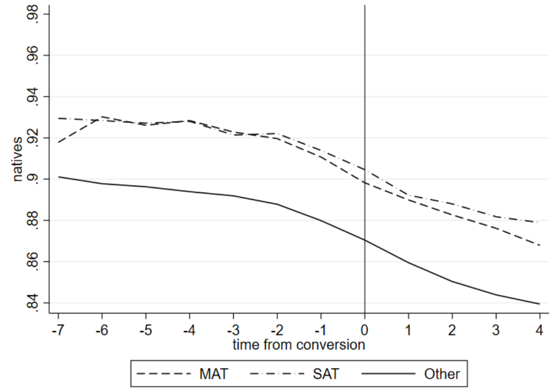
Figure 3. Student and school characteristics



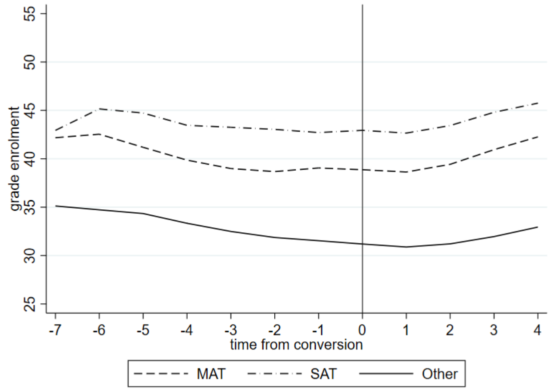
Panel A. Free school meals eligible



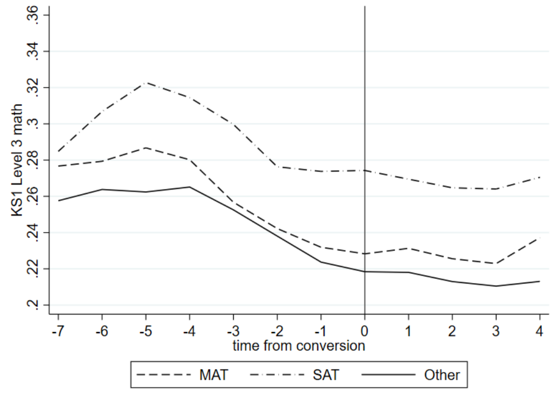
Panel B. Students with SEN



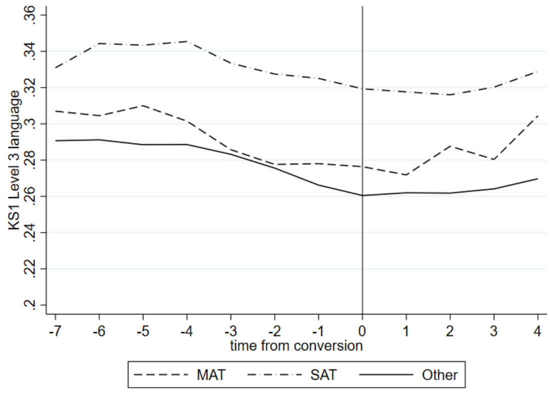
Panel C. Natives



Panel D. School enrolment



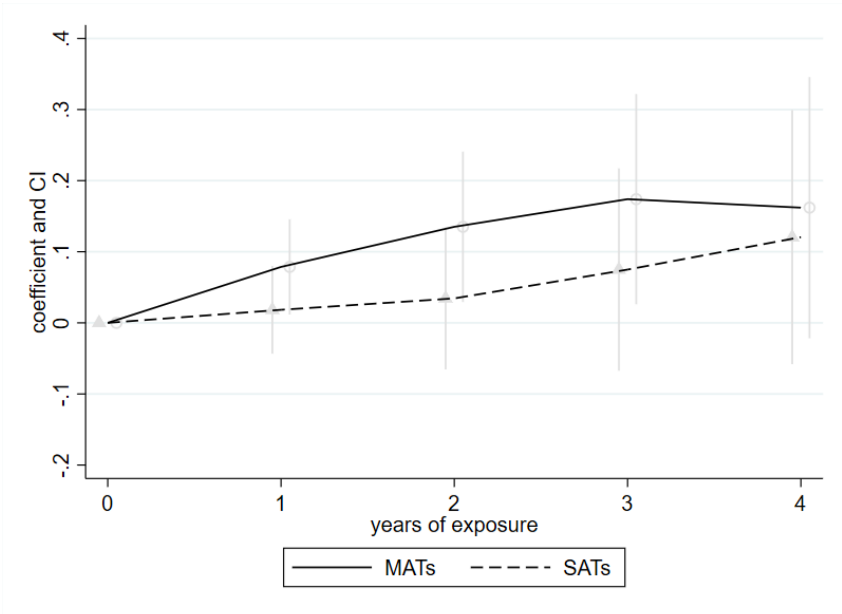
Panel E. KS1 math level 3



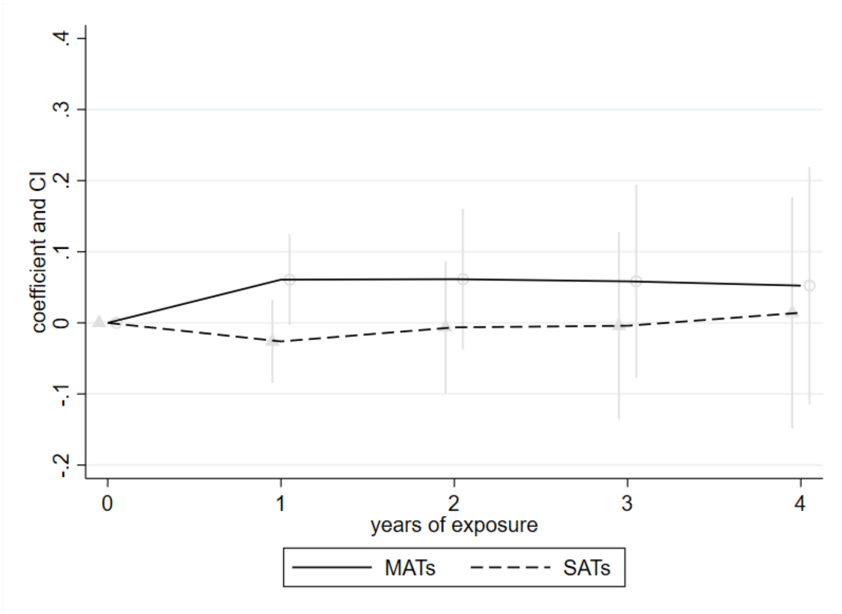
Panel F. KS1 language level 3

Note. The figure shows trends in student and school characteristics for multi-academy trusts (dashed line), single-academy trusts (dashed-dotted line) and schools that are not academies (solid line). The year of conversion is set to zero and denoted by the vertical line. Panel A shows the fraction of students eligible for free school meals at the end of primary school; Panel B shows the fraction of students with special educational needs; Panel C shows students whose first language spoken at home is English; Panel D shows KS2 grade enrolment; Panel E and F show the fraction of students awarded Level 3 in KS1 math and language assessments respectively.

Figure 4. MAT- and SAT-specific effects



Panel A. Math

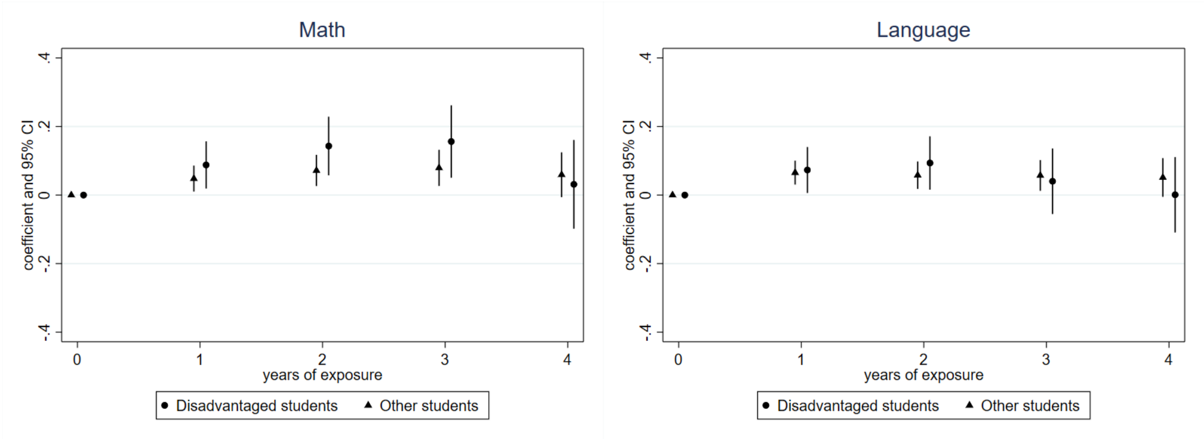


Panel B. Language

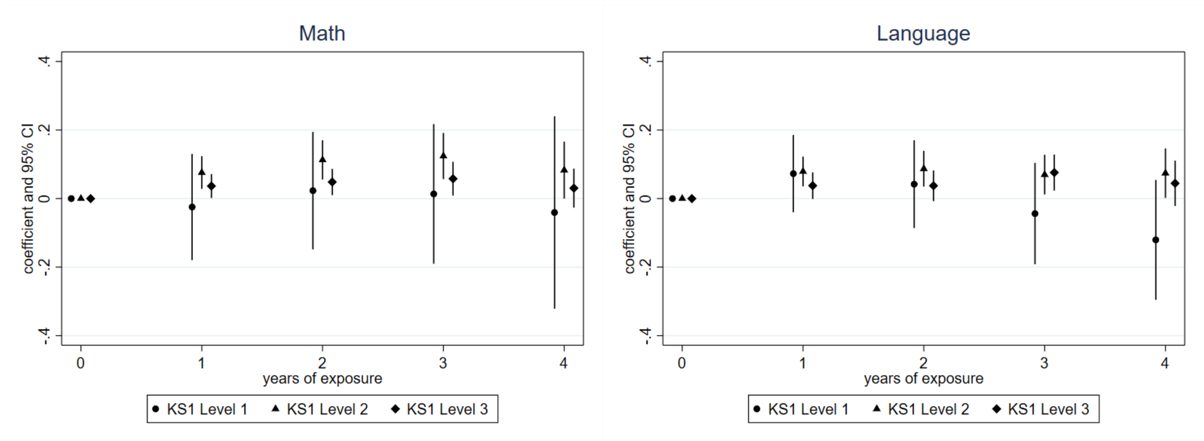
Note. The figure shows MAT- and SAT-specific estimates of the impact of years of exposure on math (Panel A) and language (Panel B) test scores and related 95% confidence intervals.

Figure 5. Heterogeneous effects

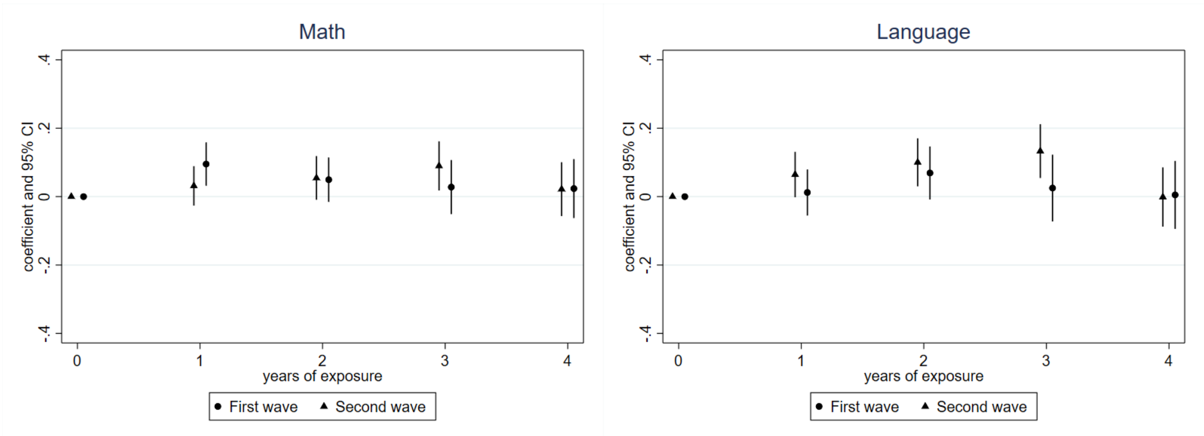
Panel A. Socio-economic status



Panel B. Baseline achievement

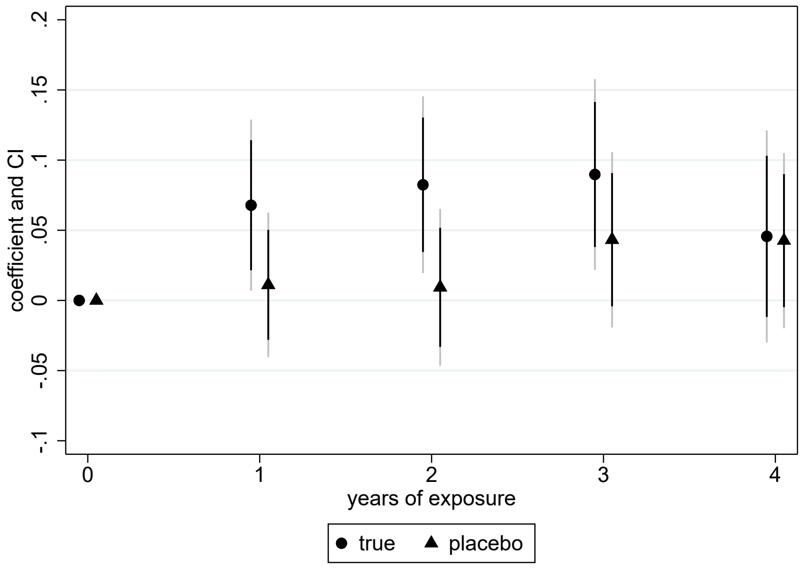


Panel C. Conversion wave

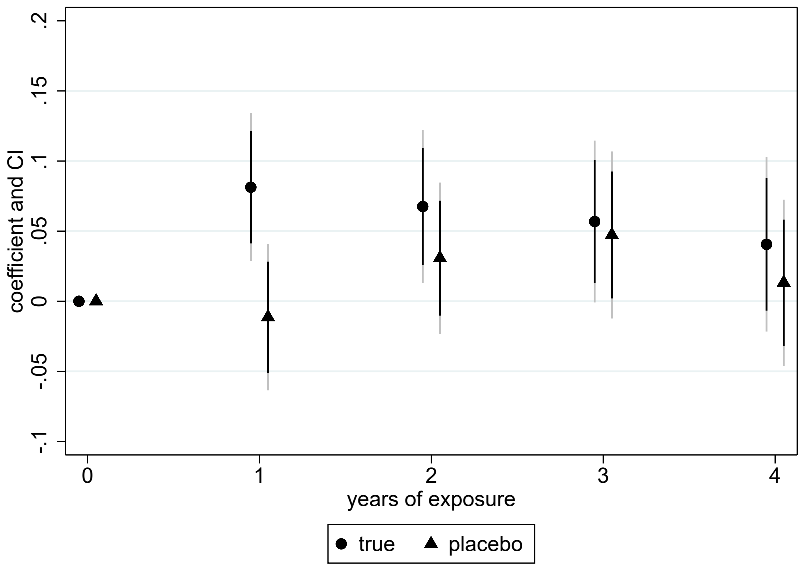


Note. The figure shows 2SLS estimates of the governance model's impact on math and language KS2 test scores by student socio-economic status (Panel A), KS1 level achieved (Panel B) and wave of conversion (Panel C).

Figure 6. Falsification Test



Panel A. Math



Panel B. Language

Note. The figure plots a falsification test for math (Panel A) and language (Panel B). The coefficients are 2SLS estimates from a regression of KS2 scores on years of exposure. For each coefficient, the black and gray vertical bars show the related 95% and 99% confidence interval respectively. The placebo treatment year is 2006, 2007 and 2008 for 2010, 2011 and 2012 converters respectively.