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Managerial Practices and Student Performance: Evidence from Changes in School Principals*

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Abstract

We study how managerial practices of school principals affect student performance and aspirations. For 2011 and 2015, we merge administrative data on Italian high school students with the management quality indices of their principals, constructed using the World Management Survey methodology. The frequent principals' turnover over this period allows us to causally interpret school-fixed-effect estimates. We find that management quality positively and substantially impacts standardized math and language tests and student desire to attend college. The comparison to pooled-OLS suggests that fixed effects correct for the downward bias arising from selection of better principals into more difficult schools.

Keywords: Management; School principals; Student outcomes.
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1 Introduction

Growth theory has long established that human capital is the main engine of growth (Lucas, 1988), a prediction confirmed by empirical evidence (Mankiw, Romer, and Weil, 1992; Hanushek and Woessmann, 2012). Given that human capital is to a large extent accumulated in schools, it is not surprising that much research effort has been devoted to identifying the attributes of a schooling system that enhance student achievements. However, a clear consensus on these attributes, actionable for policy recommendations, has yet to be reached. For example, the value-added literature has shown that teachers are very important for student achievements, but there is no clear-cut indication of which teacher characteristics matter and, as a consequence, how to increase teacher effectiveness.[1]

In recent years, some encouraging results have emerged from the growing literature on school management. Using RCTs in US schools, Fryer (2014, 2017) finds that management matters, although evidence on the persistence of the treatment is inconclusive. Moreover, external validity remains a concern. Bloom et al. (2012, 2015) and Di Liberto, Schivardi, and Sulis (2015) use the World Management Survey (WMS henceforth), a tool which measures the quality of the managerial practices within organizations (Bloom and Van Reenen, 2007, 2010, 2011), to show that schools that are better managed are also characterized by better performing students.[2] These results, based on different countries, suggest that enforcing good managerial practices could be an effective way to improve student achievements. However, their interpretation in terms of causality is questionable, as they cannot completely rule out unobserved heterogeneity correlated with both the quality of managerial practices and student achievements.

In this paper, we provide evidence suggesting that the quality of managerial practices in schools is likely to have a causal effect on student educational outcomes. We do so using a panel of Italian high schools that changed the school principal ("principal" henceforth) between 2011 and 2015 and whose managerial practices have been measured under the old and the new principal. The principal is the key figure in the functioning of the school, responsible for determining the working conditions in which teachers operate. A change

[1] In the value-added literature, the importance of teachers is estimated by regressing student achievements on teacher fixed effects. The typical finding is that the latter explains a large portion of the overall variance of student performance (Hanushek, 2011). However, when the estimated fixed effects are regressed on observable teacher characteristics, such as age, gender, teaching experience, field of study, or certification, no clear correlation emerges (Burgess, 2016).

[2] On this, see also Lemos, Muralidharan, and Scur (2021) who modify the original WMS tool to obtain more granular but yet comparable measures of management quality more suitable for less developed countries analysis, and Leaver, Lemos, and Scur (2019) who show how to scale up the measurement of school management using existing public data.

in the principal, therefore, is likely to induce a discontinuous change in the managerial practices within the school. We exploit this change and estimate the effect of the quality of managerial practices on student achievements, while controlling for school fixed effects in our regressions. In this way, we account for any fixed unobserved heterogeneity at the school level, such as the socio-economic status of the catchment area or the school's reputation, that can influence the quality of the students attracted by the school.

Fixed effects estimates are particularly well-suited to our setting for several reasons. First, the change in the principal can lead to substantial changes in managerial practices, as principals are responsible for running the school. This limits the potential bias coming from the fact that fixed effects might substantially reduce the signal-to-noise ratio if most of the variation is cross-sectional. Second, we apply the WMS protocol, which provides a precise measure of the quality of managerial practices. Third, in the Italian school system, principals manage the school in terms of organization but have limited autonomy in other areas such as the mission, the curricula, and teaching styles. This is different from a corporation, where a new CEO might choose to change the product mix or to enter new markets, making it difficult to disentangle changes in managerial practices from other possible changes within the firm. Thus, while we lack random variation in managerial practices and cannot entirely rule out the possibility of residual unobserved heterogeneity correlated with them, our setting provides a plausible basis for attributing changes in student outcomes to the managerial practices introduced by the new principal.

We build on an initial sample of principals interviewed in 2011 to measure the quality of managerial practices in their school (Di Liberto, Schivardi, and Sulis, 2015). In 2015, we identified schools that had changed their principals and run a second wave of interviews to the new principals ("switcher schools"). For schools that did not change principal, we assign the same management index computed in 2011, assuming that the quality of managerial practices is a fixed attribute of the principal. We further extend our sample by assigning the indices of the new principals interviewed in 2015 to the schools they managed in 2011. Finally, we link this panel dataset of principals and their corresponding schools to administrative data on school characteristics and student performance, aspirations, and background information. Our final sample comprises 309 principal-school-year observations and 23,514 student-year observations.

Our goal is to estimate the effect of managerial quality on different student outcomes: standardized test scores in math and (Italian) language, as well as aspirations to pursue tertiary education. The key identification challenge is that principals might select into schools

based on their ability. While we control for a large set of student, principal, and school characteristics, there might still be unobserved school attributes related to the principal's managerial ability and to student outcomes. The bias could go either way. For example, more capable principals might be assigned to the best schools. Conversely, it is possible that school districts assign the best principals to the most problematic schools. Our fixed effects strategy controls for any time-invariant unobserved heterogeneity at the school level, addressing concerns of non-random assignment. One potential threat is that the quality of students attending the school changes with changes in the principal's managerial ability. We argue this is not likely to be the case in the short period. We consider and offer evidence supporting this claim. Finally, we show that the *change* in the managerial index at the school level has a degree of variability similar to the cross-sectional within-year variability, which indicates that fixed effects are not likely to suffer from low statistical power.

Our results are clear cut: better managerial practices are associated with improved student achievement and higher aspirations. We find that a standard deviation increase in management quality increases average test scores in mathematics by 0.09 standard deviations. We find a positive effect, albeit slightly smaller in magnitude, for language test scores too: a standard deviation increase in managerial quality increases Italian test scores by 0.07 standard deviations. As for student aspirations, a standard deviation increase in the managerial index makes it more likely that students wish to achieve at least a college degree and that they aim to obtain a higher educational attainment than their parents by around a third of a standard deviation. We also find that most benefits of improved managerial practices emerge quickly and that they are fairly homogeneous across different percentiles of the score distribution.

Interestingly, when running a pooled OLS regression, that is, without school fixed effects, we obtain smaller estimates (and not significant, in the case of language test scores and educational aspirations). This indicates that, if anything, the allocation of principals to schools tends to bias downward the OLS estimates, possibly due to better principals being assigned to worse schools. However, we find no evidence of selection on observables: for example, there is no correlation between student scores in 2011 and the managerial quality of the principal in 2015. This implies that selection occurs on unobservables, questioning the possibility of identifying the effects in cross-sectional regressions.

We check the robustness of our results along several dimensions. Given that our estimates rely on "switcher" schools, that is, schools that changed principal between 2011 and 2015, we show that switching itself does not affect student outcomes. Moreover, switcher

schools are not different from the others in terms of observable characteristics of the school and of the students measured in 2011. Our results are also robust to including additional controls, excluding principals close to retirement, who might receive preferential treatment in the assignment process, and restricting the sample to the 56 balanced effective switchers, that is, schools whose principals were interviewed in 2011 (old principal) and 2015 (new principal). We also rule out the possibility that local macroeconomic conditions, which may influence the quality of the teacher supply (Nagler, Piopiunik, and West, 2020), could bias our estimates.

We further explore the mechanisms linking managerial quality to student outcomes. First, we break down the overall index of managerial practices to identify whether specific aspects of school management have a greater impact on student performance. Interestingly, the overall index consistently has a larger effect than any individual component, reinforcing theoretical and empirical findings that no single "silver bullet" managerial practice drives performance. Second, we conduct a text analysis of principals' interview transcripts to identify recurring keywords, assuming these reflect their priorities and key areas of focus. We find weak positive effects of emphasis on the teaching methodology and on orientation activities that help students learn about educational and career pathway, while other areas show no significant effects. Third, following Fenizia (2022), we run a counterfactual in which better principals are assigned to larger schools, finding a modest positive effect on average student test scores. Overall, our findings suggest that different dimensions of managerial activities complement one another in fostering a more effective learning environment.

Finally, we run a policy experiment to assess the economic relevance of the effects we find. Using the growth accounting framework of Hanushek and Woessmann (2020), we estimate that a one standard deviation increase in principals' managerial capabilities would raise long-run annual GDP growth by 0.18%. We conclude that strengthening principals' overall managerial capabilities is a very promising policy for improving student outcomes, and, through these, growth.

This paper contributes to the scant literature addressing the causal effect of management quality on student outcomes. While existing works report cross-sectional evidence (Fryer, 2014, 2017; Tavares, 2015; Di Liberto, Schivardi, and Sulis, 2015; Romero, Sandefur, and Sandholtz, 2020), our analysis exploits a panel dataset.[3] This allows us to disentangle the

[3]Fryer (2014, 2017) and Romero, Sandefur, and Sandholtz (2020) are based on RCT field experiments, while Tavares (2015) and Di Liberto, Schivardi, and Sulis (2015) adopt an instrumental variable approach. More recently, Duchini et al. (2023) use a DiD strategy to investigate the effect of the expansion of English sponsor-led academies in the UK and find evidence of the causal impact of management flexibility on teacher turnover, sorting, and pay.

effect of managerial practices implemented by principals from other fixed attributes of the school.

We also add to the large body of research investigating the importance of school leadership using the value-added model to build individual principal effectiveness measures. Estimates of principal effects on student achievement vary across studies, depending on the empirical framework, sample, and subject (Branch, Hanushek, and Rivkin, 2012; Dhuey and Smith, 2018; Bartanen and Husain, 2022; Bartanen, Husain, and Liebowitz, 2024). A review by Grissom et al. (2021) of US-based studies finds that, on average, a one standard deviation increase in principal effectiveness improves student achievements by 0.13 standard deviation in math and 0.09 standard deviation in reading. Our estimates, 0.09 and 0.07 respectively, suggest that managerial practices account for a significant portion of principal effectiveness. Compared to this literature, which does not directly address the sources of principal effectiveness, we deliver a clear policy indication: student achievements benefit from improvements in managerial practices.

In addition, our analysis contributes to the growing but still limited literature focusing on the role of school effectiveness on outcomes other than student achievements (Angrist, Hull, and Walters, 2022). We focus here on student educational aspirations. These are identified as important determinants of the individual incentives to invest by recent behavioral models describing typical poverty-trap mechanisms (Dalton, Ghosal, and Mani, 2016; Genicot and Ray, 2017).[4] We show that improving school management quality may effectively increase educational aspirations even among students whose parents did not attend college.[5]

Beyond schools, we contribute to the literature that tries to estimate the causal effect of managerial practices on performance. To the best of our knowledge, the only other studies that take advantage of panel data in combination with WMS-based measures of management quality are Bloom, Sadun, and Van Reenen (2016) and Bloom et al. (2019). They analyze private corporations and find that the link between management quality and performance is positive and statistically significant when including firm fixed effects. However, the size

[4] Academic ambitions differ substantially by socio-economic background, even among students who are similarly proficient at school (Haveman and Wolfe, 1995; OECD, 2019), while recent evidence finds that lower educational aspirations are associated with poorer school outcomes (Guyon and Huillery, 2021). Using data on Italy, Carlana, La Ferrara, and Pinotti (2022) find that specific school programs may be effective in modifying student aspirations and soft-skills among high-achieving immigrants, while Pagani, Comi, and Origo (2021) show that class rank improves conscientiousness through perceived ability and academic motivation.

[5] A large literature finds that parent's education matters for the student educational ambitions (Haveman and Wolfe, 1995; Björklund and Salvanes, 2011; OECD, 2022). Evidence on Italy shows that the educational career is even more affected by parental education than in other industrialized countries (Checchi and Flabbi, 2013).

tends to be smaller than in OLS estimates. We focus on schools that changed principals, which has two advantages. First, the change in principal is likely to bring about substantial changes in managerial practices, reducing the concern of limited time series variability in the practices. Second, principals in our setting are markedly constrained in their executive capacity in comparison to managers of private firms, and this allows us to rule out potential time-varying confounders that would not be accounted for by school fixed effects.

The remainder of the paper is organized as follows. Section 2 outlines how principals can contribute to enhancing student achievement and details their powers and responsibilities in Italy. Section 3 describes the data. Section 4 introduces the empirical framework and outlines the identification. Sections 5 and 6 discuss the results, selection issues, heterogeneity and mechanisms. Section 7 concludes.

2 How can principals affect students' outcomes?

This section first briefly summarizes the channels identified in the literature through which principals can improve students' achievements. Next, given the substantial cross-country variations in the principals' roles and powers, we provide an overview of the Italian context for readers unfamiliar with it.

2.1 The role of principals for students' performance

A substantial body of research emphasizes the importance of high-quality teaching in producing significant returns for student learning (Hanushek and Rivkin, 2006; Hanushek and Woessmann, 2012). Consistently, the literature on school principals emphasizes that their influence on student learning is primarily indirect, operating through the quality of teachers and the effectiveness of their teaching (Branch, Hanushek, and Rivkin, 2012). Principals can enhance teaching quality by recruiting skilled teachers and removing under-performing ones. They can also motivate existing staff through performance-based incentives, such as bonuses and professional development opportunities (Brewer, 1993; Hanushek and Rivkin, 2012). As such, the quality of human resource management practices represents a crucial channel through which principals can shape students' academic achievements.

Beyond HR management, principals play an important role in shaping the environmental conditions that influence teachers' effectiveness in the classroom. They establish learning objectives, communicate them to teachers, and implement monitoring systems to track progress. Research has documented significant variation in the quality of these practices (Bloom et al., 2015). Additionally, principals can shape a school's learning environment

through instructional-focused interactions with teachers. Principals play a crucial role in enhancing educational outcomes by fostering teaching innovations, supporting professional development, aligning instructional practices, and addressing student needs (Robinson, Lloyd, and Rowe, 2008; Grissom and Loeb, 2011). Beyond economic incentives, effective teacher management also relies on strong leadership to motivate and engage teachers, as emphasized in the literature (Leithwood, Harris, and Hopkins, 2008).

Principals can also directly impact student outcomes. The first channel is managing student discipline: a well-disciplined environment may reduce classroom disruptions and improve student performance (Lazear, 2001; Grissom et al., 2021). The second is the strategic allocation of teachers across classrooms to optimize overall achievement (Hallinger and Heck, 1998; Grissom et al., 2021). Third, there is evidence that class size, gender composition, and peer effects are important for students' performance (Hoxby, 2000; Lavy and Schlosser, 2011; Sacerdote, 2011). Principals are typically responsible for how students are assigned to different classes.

2.2 What do Italian principals do?

Our data refer to public schools, which enroll the vast majority of Italian high school students. We therefore focus our discussion on public school principals.[6] An important reform in 2001 substantially increased principals' powers and responsibilities. Article 25 of Legislative Decree of 165/2001 states: "The Principal is responsible for the financial and instrumental resources and the results of the service. The Principal has autonomous powers of direction, coordination, and enhancement of human resources." We briefly illustrate these powers.

In terms of teaching staff, permanent teachers are assigned to schools through a centralized system, which takes into account teachers' preferences. Principals can however indirectly influence which permanent teachers a school attracts and retains. Anecdotal evidence indicates that good teachers are more likely to apply for positions in well-managed schools, which might require more effort but are more professionally rewarding. Principals can also use strategic role assignments to shape their faculty composition - offering additional paid responsibilities to high-performing teachers while creating less favorable conditions and using moral suasion for others to leave.[7] Moreover, principals have full discretion

[6] Private schools account for less than 4% of enrolled students (Ministero dell'Istruzione, 2014). Note also that, unlike most other countries, private schools in Italy are mostly geared towards the recovery of less able students, and students in these schools perform worse on standardized scores (Di Liberto, Schivardi, and Sulis, 2015; OECD, 2012).

[7] In the contest of the Italian Social Security Administration, which is also subject to the constraints of

over temporary replacement teachers. Good HR management practices can therefore affect the quality of the teaching staff.

Principals supervise teaching and non-teaching staff. They organize work to enhance the efficiency and effectiveness of teaching. They are in charge of the school timetable, staff assignment to classes, and class composition.[8] Principals are responsible for developing the school's Educational Offer Plan (*Piano dell'Offerta Formativa*, POF), which outlines the educational and formative objectives. They also manage the school's budget, ensuring resources are allocated effectively to meet both educational and infrastructural needs. Additionally, principals oversee the school's external relationships, including engaging in fundraising activities with local authorities, other educational institutions, and the broader community. The additional funding secured through these efforts can be used to enhance the educational offerings and enrich the students' learning experiences. If issues arise, principals can conduct classroom observations to provide guidance on teaching strategies. They are also responsible for maintaining student discipline, a role that becomes especially important in compulsory high schools, where disciplinary challenges tend to be greater than in primary and middle schools.

Principals have full responsibility for staff training. While the funds are allocated by the national Government based on the number of teachers, principals have a significant decision-making power in deciding the type of training and organizing its implementation. This is particularly important in small schools, where coordinating training with other schools can help mitigate organizational fixed costs. However, such coordination is challenging and requires strong managerial skills.

In sum, principals can affect the quality of students' learning through various channels. They, directly and indirectly, shape staff composition, establish internal goals to drive accountability and improvement, use both formal and informal incentives to motivate staff, oversee teachers' training and manage student discipline. Principals who apply better managerial practices, therefore, can make a significant impact on students' achievements.

the public sector in terms of workers' management, Fenizia (2022) shows that productivity gains are driven primarily by the exit of older workers who retire when a productive manager takes charge.

[8] Unlike in the United States, where high school students typically move between different classes based on their subjects, in Italy, classes are fixed. All students in a given class take every subject together and remain in the same physical classroom. Managing class composition and teachers' assignments are therefore important responsibilities of principals.

3 Data and descriptive statistics

We use a rich dataset on upper secondary Italian schools that merges information from three different sources in two school years (2011 and 2015). We first collect longitudinal data on managerial practices adopted in Italian secondary schools using the WMS methodology (Bloom and Van Reenen, 2007). This procedure allows us to obtain a quantitative measure of organizational and leadership abilities of the principals. These are then merged with administrative data on student performance and background information drawn from INVALSI (National Institute for the Evaluation of the Educational System of Instruction and Training) and with a second administrative dataset on school characteristics provided by MIUR (the Italian Ministry of Education).

In this section, we describe the construction of the school management panel dataset and discuss how these variables relate to the channels identified by the literature through which principals and their managerial activities influence student outcomes. Then, we present the information drawn from the two administrative datasets. Last, we provide some descriptive evidence of our key variables.

3.1 Management outcomes: the World Management Survey panel data

Evaluating the impact of managerial practices on an institution's performance is empirically challenging due to the difficulty of measuring managerial quality. As noted in the introduction, most quantitative studies on schools use the value-added approach. In this framework, students' achievements are regressed on individual principal (or teacher) fixed effects. The estimated fixed effects are the measure of the individual principal's contribution to performance and can be interpreted as their ability.[9] While clearly informative, this approach produces an overall measure of the principals impact without identifying what principals actually do to influence students' learning. Moreover, the data requirements are demanding: one needs a long panel to observe a sufficient number of principal switches to identify the individual effects.

A second approach exploits the survey responses based on principals' self-assessments. This allows to measure specific principals' managerial activities implemented within schools. However, the use of these types of indices raises concerns over mismeasurement, as they are likely to suffer from the typical problems of self-assessment bias (Grissom and Loeb, 2011; Grissom, Blissett, and Mitani, 2018).

[9] Outside schools, in a seminal contribution, Bertrand and Schoar (2003) employed this framework to determine how individual managers affect corporate behavior and performance.

To measure the quality of managerial practices in Italian schools, this study follows the WMS project, which supplies a protocol that enables the collection of high-quality data on the managerial practices adopted within different organizations (Bloom et al., 2015).[10] This methodology, which is described in detail in the Appendix, is based on extensive telephone double-blind and open-ended interviews during which a set of qualitative answers of principals are translated into quantitative measures with a score ranging between 1 (worst) to 5 (best).[11] The methodology has been extensively applied over the last twenty years to thousands of firms, hospitals, and schools throughout the world. The method is by now a standard tool of analysis and a large number of papers using it have been published in top academic journals (see worldmanagementsurvey.org for details). During the interviews, respondents do not know that their answers are converted into a score that summarizes the quality of managerial practices they implemented. At the same time, the interviewers' team, which follows specific training on how to score the qualitative answers, only has basic information about the individuals interviewed and the schools they run. In sum, while this approach is substantially more costly than the previous ones, it offers the significant advantage of controlling for both the typical problems of self-assessment bias and the use of subjective measures of managerial practices (Bloom and Van Reenen, 2011, 2010).

The WMS school survey covers a series of managerial activities grouped into five specific management areas: operations, monitoring, targets, people (i.e. human resource management), and leadership. In our context, *Operations* (four questions) is concerned with the standardization of the educational processes, the personalization of teaching, and the diffusion of best practices within the school. *Monitoring* (five questions) focuses on monitoring performance and reviewing the results at the school level, while *Targets* (five questions) assesses the quality of the process through which quantitative and qualitative targets are set and their interconnection in the short, medium and long run. *People* (five questions) is dedicated to human resource management, such as removing poor performers, rewarding employees based on performance, and hiring and keeping the best teachers or staff in schools. Finally, *Leadership* (three questions) assesses the principal's leadership capacity jointly with a clear definition of roles and responsibilities within the school.

Within the literature on management and educational outcomes, human resource man-

[10] The WMS data collection method identifies managerial practices that are common across units, such as firms or schools, and it focuses on the solutions adopted by managers to solve specific problems. This standardization allows for meaningful comparisons across sectors and countries. Bloom et al. (2015) first apply this approach to study the relationship between school managerial practices and student performance in a cross-country setting.

[11] All the details on the methodology and data collection are in Appendix A. The full set of questions is reported in Table C1 in Appendix C.

agement (*People*) is consistently identified as a critical area of management for schools. However, the level of autonomy that principals have in this area depends heavily on institutional factors that shape their ability to select and incentivize teachers and staff (Bloom et al., 2015; Bartanen and Grissom, 2023). This is important to note because the WMS measures actual management practices, which are influenced by these institutional constraints. In Italy, principals have limited autonomy when it comes to teacher allocation and salaries, as these decisions are made at the central level.

Italian principals have more discretion in other areas of management which also impact student performance. For example, the introduction of organizational innovations that enable teachers to work more effectively is captured by the *Operations* section of the survey. The *Monitoring* and *Targets* sections capture activities such as supervising teachers, monitoring their performance, assigning them to classrooms, and setting specific targets. The *Leadership* section of the survey captures the motivation of the teaching staff, which is also an important aspect of the principal job.[12] In addition, principals can directly influence student outcomes through activities such as allocating teachers and students across classes or addressing discipline and absenteeism (Bartanen, 2020). Principals can coordinate effective school-wide policies, such as increasing communication from school staff to families or implementing data systems to support at-risk students. While the WMS does not directly measure the quality of specific principal actions on these factors, they are likely captured by the other areas of management analyzed, since these policies can only be implemented in a well-organized and monitored environment. Following the literature, in most empirical specifications we use an overall management quality index that is calculated as the average of the indices obtained in each question of the survey. However, we will also investigate its individual components.

Together with the management indices, the WMS also collects data on demographics and background characteristics of the principals and the school they manage. This set of variables includes information on age, gender, tenure as principal within the school, overall tenure (both as teacher and principal) within the school, whether they had other job experience outside the school, whether they chose to be assigned to that specific school, and if they manage multiple schools.[13]

[12]The *Operations* and *Leadership* sections broadly cover what the management literature and education scholars identify as instructional leadership activities (Grissom and Loeb, 2011) and transformational leadership activities (Robinson, Lloyd, and Rowe, 2008).

[13]The few and lengthy national selection processes that have occurred in Italy over the years imply that, during the period analyzed, principals were fewer than the number of vacancies in Italian schools, and some principals managed multiple schools in the same year. The management of multiple schools (*reggenze*) is usually allowed in exceptional cases and for limited periods of time. However, since this may affect the

We exploit a two-wave panel of managerial indices at school level. During the school year 2010-11, we collected the first wave of data on managerial practices of principals for a representative sample of 341 upper-secondary Italian schools. During the school year 2014-15, we checked if our 2010-11 schools had the same principal or not. In schools where the principal did not change, we assume that the quality of managerial practices also remained the same. Hence, in 2014-15 we assign the same managerial index the principal obtained during the 2011 interview.[14] To validate this assumption, Appendix Figure B1 plots the managerial index against tenure as principal, both for the whole sample and for individuals who became school principals starting in 2006—the first ones selected after the 2001 reform, which granted school principals managerial powers and responsibilities. We find no correlation between the two variables. As for the schools where the principal had changed since 2011 ("switcher" schools), we interviewed the new principal in 2015 following the same WMS protocol.

Finally, to further expand our panel sample, we exploit a "chain" approach, which also assumes that the quality of managerial practices stays constant over time.[15] Specifically, we asked newly interviewed principals in 2015 which school they managed in 2010–11 and assigned the same managerial index to those school for the academic year 2010-11. As for 2014-15, we collected new data from additional interviews with the new principals in these schools. With this approach, we also extended our panel with new schools that were not part of the first wave sample. However, since there may be complementarities between the principal and the school, and principals may adapt their managerial practices accordingly, in our robustness section we will check if our results are confirmed when we exclude these additional schools and use only the smaller sub-group of "switcher schools".

quality of managerial practices implemented in a school, in our analysis we include a specific dummy that flags if a principal runs multiple schools.

[14]This assumption is especially reasonable in our context, due to the short time interval between the two waves of data collection. Interviewing principals twice may also result in recall bias, questioning the comparability of the two measurement exercises. On this, see also Lemos, Muralidharan, and Scur (2021), who exploit panel data on a sample of Indian schools and student outcomes but measure management quality only once in each school at the end of the study period, treating school management as fixed over time. In any case, given that we use school fixed effects, schools that did not experience principal turnover do not contribute to the estimation of the effect of managerial practices on student performance.

[15]The hypothesis of constant managerial quality is also supported by the literature that uses value-added (VA) models to measure principals' contribution to improving student outcomes, and which relies on the premise that a principal's effectiveness is constant across any two schools (Bartanen and Husain, 2022).

3.2 Administrative data on students and schools

To obtain our final dataset, we first merge the WMS database with the database provided by INVALSI, a government agency that carries out a yearly evaluation of student attainment in both mathematics and Italian language. This is our main source of information at the student level.

The INVALSI standardized tests are compulsory for all Italian public or private school students attending the second and fifth grades (in primary schools), the sixth and eighth grades (in lower secondary), and the tenth and thirteen grades (in upper secondary). We focus on tenth-grade upper secondary school students in the 2010-11 and 2014-15 years.[16] Our outcomes consist of standardized test scores in math and language and aspirations to pursue tertiary education.[17] The INVALSI questionnaire also collects detailed information about the student's background and family characteristics. In our analysis, we include the following additional student demographic information: gender, immigration status, age relative to the student's class cohort, class size and socioeconomic status (SES).[18] The latter is proxied for by the parents' occupational status, their educational attainment and the household's possession of educational resources.[19]

Finally, we merge a second administrative dataset on public schools ("*La scuola in chiaro*") provided by the Italian Ministry of Education (MIUR), which includes additional information on teacher and staff characteristics at the school level.[20] For each school, the

[16] We do not follow the same student along the different grades and, thus, we cannot control for the student's prior-year test score.

[17] Educational aspirations are measured by INVALSI with the following question: "Which educational attainment do you wish to achieve?". Respondents can choose among: a) compulsory education only; b) secondary vocational or technical qualification; c) high-school diploma; d) post-secondary vocational or technical qualification; e) bachelor's degree; f) higher education (Masters or PhD).

[18] As for immigration status, we flag whether the student is a first- or second-generation immigrant. We use two dummies to control for the relative age-to-grade cohort. One is for students who are at the expected age for their grade level (or "regular" students, 15 years old), and the other is for students who are one year younger and attending tenth-grade classes ahead of schedule (14 years old). The remaining category encompasses students who are repeating a grade or those (typically immigrant students) who are enrolled in a grade lower than their age would imply.

[19] We categorize parents' occupational status as self-employed, high-SES jobs (such as managers, executives, and civil servants), medium-SES jobs (office workers, teachers, etc.) low-SES jobs (such as construction workers and waiters), and "at home" (houseworkers, the unemployed, or the retired). Parents' educational attainment is divided into three categories: below, equivalent to, or above upper secondary education. Both are computed separately for mothers and fathers. We measure the possession of educational resources in the household by the number of books in the house. In addition, in our robustness exercises, we also use a comprehensive SES index, obtained by a principal component analysis, computed by INVALSI and similar to the one used by the OECD for the PISA test.

[20] Given that this information is only available for public schools, we lose observations corresponding to private schools (422 students). The number is small because most upper secondary schools are public in the Italian school system. On this, see also Section 2.2.

MIUR dataset provides time-varying information on the number of teachers and students, the number of permanent teachers, the number of female teachers, the number of administrative staff, and the number of students who are transferred to or from another school.

3.3 Descriptive statistics

Our final sample consists of data on all schools from the WMS panel that could be matched to the administrative datasets from the INVALSI and MIUR. It comprises 309 school-principal-year observations (172 in 2011 and 137 in 2015) and 23,514 student-year observations. This is the sample used in the main analysis. In some specifications, we also rely on different versions of the sample, including a balanced sub-sample of "switcher schools", i.e., the 56 schools that change the principal and where the management quality is measured both in 2011 and 2015. Additional details about these different samples together with potential attrition issues are available in Appendix A. Appendix Table B1 reports the main descriptive statistics separately for 2011 and 2015 for all variables used in the analysis: outcome variables, student characteristics, managerial quality indices, and principal and school characteristics.

Figure 1 describes our four dependent variables. The plots at the top show the kernel distributions of the mathematics and language standardized test scores by year (2011 is in light grey and 2015 is in dark grey). The distributions are statistically different across subjects and years. The math scores tend to be distributed along the whole range of skill, with a larger variance in 2015. The distributions of the language scores are positively skewed, with a leftward shift of the 2015 score distribution relative to the 2011 score distribution.

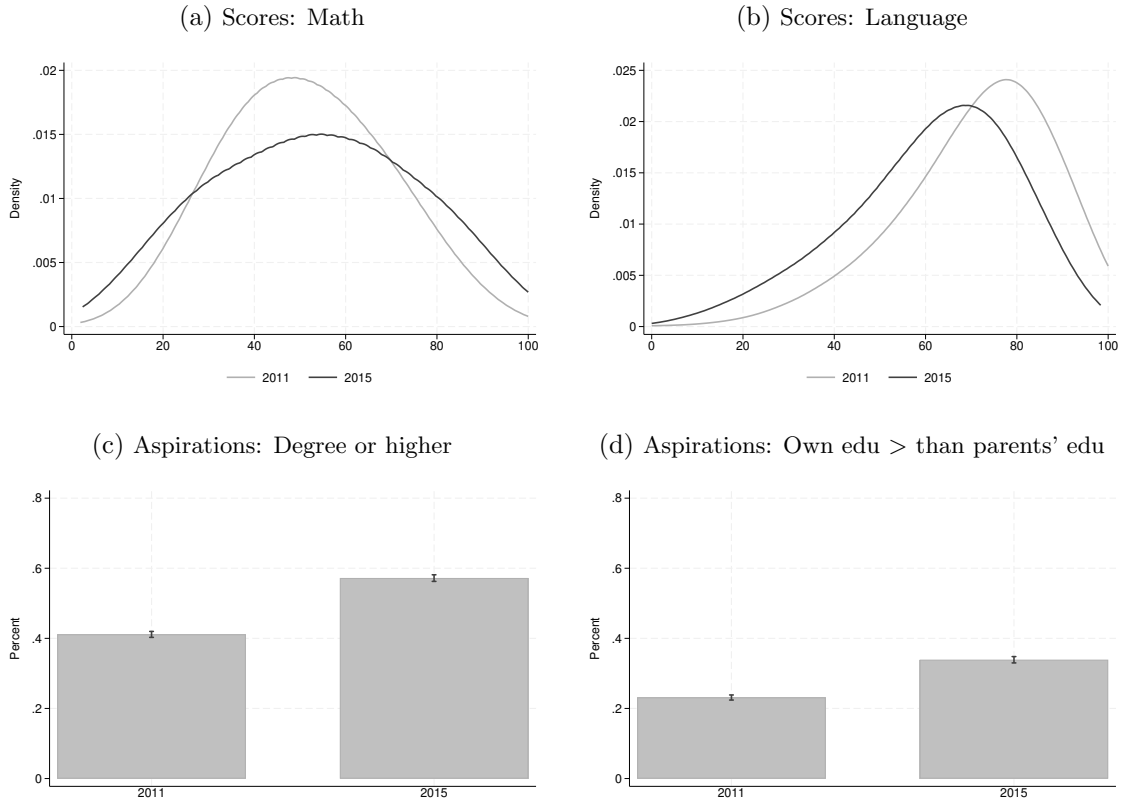
The two additional outcomes described at the bottom of Figure 1 relate to the educational aspirations of students. We compute a dummy for whether the student aims to obtain at least a bachelor's degree and a dummy for whether the student wishes to achieve a higher level of education than their own parents. This is equal to one if the student intends to obtain at least a bachelor's degree and their parents do not have one. This second variable specifically aims to capture the students' ambitions for intergenerational upward mobility. The two plots show that the share of students with higher educational ambitions increased from 2011 to 2015 by around a third. These differences are statistically significant at conventional levels.

Figure 2 plots the kernel density distribution of the overall management index of principals in 2011 and 2015. In both years we observe a susbtantial dispersion of the management indices across schools. Compared to 2011, the 2015 distribution is shifted to the right, and

suggests a decrease of the share of principals adopting poor managerial practices. This shift may be explained by the fact that, in 2011, the government held a national competition for principals where, for the first time, an important element of screening was managerial ability. This implies that newly appointed principals have on average better managerial skills than before.

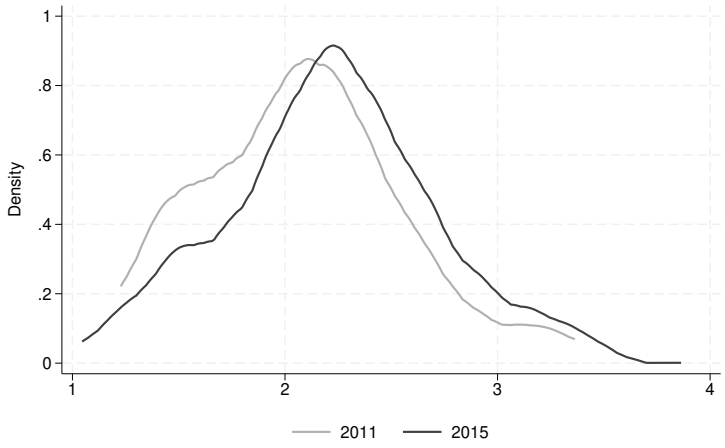
Appendix Table B1 shows that the increase in the managerial index between 2011 and 2015 holds for all areas but *People*, which has consistently low indices in both years. As discussed above, this is a reflection of the Italian institutional features and the survey design. In fact, the WMS measures the quality of managerial practices actually adopted by principals in each school, not their managerial abilities *per se*. As argued by Di Liberto, Schivardi, and Sulis (2015), compared to the other dimensions, human resource management

Figure 1: Distribution of the dependent variables, by year



Note: The plots at the top report the kernel distributions of the student standardized test scores in math (left) and language (right), by year. Light grey lines refer to 2011, dark grey lines refer to 2015. The vertical bars in the plots at the bottom show the average share of students wishing to achieve at least a degree (left), or at least their parents' educational attainment (right), by year. Vertical black lines refer to confidence intervals. In all cases, we reject the null hypothesis that the distributions in 2011 and 2015 are equal.

Figure 2: Distribution of the overall management index, by year



Note: The plot reports the kernel distribution of the overall management index, by year. The light grey line refers to 2011, the dark grey line refers to 2015. We reject the null hypothesis that the distributions in 2011 and 2015 are equal.

is the area with the highest degree of institutional constraints. Also, institutional constraints have not changed between 2011 and 2015.

4 Empirical framework and identification

While there is widespread evidence that managerial practices correlate positively with performance in a variety of settings, moving from correlation to causation has proven difficult. This difficulty is due to the possible presence of unobserved heterogeneity correlated with both performance and managerial practices. In our specific context, it is possible that principals who implement better managerial practices may self-select into the best schools, which are typically located in catchment areas with high socio-economic status and better-performing students. The opposite could also be true, with better principals assigned to more challenging schools. Cross-sectional estimates cannot rule out all endogeneity concerns, as finding suitable instruments for managerial practices is also difficult.

We follow a different strategy: given the structure of our data, we use school fixed effects to control for all time-invariant unobserved heterogeneity. Specifically, we study the effects of managerial practices on student achievements using the following regression framework:

$$Y_{ijt} = \alpha + \beta MI_{jt} + \gamma X_{ijt} + \delta Z_{jt} + \theta_j + \eta_{r(j)t} + \upsilon_{ijt}, \tag{1}$$

where Y_{ijt} is an indicator of performance or aspirations of student i attending school j in

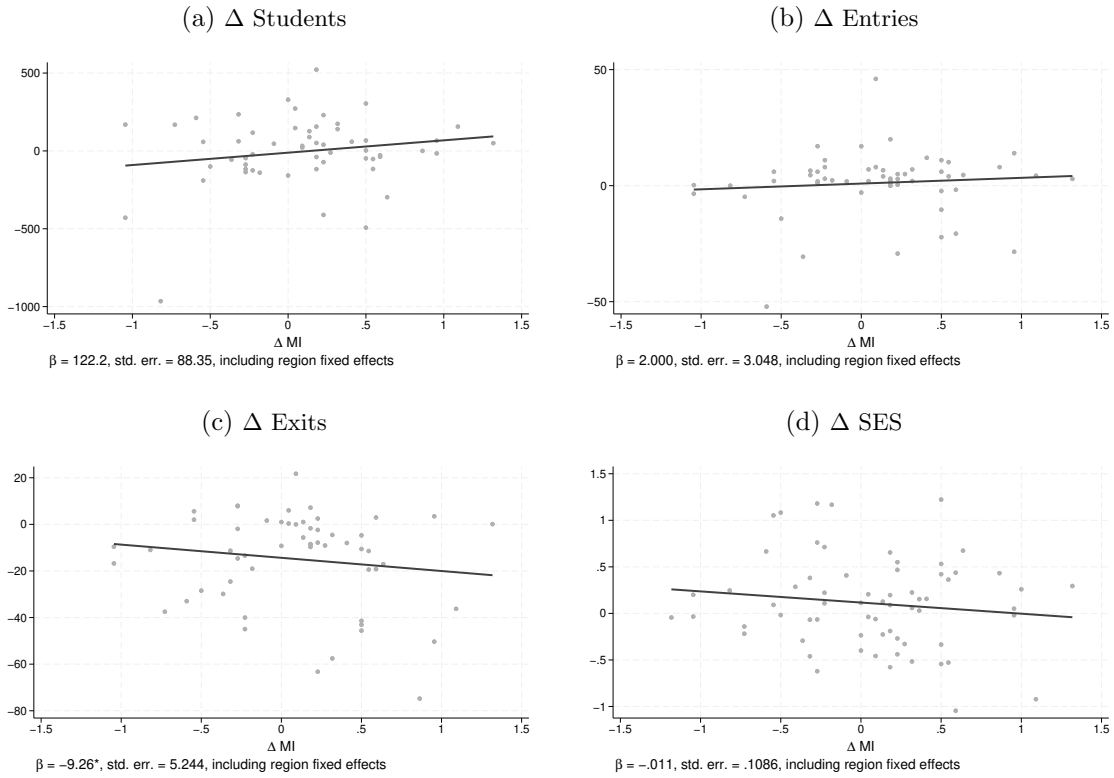
year t, MI_{jt} is the managerial quality index for school j in year t, X_{ijt} is a set of individual student controls and Z_{jt} are school and principal controls, listed in the note to Table 1. The model also includes school and area-year fixed effects (θ_j and $\eta_{r(j)t}$, respectively, where $r(j)$ is the area in which school j is located), while υ_{ijt} is the error term.[21] Standard errors are clustered at the school level. The inclusion of school fixed effects ensures that time-invariant school heterogeneity does not bias our estimates of managerial practices. In fact, we are measuring how student outcomes at the school level change with managerial practices, where changes in the latter are related to changes in the principal.

School fixed effects address what we see as the main endogeneity concern. However, other factors can threaten our identification strategy. The first is time-varying shocks to student performance potentially related to changes in managerial practices. We see two potential channels: change in the pool of teachers and of students. As far as the teachers are concerned, studies on Italian teachers' mobility indicate that the major issue in the school choice decision is the distance from residence (Barbieri, Rossetti, and Sestito, 2011). Furthermore, even if Italian principals cannot hire or fire teachers due to institutional constraints, the scoring grid of the WMS survey suggests that the activities identified as best practices (and high index values) in almost all management areas imply higher effort for the school staff. Therefore, principals who implement effective managerial practices are likely to attract more motivated and productive teachers while encouraging the departure of less effective ones. As a consequence, we expect that one of the effects of better managerial practices, if anything, is to induce positive teacher selection. As explained before, this is an important channel through which principals can affect student performance, and we want to take it into account in our estimate.

The change in the student pool could undermine our identification. However, we deem it unlikely that the student pool changes (due, for example, to shifts in neighborhood characteristics) so quickly following a change in the principal. Panel a of Figure 3 plots the change in the management index versus the change in the total number of students for the sub-sample of switcher schools, showing a positive but not significant correlation. This slight increase is driven by a decrease in the number of students who transfer to another school (ΔExits, panel c) rather than an increase in the number of students who transfer from another school (ΔEntries, panel b). This suggests that, if anything, we can exclude

[21] Areas are defined in terms of the 4 Italian macro-regions: North-West, North-East, Centre, South and islands. Descriptive statistics for the full list of control variables are in Table B1 under the headings "Student characteristics", "School characteristics", and "Principal characteristics". If a covariate is included as categorical, the table reports statistics for each category.

Figure 3: Change in management index and in number of students and student composition



Note: Correlation between the change in management index (ΔMI) and the change in the school's total number of students, total number of entries (students who transfer from another school), total number of exits (students who transfer to another school), and average socio-economic status of students. Sample of switcher schools only (56 schools). Each plot reports the correlation coefficient and robust standard errors, conditional on region fixed effects. * p<.10.

that a positive change in the management index is associated with the principal being able to attract better students from competing schools or by screening students based on ability (e.g., changing the school retention policy and increasing the share of students that are not promoted to the next grade level, thus inducing the worst performing students to transfer to other schools).[22] Finally, panel d shows that the change in the management index is not associated with a change in the student composition in terms of socio-economic background, further dispelling concerns related to the students' composition. In any case, we will directly control for the socio-economic status of students in the regressions.

Another possibility is that managerial practices are correlated with other policies that

[22]In Appendix Figure B2 we also provide a simple event-study analysis that shows the absence of correlation between changes in these school-level indicators pre-2015 and the management index of the new principal in 2015. In other words, the evidence does not support the hypothesis that better principals select into schools with a growing number of students or transfers.

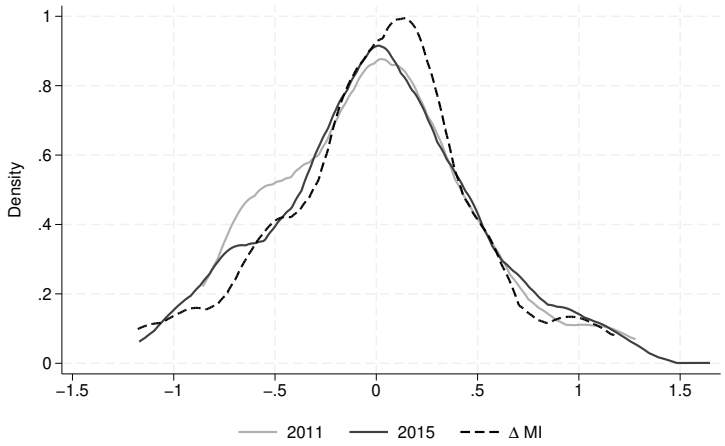
principals introduce. This too is not likely to be the case. Specifically, principals cannot influence their school's mission or curricula as these are centrally established by the Ministry of Education, which also provides guidance on the specific skills and knowledge that students are expected to acquire. Therefore, although we cannot entirely rule out the influence of other actions taken by principals that may correlate with managerial practices, our empirical framework provides support for attributing changes in student outcomes to the managerial practices implemented by the new principal.

One last potential problem with fixed effects estimates is that the time series variability might be limited, decreasing the signal-to-noise ratio of the explanatory variable and leading to imprecise estimates. Again, this is not likely to be the case in our setting. First, the WMS is based on long and detailed interviews that accurately measure the quality of managerial practices. Second, as previously mentioned, principals have a significant impact on school organization, meaning that a change in leadership can lead to substantial shifts in managerial practices. To test this conjecture, in Figure 4 we plot the distribution of the management index in 2011 and in 2015, and the change in the management index for the sample of switchers (ΔMI). To ease comparability, we center the three distributions at zero. Reassuringly, they are very similar. In particular, the degree of variability that characterizes the change in the management index is similar to the cross-sectional variability within each year, suggesting that our fixed effects estimation should not suffer from low variability problems.

5 Results

In this section, we describe the main results, deferring robustness and extensions to the next section. Table 1 presents the main results on the effect of managerial practices, measured by the overall management index, on student performance. The dependent variables are the standardized test scores in mathematics (Panel A) and in Italian language (Panel B). In Column 1 we begin with a parsimonious specification that only includes our management index and a base set of school and area-by-year fixed effects. In subsequent columns, we augment our set of controls and include the characteristics of the principal, the school, and the student and their family. Our saturated model in Column 4 thus includes a large set of potential determinants of student outcomes. Including additional controls is important, as the adoption of good managerial practices may be correlated with the principal's observable characteristics, such as age, tenure and experience, or with other school or student characteristics.

Figure 4: Demeaned distribution of the management index and of the change in the management index



Note: The solid lines refer to the distribution of the demeaned management index in 2011 (light grey) and 2015 (dark grey). The dashed black line shows the distribution of the change in management index (ΔMI) in the sample of switchers only (i.e. 56 schools where the principal has changed between 2011 and 2015).

For both mathematics and language, in Column 1 we obtain a positive but marginally statistically insignificant coefficient. However, as we add more controls the estimated coefficient increases and becomes statistically significant at conventional levels for both outcomes. Our estimates are also quantitatively important. Our preferred specification in Column 4 implies that a standard deviation increase in the management index increases average student test score results by 0.091 standard deviations in mathematics and 0.066 standard deviations in language.

Our estimates are in line with previous evidence in the managerial literature. Exploiting an IV strategy on the first wave of the data used here, Di Liberto, Schivardi, and Sulis (2015) find that a one standard deviation increase in the management index causes a 0.10 standard deviation increase in student math achievement. Tavares (2015) finds that participation in a school management program increases the math performance of Brazilian eighth graders by approximately 0.14-0.22 standard deviations. Bloom et al. (2015) identify significant cross-country variation, showing that a one standard deviation rise in the managerial index corresponds to an improvement in student outcomes ranging from 0.2 to 0.4 standard deviations. Our estimates also compare with those of the literature that uses the value-added approach to quantify the overall impact of effective leadership on student outcomes. Estimates vary across studies, with a one standard deviation increase in principal effectiveness improving student achievement by 0.03 to 0.20 standard deviations in math, with smaller

but similarly variable effects for reading (Branch, Hanushek, and Rivkin, 2012; Dhuey and Smith, 2018; Bartanen and Husain, 2022; Bartanen, Husain, and Liebowitz, 2024). Surveying the recent literature, Grissom et al. (2021) find that a one standard deviation increase in principal effectiveness improves student achievement by 0.13 in math and 0.09 in reading. Our estimates (0.09 and 0.07) suggest managerial practices account for a substantial share of this effect.

As mentioned in Section 4, our fixed effects model should capture an important source of heterogeneity across schools which may potentially bias our estimates of the managerial index. In order to verify the direction of the bias, in Column 5 we also estimate our model excluding school fixed effects (but including all other controls). The comparison between

Table 1: Effect on student scores

	(1)	(2)	(3)	(4)	(5)
Panel A					
Dep. variable	Score: Math				
Management index	2.628	3.360**	3.490**	3.729**	2.489**
	(1.719)	(1.675)	(1.610)	(1.648)	(1.212)
Observations	23,514	23,514	23,514	23,514	23,514
School-year clusters	309	309	309	309	309
R-squared	0.331	0.332	0.335	0.384	0.258
School FE	✓	✓	✓	✓	
Area × Year FE	✓	✓	✓	✓	✓
Principal characteristics		✓	✓	✓	✓
School characteristics			✓	✓	✓
Student characteristics				✓	✓
Panel B					
Dep. variable	Score: Language				
Management index	1.441	2.084*	2.233*	2.420**	0.734
	(1.187)	(1.248)	(1.186)	(1.191)	(0.811)
Observations	23,436	23,436	23,436	23,436	23,436
School-year clusters	309	309	309	309	309
R-squared	0.411	0.412	0.413	0.451	0.361
School FE	✓	✓	✓	✓	
Area × Year FE	✓	✓	✓	✓	✓
Principal characteristics		✓	✓	✓	✓
School characteristics			✓	✓	✓
Student characteristics				✓	✓

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, and South. Student characteristics comprise gender, immigration status, class size, whether the student is regular or younger than regular, the number of books in the house, mother's and father's education and occupational status. Principal characteristics encompass age, gender, overall tenure within the school, tenure as principal within the school, additional job experience outside the school, whether the school was chosen, and whether the principal manages multiple schools. School characteristics are the number of pupils, teachers, administrative staff, female teachers, and permanent teachers.

the two specifications suggests that the inclusion of school fixed effects allows to correct for the presence of a downward bias in the pooled cross-sectional estimates, consistent with the hypothesis that principals with better managerial capabilities tend to be assigned to schools with low-performing students.[23]

Next, we consider the effect of managerial practices on student educational aspirations towards pursuing tertiary education. Results are reported in Table 2. The first dependent variable is a dummy for whether the student aims to obtain at least a bachelor's degree (Panel A), while the second one measures whether the student wishes to achieve a higher level of education with respect to their own parents (Panel B). Results again suggest a positive and statistically significant effect of managerial quality, which emerges more clearly when including principal, school and student controls. Estimates in Column 4 of Table 2 indicate that a standard deviation increase in management index increases average student

Table 2: Effect on student aspirations

	(1)	(2)	(3)	(4)	(5)
Panel A					
Dep. variable	Aspirations: Degree or higher				
Management index	0.016	0.031	0.033*	0.036**	-0.002
	(0.022)	(0.020)	(0.019)	(0.018)	(0.018)
Observations	23,514	23,514	23,514	23,514	23,514
School-year clusters	309	309	309	309	309
R-squared	0.285	0.286	0.287	0.317	0.262
School FE	✓	✓	✓	✓	
Area × Year FE	✓	✓	✓	✓	✓
Principal characteristics		✓	✓	✓	✓
School characteristics			✓	✓	✓
Student characteristics				✓	✓
Panel B					
Dep. variable	Aspirations: Own edu > parents' edu				
Management index	0.032	0.047***	0.048***	0.035**	-0.006
	(0.020)	(0.018)	(0.017)	(0.015)	(0.014)
Observations	23,514	23,514	23,514	23,514	23,514
School-year clusters	309	309	309	309	309
R-squared	0.100	0.101	0.101	0.327	0.288
School FE	✓	✓	✓	✓	
Area × Year FE	✓	✓	✓	✓	✓
Principal characteristics		✓	✓	✓	✓
School characteristics			✓	✓	✓
Student characteristics				✓	✓

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, South. The set of additional controls is identical to that included in Table 1.

[23] Here, estimates imply that a standard deviation increase in management index increases average student test score results by 0.061 standard deviations in mathematics (statistically significant at 5% level) and 0.020 standard deviations in language (not statistically different from zero).

aspirations by a third of a standard deviation. As for the previous two outcomes, estimates would be considerably biased towards zero in the absence of fixed effects (Column 5).

The comparison between Columns 4 and 5 in Tables 1 and 2 suggests the presence of a negative selection of principals in terms of managerial capabilities in the highest-performing schools. The process through which principals are assigned to schools in the Italian system can help us explain this result. First, actual assignments are made by the Regional School Authorities (RSAs), which aim to accommodate principals' requests but must also fill positions at schools not selected by any principal. These are likely to be the most 'difficult' schools, for which RSAs might try to allocate more capable principals. Second, anecdotal evidence suggests that the most prestigious schools are assigned by RSAs to older principals as a sort of 'end-of-career benefit'. While older principals may be more experienced, they tend to be less trained and rely less on formal managerial procedures than younger principals. Cohort effects may also play a role since newly appointed principals have a stronger background in management due to recent national competitions putting more emphasis on managerial capabilities during the selection process. The newly selected principals might tend to be assigned to more difficult schools.[24]

Managerial practices might take some time to display their effects fully. We investigate the timing of the effects in Table 3, which shows the results of our baseline specification from Column 4 in Table 1, augmented with an interaction term between the management index and a dummy variable indicating principal tenure of more than one, two, or three years, respectively. Starting with math, we find no significant difference when distinguishing between the first and subsequent years (Panel A, Column 1): the interaction between the dummy for tenure longer than one year and the management index is positive but not statistically significant. The difference turns significant when we distinguish between the first two and subsequent years (Column 2) and especially between the first three and subsequent years (Column 3). For language, the difference turns significant only when distinguishing between three or more years. This suggests that most of the effects of better managerial practices emerge quickly, but some additional effects manifest in the medium run.

Panel B of Table 3 reports the results when using students' aspirations. In this case, we find no differences according to the principal's tenure. This suggests that aspirations

[24] In terms of replacement, principals are appointed for three-year terms, renewable once. After six years, they may request to stay. Informal interviews with officials revealed that replacements were rare, occurring mainly for serious disciplinary issues or school reorganizations. Test score results could not be used to assess principals.

are more immediately responsive to better practices than test scores, possibly because expectations change more quickly than actual learning outcomes. Overall, we conclude that the impact of experience is rather limited, consistent with the recent findings of Bartanen et al. (2024) for the US.

An important question is whether the impact of managerial practices varies across different percentiles of the test score distribution. Figure 5 reports coefficients estimated via quantile regression models for the 10^{th}, 25^{th}, median, 75^{th}, and 90^{th} percentiles for math and language. Results suggest that the effect of managerial practices is homogeneous across the distribution of the student math score, while the effect on language scores is stronger at the left tail of the student outcome distribution, that is, low-performing students benefit the most.[25]

Table 3: Effects by principal's tenure

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	Scores					
Dep. Variable	Math			Language		
Management index	3.662**	3.395**	3.692**	2.450**	2.148*	2.394**
	(1.624)	(1.526)	(1.604)	(1.177)	(1.120)	(1.190)
Management index ×𝟙 (tenure>1 yrs)	0.215			-0.097		
	(0.625)			(0.475)		
Management index ×𝟙 (tenure>2 yrs)		0.855*			0.691	
		(0.498)			(0.432)	
Management index ×𝟙 (tenure>3 yrs)			1.188**			0.725*
			(0.576)			(0.431)
Observations	23,514	23,514	23,514	23,436	23,436	23,436
R-squared	0.384	0.384	0.385	0.451	0.451	0.451
Panel B	Aspirations					
Dep. Variable	Degree or higher			Own edu > parents' edu		
Management index	0.040**	0.037**	0.036**	0.036**	0.035**	0.035**
	(0.020)	(0.018)	(0.018)	(0.016)	(0.015)	(0.015)
Management index ×𝟙 (tenure>1 yrs)	-0.012			-0.002		
	(0.009)			(0.006)		
Management index ×𝟙 (tenure>2 yrs)		-0.002			-0.001	
		(0.007)			(0.005)	
Management index ×𝟙 (tenure>3 yrs)			-0.003			-0.005
			(0.009)			(0.007)
Observations	23,514	23,514	23,514	23,514	23,514	23,514
R-squared	0.317	0.317	0.317	0.327	0.327	0.327

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, South. The set of additional controls is identical to that included in Table 1.

[25] We also interact the management index with principal, school and student characteristics, finding that the effect is fairly homogeneous across them. If anything, the positive effect of managerial practices on the student scores is slightly reinforced the higher the principal's tenure, in accordance with the results of Panel

6 Robustness and extensions

In this section, we analyze the robustness of our results and perform some additional estimations to shed some light on what good principals actually do.

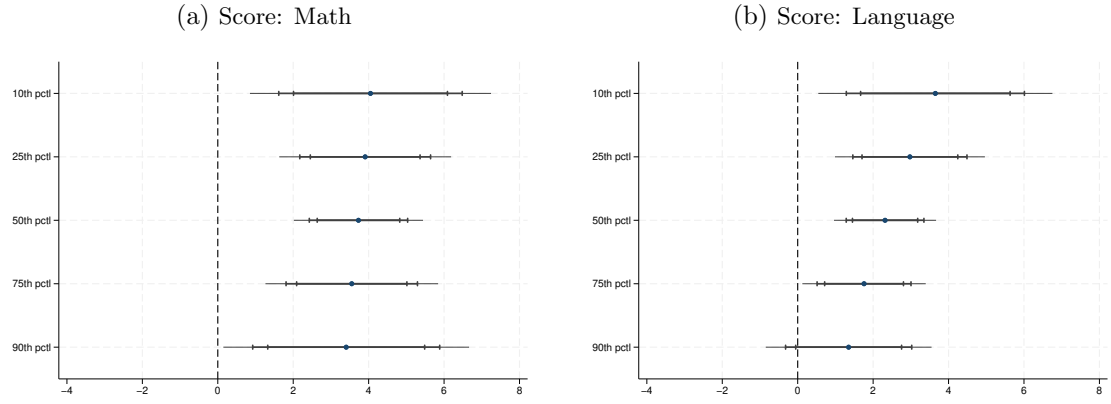
6.1 Selection of principals in schools

We further investigate the presence of potential selection of principals in schools and confounding issues that might generate bias in our estimates regardless of the inclusion of the school-fixed effects. First, in Table 4 we use the balanced sample of switcher schools, i.e. those where the principal has changed between 2011 and 2015, and show that the managerial quality of the new principal in 2015 is is unrelated to the math and language scores of students enrolled in the same school in 2011, as well as to their aspirations. Moreover, we also find that the socio-economic indicator SES is unrelated to the current managerial quality (Column 1 of Table 5).

Second, given that our effect is identified by the switcher schools, we need to rule out that our results are driven by additional potential unobservable confounders that influence both principal turnover and student performance. In columns 2-5 of Table 5 we show the absence of a relationship between a school's switcher status and the student outcomes.

Third, in Appendix Table B2 we assess the impact of various school-specific attributes measured in 2011 on the probability that the principal changes between 2011 and 2015.

Figure 5: Effects on scores by percentiles



Regressions estimated using the Stata command `xtqreg` by Machado and Santos Silva (2019). They include area-year fixed effects and controls for principal, school and average student characteristics. Confidence intervals at 90, 95 and 99 percent level are shown.

A of Table 3.

The coefficients, estimated in separate regressions, imply that turnover is associated to the principal's age and tenure and by managing multiple schools. In all cases, the positive relation is expected, because older or more experienced principals are more likely to retire, and the management of multiple schools is temporary by definition as it is usually allowed in exceptional cases and for limited periods of time. A positive coefficient associated with the number of administrative staff might also suggest that bigger schools are more likely to change principal, but this is not confirmed by the coefficients referred to the number of students and teachers. Importantly, the probability of changing principal is not statistically related to the student characteristics.

6.2 Model specification and sample selection

Next, we test the robustness of our results to different model specifications and sample selections. In Table 6 we specifically examine if considering only the balanced sub-samples of schools affects our results. In Column 1 we restrict our main sample of 309 school-year observations to a balanced panel of 236 school-year observations (i.e., 118 schools observed both in 2011 and 2015). In this case, we exclude schools participating in the first wave of data collection but whose new principal did not answer the interview in 2015, and also schools that could not be matched with administrative data in either 2011 or 2015. Here, we could expect some sample selection bias, as these schools may be worse in terms of student characteristics or managerial practices, or both. However, this source of attrition does not appear to impact our analysis, as our main results are confirmed across all four outcome variables.

Table 4: 2011 student scores and managerial indices of principal in 2015

	(1)	(2)	(3)	(4)
Dep. variable	Management index in 2015			
Avg score in 2011: Math	0.005			
	(0.007)			
Avg score in 2011: Language		0.003		
		(0.006)		
Avg aspirations in 2011: Degree or higher			-0.072	
			(0.263)	
Avg aspirations in 2011: Own edu > parents' edu				-0.074
				(0.592)
Observations	56	56	56	56
R-squared	0.096	0.089	0.088	0.087

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors. All regressions include area fixed effects, where areas are North-West, North-East, Centre, South. Dependent variable is the principal's management index in 2015. Average scores are measured in 2011. Balanced sample of switcher schools (n=56).

Table 5: Effect on student scores and aspirations, selection of principal

Dep. variable	(1)	(2)	(3)	(4)	(5)
		Scores		Aspirations	
	SES	Math	Language	Degree or higher	Own edu > parents' edu
Management index	-0.009				
	(0.025)				
Principal has changed		-0.337	-0.341	0.007	0.004
		(1.112)	(0.796)	(0.018)	(0.014)
Observations	23,318	23,514	23,436	23,514	23,514
R-squared	0.783	0.255	0.360	0.262	0.288
School-year clusters	308	309	309	309	309
Sample	Whole	Whole	Whole	Whole	Whole
School FE	✓				
Area × Year FE	✓	✓	✓	✓	✓
Principal characteristics	✓	✓	✓	✓	✓
School characteristics	✓	✓	✓	✓	✓
Student characteristics	✓	✓	✓	✓	✓

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, South. *Principal has changed* identifies the school's switcher status. The set of additional controls is identical to that included in Table 1.

In Column 2 we exclude schools that did not change their principal between the two waves, leaving us with 140 school-year observations. As our coefficient of interest is always identified by these schools, as expected, we find consistent evidence that management is positively and significantly related to our outcomes of interest, with larger coefficients for math and student aspirations. Column 3 reports coefficients referred to the same sample but estimated without school-fixed effects. As mentioned in Section 4, the comparison between the two specifications suggests the presence of a downward bias in the pooled cross-sectional estimates.

In Column 4 we further restrict the sample to the schools where the principal has changed between 2011 and 2015 and the management indices were collected when each principal was running the school (i.e., the 56 switcher schools). In this sample, we are not exploiting the assumption (described in Section 3.1) that managerial quality is time-invariant since we use only those schools where we observe principal turnover between the two waves and where the old principal has been interviewed in 2011 and the new in 2015. Last, Column 5 reports the pooled OLS estimates. Even for this sub-sample, the estimated coefficients are all in line with the main results, despite some loss of statistical power due to a significant drop in sample size.

Next, we test the robustness of our results to alternative model specifications and further sample selection choices. We report the results in Appendix Table B3. In the first two columns, we allow for differences in the model specification. In Column 1 we replace the

information on the number of books in the house and the parents' education and job status with the standardized student's socioeconomic status (SES) index. In Column 2 we allow for non-linearity in the principal's tenure within the school. The estimates of the managerial index coefficient are unaffected.

In Columns 3 and 4 we check if results are confirmed when using different samples. In Column 3 we exclude the few observations related to temporary principal posts (namely,

Table 6: Effect on student scores and student aspirations, balanced samples of schools

	(1)	(2)	(3)	(4)	(5)
Panel A					
Dep. variable	Score: Maths				
Management index	3.829**	4.524**	2.348	3.575*	2.340
	(1.663)	(1.740)	(1.951)	(2.107)	(2.351)
Observations	18,988	11,180	11,180	8,404	8,404
School-year clusters	236	140	140	112	112
R-squared	0.374	0.386	0.284	0.410	0.301
Panel B					
Dep. variable	Score: Italian				
Management index	2.484**	2.505*	1.879	2.916	2.694*
	(1.197)	(1.263)	(1.229)	(1.863)	(1.417)
Observations	18,915	11,109	11,109	8,351	8,351
R-squared	236	140	140	112	112
School-year clusters	0.459	0.469	0.394	0.476	0.406
Panel C					
Dep. variable	Aspirations: Degree or higher				
Management index	0.036**	0.046**	0.013	0.034	0.041
	(0.018)	(0.019)	(0.029)	(0.030)	(0.032)
Observations	18,988	11,180	11,180	8,404	8,404
School-year clusters	0.311	0.326	0.278	0.348	0.302
R-squared	236	140	140	112	112
Panel D					
Dep. variable	Aspirations: Own edu > parents' edu				
Management index	0.035**	0.036**	0.006	0.033	0.028
	(0.015)	(0.018)	(0.021)	(0.025)	(0.021)
Observations	18,988	11,180	11,180	8,404	8,404
R-squared	0.339	0.358	0.325	0.379	0.350
School-year clusters	236	140	140	112	112
School FE	✓	✓		✓	
Area-Year FE	✓	✓	✓	✓	✓
Principal characteristics	✓	✓	✓	✓	✓
School characteristics	✓	✓	✓	✓	✓
Student characteristics	✓	✓	✓	✓	✓
Sample	Whole	Switchers + Chain	Switchers + Chain	Switchers	Switchers

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, South. The set of additional controls is identical to that included in Table 1.

when the principal manages multiple schools) and find that the coefficient for the managerial index remains almost the same. Next, we verify that the estimates are robust to excluding principals close to retirement (namely, those in the 4th quartile of the age distribution, equal to 60 years old). As previously mentioned, in Italy principals are often assigned the more prestigious or preferred schools at the end of their career as a form of recognition. Therefore, the effect may be primarily driven by principals with longer tenure and more experience assigned to the best-performing schools. This is unlikely to be the case, as the estimates in Tables 1 and 2 without school fixed effects (Column 5) indicate that, if anything, the bias goes in the opposite direction. Consistently, Column 4 of Appendix Table B3 shows that the estimates are robust to excluding older principals.

Evidence from the United States suggests that the quality of entering teachers tends to improve during recessions due to the decline in alternative job opportunities (Nagler, Piopiunik, and West, 2020). The period covered by our analysis coincides with the European double-dip recession, making it a potential concern if the quality of teachers has improved contemporaneously with–but independently from–managerial practices. We argue that our findings are robust to this concern due to both institutional factors and our identification strategy. First, during the years we consider, Italy went through a process of strong fiscal consolidation. A series of pension system reforms increased substantially the retirement age, reducing the teachers' exit rate. This coincided with a hiring freeze of permanent teachers, which lasted until the reform of the school system *"La Buona Scuola"* (The Good School, Law 107 of 2015), enacted after the most recent data we use. As a result, teachers' composition remained stable during our study period.

More importantly, our estimates rely on within-school, cross-sectional variability in students' outcomes, ensuring they are unaffected by aggregate trends. There might still be differences in the strength of the recession at the local level, not fully accounted for by the year-macro area dummies. To account for this possibility, we add to our regressions the lagged unemployment rate at the provincial level. Provinces are 110 administrative units comparable to US counties and approximately correspond to school districts. Panel A of Table 7 shows that our estimates are identical to the basic ones of Tables 1 and 2, Column 4. Moreover, the unemployment rate is never significantly different from zero. This confirms that macroeconomic conditions are not likely to affect students' outcomes.[26]

[26] Appendix Table B4 reports the results of school-level regressions where the dependent variables are measures of teachers and class characteristics (% female teachers, % tenured teachers, student-teacher ratio, class size). We find no correlation between these characteristics and the provincial unemployment rate, confirming that the public school system's operations remained unaffected by local cyclical conditions during this period.

Table 7: Controlling for local economic conditions

	(1)	(2)	(3)	(4)
Panel A	Local unemployment rate			
Dep. variable	Scores		Aspirations	
	Math	Language	Degree or higher	Own edu > parents' edu
Management index	3.714**	2.239*	0.036**	0.036**
	(1.649)	(1.204)	(0.018)	(0.015)
Lagged unempl. rate	-0.032	-0.381	0.001	0.002
	(0.310)	(0.261)	(0.005)	(0.004)
Observations	23,514	23,436	23,514	23,514
R-squared	0.384	0.451	0.317	0.327
Area × Year FE	✓	✓	✓	✓
Panel B	Province-year fixed effects			
Dep. variable	Scores		Aspirations	
	Math	Language	Degree or higher	Own edu > parents' edu
Management index	5.808***	3.115**	0.068***	0.051**
	(1.955)	(1.540)	(0.024)	(0.021)
Observations	23,514	23,436	23,514	23,514
R-squared	0.392	0.460	0.321	0.329
Province × Year FE	✓	✓	✓	✓

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. Whole sample (309 school-year clusters). All regressions include school fixed effects. The set of additional controls (principal, school, and student characteristics) is identical to that included in Table 1. Panel A includes area-year fixed effects, where areas are North-West, North-East, Centre, South. Panel B includes province-year fixed effects (provinces are 110).

It could still be argued that other local shocks, beyond those captured by the unemployment rate, might influence our estimates. To address this, Panel B of Table 7 presents results where the four macro area dummies are replaced with 110 province dummies, interacted with year dummies. This approach controls for shocks at the province-by-year level, ensuring that unobserved local-time heterogeneity does not impact the findings. If anything, the estimates get larger.

6.3 Mechanisms

Our evidence supports the assumption that managerial practices have a positive impact on students' test scores and aspirations. In this section, we move beyond the overall summary index of managerial practices to examine whether specific aspects of school management have a greater impact on students' performance.

Our overall management index summarizes different dimensions of managerial skills, namely Leadership, Targets, Operations, Monitoring, and People. In Figure 6 we show the

effect of each component on the four outcomes estimated separately. Overall, all dimensions contribute fairly homogeneously to the increase in student scores and aspirations. The main exception is People, where the estimates, despite always being positive, are not statistically significant at conventional levels, and, to a lesser extent, Targets.

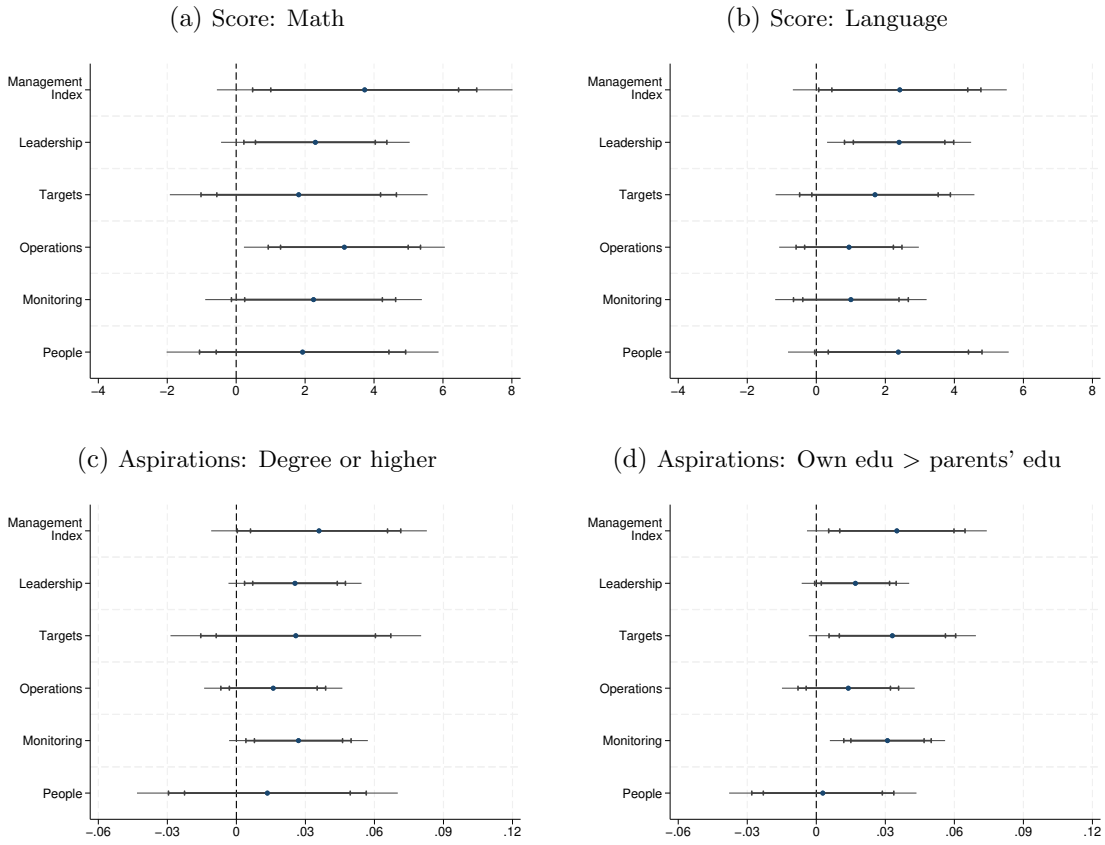
Interestingly, the overall index exhibits a larger coefficient than any individual component in all specifications. This suggests that the various dimensions of management activities complement one another in producing a more productive environment for students' learning outcomes. This aligns with previous theoretical results and empirical evidence. Brynjolfsson and Milgrom (2013) highlight the importance of complementarities among practices within organizations—underscoring the added value of cohesive clusters of practices working together compared to their individual effects. On the empirical side, Bruhn, Karlan, and Schoar (2018) conduct a randomized controlled trial involving the provision of managerial training to entrepreneurs of Mexican SMEs. While managerial training improves firm outcomes, they find no single "silver bullet" managerial practice that independently enhances firm performance. Similar results are obtained by Lamorgese et al. (2024) regarding the adoption of remote work by Italian firms during the Covid-19 pandemic. We conclude that managerial training for principals should adopt a holistic approach rather than concentrating on specific managerial practices.

To conduct a more detailed micro-level analysis of specific actions, we examine the transcripts of the principals' interviews. As explained earlier, the WMS is based on phone interviews in which the interviewer asks a series of open-ended questions, and principals provide responses without a predefined structure. Using text analysis on the principals' open-ended responses as transcribed by the interviewers, we identify recurring keywords, which we group into six categories of actions: dealing with disability; jobs and college; discipline; projects and grants; teaching methodology; and teachers' training. For each set of actions, we construct a dummy variable equal to one if the principal mentions at least one of the associated keywords. The underlying assumption is that during the interview, principals are more likely to emphasize aspects of their work they consider important.[27] We then regress test scores on the usual controls along with these dummies.

The results are reported in Appendix Table B5. For math, the only significant coefficient

[27] Dealing with disability is equal to one when words such as 'disability', 'catch up', 'special needs teacher', and synonyms are mentioned (80% of the sample); Jobs and college is one when 'job', 'university', 'firms' and synonyms are mentioned (75%); Discipline is one when 'discipline', 'retention', 'punishment', 'authority' and synonyms are mentioned (51%); Projects and grants is one when 'projects', 'grants', 'labs' and synonyms are mentioned (83%); Teaching methodology is one when 'methodology', 'innovative', 'interactive' and synonyms are mentioned (58%); and Teachers' training is one when 'training' and synonyms are mentioned (3%).

Figure 6: Effects by management dimension



Note: All coefficients are estimated in separate regressions, based on the model as from equation 1. All regressions include school and area-year fixed effects, as well as controls for the characteristics of principal, school, and students. Robust standard errors clustered at the school level. Confidence intervals at 90, 95 and 99 percent level are shown.

is for the teaching methodology dummy (Column 1): emphasizing this aspect during the interview is associated with a 3-basis-point increase in scores. The effect is slightly smaller when we also include the management index, likely because emphasizing teaching methodology contributes to a better managerial score. The coefficient is also positive for language, but not statistically significant. Higher language scores are associated with emphasizing jobs and college preparation, which identifies orientation activities that help students learn about educational and career pathways. There is some weak evidence of a negative correlation between outcomes and focusing on disabilities, while other areas show no significant effects.

6.4 Policy experiments

In this section, we conduct two analyses to assess the importance of investing in the improvement of principals' managerial skills.

The first exercise studies the assignment of principals to schools. Recent work by Fenizia (2022) suggests that efficiency gains from optimally reassigning managers across production units may be substantial. In what follows, we conduct a similar policy experiment on our sample of students/principals. In this setting, assigning better principals to larger schools would increase overall efficiency as a larger proportion of students would benefit from better managerial practices. We compute the counterfactual average score each student would get under the optimal allocation of principals and then compare it to the actual one. We first rank schools in terms of the number of students, then we rank principals in terms of management index and assign the one with the highest management index to the larger schools, the second best principal to the second largest, and so on. Thus for each school, we have both the actual MI_{jt} and the counterfactual measure of management MI^*_{jt}. The corresponding counterfactual score of student i in school j is given by $Y^*_{ijt} = Y_{ijt}+\beta(MI^*_{jt}-MI_{jt})$, where β is the estimated coefficient of our preferred baseline regression of student test scores on management and reported in Column 4 of Table 1. Finally, we calculate each student's percentage change in test scores. Using the sample of our main regressions, we find that optimal assignment of principals would increase student test scores on average by 0.8% in mathematics and by 0.4% in language. Despite being non-negligible, the effect is modest because differences in school size are limited (see Appendix Table B1).

As a second exercise, we perform back-of-the-envelope calculations to assess the potential GDP gains from policies that enhance principals' managerial capabilities. We draw on Hanushek and Woessmann (2020), who simulate the impact of some education policy reforms on the long-run growth rate. Their projections consider various reforms whose effects take 15 years to fully materialize. They also assume that it takes 55 years to completely replace the workforce present in the labor market at the time the reform is introduced. Using standardized OECD-PISA results in math and science in EU countries in 2015, they estimate that a quarter of a standard deviation increase in student achievement raises annual GDP growth by around 0.5 percentage points over a 40-year horizon. They estimate that in Italy, this would translate in roughly 7,585 billion euros of added GDP by 2060, equal to 340% of current GDP and 7.3% of discounted future GDP.

We combine their long run estimates to our finding that one standard deviation increase in school management quality improves math test scores by 0.09 standard deviations. Based

on this approach, the improvement in test scores linked to this increase in school management quality generates a 0.18 percentage point increase in yearly growth. This corresponds to a 2,731 billion euros increase in GDP over 40 years, equal to 122% of current GDP and 2.6% of discounted future GDP. Of course, as Gust, Hanushek, and Woessmann (2024) note, long-run growth projections are inherently subject to uncertainty and must be taken with a grain of salt. This said, these values suggest that the returns from improving principals' managerial capabilities are large. Importantly, improvements in school management are also cost-effective, as they involve targeted interventions affecting a relatively small number of principals with system-wide implications for student performance and aspirations.

7 Conclusions

In this paper we contribute to the still scant literature on the effects of principal managerial practices on student performance. Our key methodological contribution is to account for unobserved heterogeneity and selection through a school fixed effects regression framework, using the fact that, for a number of schools, we exploit the change in the principal and the resulting variation in managerial practices. This is an important step forward in terms of interpreting the results in causal terms.

We find that managerial practices positively and substantially impact student performance and educational aspirations. Our estimates imply that a standard deviation increase in the management index increases average student test score results by 0.09 standard deviations in mathematics and 0.07 standard deviations in language. As for aspirations, the probability that students wish to achieve at least a bachelor's degree or intend to obtain a higher educational attainment than their parents increases by roughly a third of a standard deviation. We show that our results are robust to several modifications of the empirical framework and to controlling for student, school and principal characteristics.

Our findings imply that policies directed at improving the quality of managerial practices in schools will positively affect student academic success. Our results on student educational aspirations further suggest that well-run high schools not only improve cognitive skills but also have positive effects on psychological traits considered important drivers of student further educational attainments and, in particular, on tertiary education ambitions.

Overall, our evidence indicates that increasing the quality of managerial practices in schools is a promising area of intervention to improve student outcomes. We show that such practices depend primarily on principals. This analysis also implies that a rigorous initial screening of managerial capabilities can help filter out potentially low-performing principals

and enhance the school's learning environment. Moreover, given that the literature shows that managerial practices can be taught (Bloom et al., 2013; Bruhn, Karlan, and Schoar, 2018) and that principals are a population substantially smaller than that of teachers, interventions aimed at improving their managerial capabilities might be a cost-effective way to improve student achievements.

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A Data Appendix

A.1 The World Management Survey approach

The aim of the World Management Survey (WMS) methodology is to obtain robust measures of management quality identifying a set of managerial practices that are possibly not contingent on the specific production environment and thus applicable to different countries and sectors, including schools.[28]

Bloom and Van Reenen (2007, 2010) discuss the main challenges to face in order to obtain reliable standardized measures of managerial quality. First, WMS employs open-ended questions and long telephone interviews until a precise assessment of actual management practices is achieved. To this aim a metric defines ex-ante what is a good and bad managerial practice, and the qualitative answers of each principal for each question are recorded into quantitative measures with a ranging between 1 (worst) and 5 (best managerial practices). To clarify this point, in Appendix C we include an example of the scoring grid, while Table C1 reports the full set of questions of the school survey used in this study.

Second, the survey methodology uses a double-blind approach. During the telephone interviews, principals are not notified that their open answers will be assessed against a scoring grid, thus acquiring insights into actual management practices rather than their aspirations or perceptions. On the other hand, interviewers did not have ex-ante information on the manager quality (e.g., their background and seniority) or of the school characteristics (e.g., student test scores or socio-economic background).

Third, the interviewers received specific training following a protocol that assures a) that each interviewer conducts a minimum amount of interviews in order to correct any inconsistent interpretation of responses, and b) double-scoring, i.e, having another interviewer listening and separately scoring the responses provided during the interview to be discussed with the primary interviewer. In particular, in order to reduce differences in scoring across analysts, especially at the start of the data collection, some of the interviews were jointly scored by the whole team, and a large fraction (about half) of the interviews subsequently conducted by the analysts were double-scored by the managers or by another analyst.[29]

This survey design implies that our collected management indices do not measure the intrinsic abilities of the principal but, rather, the quality of managerial practices implemented in schools. Indeed, the focus is on the solutions actually adopted by principals/managers to solve specific problems, and these, especially in the public sector, are often influenced by the presence of institutional constraints that may limit the ability to adopt good management practices and solutions. This is the case, for example, for the HRM section "People" in the survey, which asks if rewards or punishments are awarded as a consequence of well-defined

[28] Additional information on the methodology is available on the WMS website https://worldmanagementsurvey.org/data/dwms-public-sector/wms-methodology/. For more information on its application to the context of schools see Bloom et al. (2015) and Di Liberto, Schivardi, and Sulis (2015).

[29] Another tool adopted to improve the quality of the data was the back scoring, that is, the review of the notes taken during an interview with a further check of the interviewers' assessments with the whole team. This process was mostly implemented during the first period, to avoid potential differences in the understanding of the scoring grid across interviewers and ensure team calibration.

and monitored individual achievements and how the school actively controls the school staff.[30]

A.2 The two waves of data collection

Using the methodology described above, between February and May 2011 we carried out the initial round of 341 double-blind interviews with Italian principals. Our 2011 sample was randomly drawn from the population of Italian upper secondary schools, and stratified by type of school and geographical location.[31] At this educational stage, Italian students face a tracking system determined by the presence of differentiated curricula rather than by a formal assignment process to academic or vocational courses depending on student past performance or on alternative selection processes. The choice is among three main curricula: Lyceum, Technical, and Vocational. Access to tracks is based on individual or parental choice, and more academic curricula are typically chosen by students with a more privileged parental background.[32]

The interviews were conducted by the Italian team of five analysts and two senior managers who received training and monitoring from the international WMS team. The 2011 sample of 341 schools-principals is representative of the population of Italian upper secondary schools.

The follow-up in 2015 strictly followed the rules and procedures of the first wave of the WMS team, and it was characterized by a large degree of coordination across the two waves. The 2015 team consisted of six new interviewers who were trained following the same WMS protocol, and worked under the supervision of the same two senior managers of 2011. The data collection process started in January and ended in June 2015.

In 2015, we first detected which schools of the 2011 sample changed principal since the first interview. Out of the initial 2011 sample of 341 schools, we identified 127 schools managed by the same principal, while in 190 schools we observed principal turnover (turnover schools). For 24 schools we could not collect any information.[33]

We did not conduct a second interview with the 127 principals who had already answered the WMS in 2011 and did not change the school they managed. We assume that managerial quality is constant, and assign the same information collected during the 2011 interviews in 2015. However, the time-varying characteristics (such as principals age, tenure etc.) of the dataset were adjusted accordingly.

[30] In terms of hirings and firings and wage determination, Italian principals have very limited autonomy since both teachers allocation across schools and salaries are set at the central level. Therefore, based on findings from the 2011 analysis, in our 2015 data collection we omitted one final question of the international WMS survey (Q23 in Table C1), since Italian principals activities on the task were tightly restricted by institutional constraints obtaining index values almost identical for all principals. See also Bloom et al. (2015) for a discussion concerning measuring school managerial practices.

[31] Many studies show that geographical location is an important determinant of the Italian students educational attainment (Bratti, Checchi, and Filippin, 2007; Di Liberto, 2008).

[32] Brunello and Checchi (2007) show evidence of Italian upper secondary students sorting driven by the family background, while Agarwal, Brunello, and Rocco (2021) investigate the effect of the high school track on the returns to college and labor market outcomes.

[33] In most cases, these are schools where the administrative staff refused any interview or postponed it, and we could not collect the information within the scheduled data collection period.

In 2015 we conducted the WMS double-blind interviews only with the new principals of the schools that changed principals between the two waves. We collected information on managerial practices for 114 of them. Thus, for each school in this group, we have two independent measures of management collected in 2011 and 2015, interviewing the two different principals who were in charge of running the same school. We label this sub-group as "switcher schools".

In order to increase the size of our sample, in 2015 we also selected a new sample of 28 schools that were not previously interviewed. To this new sample we applied what we call the "chain" method. Table A1 below helps to illustrate how it works. We proceeded in steps: i) we interviewed the principal of school A in 2015 (principal Y in Table A1) and assigned the managerial index to school A in 2015; ii) during the interview, we asked principal Y about the school they were in 2011 (call it school B) and assigned the managerial index of principal Y to school B in 2011; iii) we then called school B, asked the new principal to participate in the project, interviewed them (principal W in Table A1), and assigned the managerial index of principal W to school B in 2015. Again, these are schools that changed principal between 2011 and 2015, or turnover schools, but we assume that managerial quality of the same principal is constant between 2011 and 2015. In other words, although for this group of schools the WMS double-blind interviews were both conducted in 2015, we still obtain two measures of management from two different principals who managed the school in 2011 and 2015. This is different from the group of 114 schools mentioned above, where interviews were conducted separately in 2011 and 2015, and assigned to each school accordingly.

To sum up, the WMS interviews conducted during the two waves yield a panel of schools such that, out of the initial 2011 sample of 341 schools, in the 114 turnover schools in 2015 we interviewed the new principal, while 127 that did not change principal were assigned the same management index as 2011. Finally, 28 schools are added to this final panel sample, but their principals were interviewed in 2015. Thus, at this stage, we drop from the sample 24 schools for which, as said above, we could not collect information, plus 76 turnover schools we were not able to interview in 2015.[34] In total, with our two waves of WMS interviews, we end up with 269 schools observed twice. The construction of the WMS panel is outlined in Figure A1.

The merge with the administrative INVALSI student data and the MIUR administrative information on schools resulted in the loss of some observations. This was mainly due to discrepancies in the school administrative identifier or to missing or inconsistent data in the administrative records from INVALSI or MIUR. Of the 114 that changed principal between

Table A1: The chain method

School managed in	2011	2015	
School A	principal X	**principal Y**	(2015 interview)
School B	**principal Y**	principal W	(2015 interview)

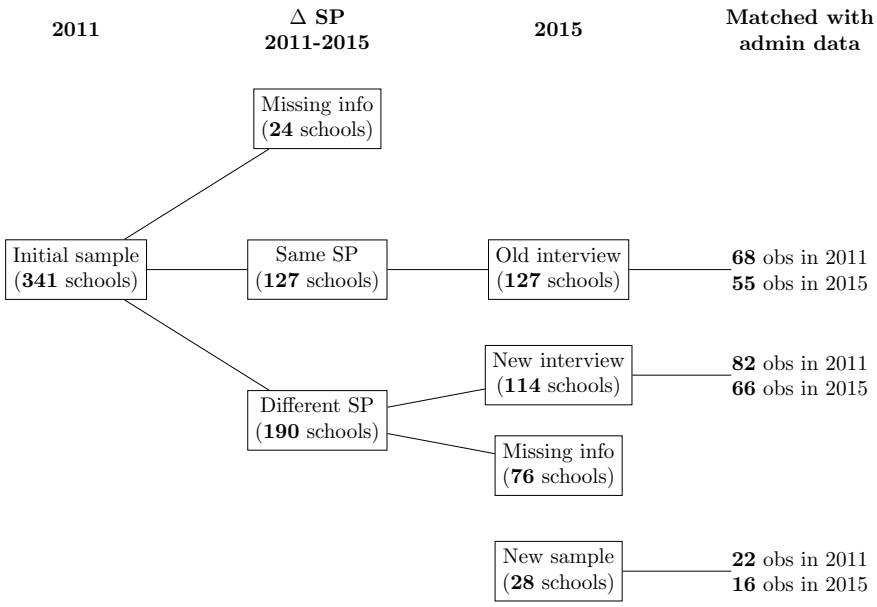
[34] Again, these 76 dropouts are mostly schools in which the new principal explicitly refused or continuously delayed her/his participation in the survey.

2011 and 2015, we are left with 82 in 2011 and 66 in 2015; of the 127 that did not change principal, we observe 68 observations in 2011 and 55 in 2015; of the additional sample of 28 schools, we observe 22 in 2011 and 16 in 2015 (see last column of Figure A1).[35]

In sum, in our analysis we mainly use the largest sample we obtain from the merge with the two administrative datasets which consists of an unbalanced panel of 309 schools (172 schools/principals observed in 2011, 137 in 2015) and 23,514 observations at the student level. We also use an unbalanced panel sub-sample that only includes turnover schools where the different principals have been interviewed in each wave when they were running the school or "switcher schools". This comprises 148 school-year observations (10,626 student-year observations).

Throughout the paper, we also present further evidence based on the balanced versions of the panel. First, we restrict our main sample of 309 school-year observations to a balanced panel of 236 school-year observations (i.e. 118 schools observed both in 2011 and 2015). Second, we exclude schools that did not change their principal between the two waves (96 school-year and 7,808 student-year observations), leaving us with only those schools that experienced an principal turnover and 140 school-year observations. This sub-sample consists of both schools recovered using the "chain method" as described above (comprising 28 school-year units and 2,776 student-year observations) and the "switcher schools" which

Figure A1: WMS interviews: construction of panel of schools



[35]Our initial dataset was merged with two distinct administrative datasets. Regarding schools that changed the principal, we were able to merge with the INVALSI data 90 schools out of the original 114. The missing mergers primarily stemmed from discrepancies in school identifiers due, in some cases, to a school consolidation process. Furthermore, the second integration with the Ministry of Education (MIUR) data led to a further loss of 8 schools.

comprises 56 schools (i.e. 112 principals and 8,404 students). Finally, since the former are schools where the principal changed between 2011 and 2015 but for which we assign the 2011 managerial quality index based on interviews carried out in 2015, we also relax this assumption and follow a conservative approach replicating the analysis using only the sub-group of 56 "switcher schools".[36] All details are summarized in Table A2.

Table A2: Final sample of schools by sub-group and year

	Main sample			Balanced sample		
	2011	2015	Total	2011	2015	Total
Principal changed ("switcher schools")	82	66	148	56	56	112
Principal changed ("chain method")	22	16	38	14	14	28
Same principal in 2011 and 2015	68	55	123	48	48	96
Total	172	137	309	118	118	236

A.3 Attrition

As described above, from the first and second wave of the data collection and from the merge with the two additional administrative datasets we lose observations and in this subsection we analyze if this attrition implies also sample selection. To this end, we check if the schools we lose are similar or not along some key characteristics measured in 2011, namely, the management index, the average socio-economic status of students, their score in math and Italian language, the area where the school is located and the type of school.

The first three columns of Table A3 divide our initial representative sample of 341 schools/principals interviewed in 2011 into three groups: the 127 schools that at the moment of recall in 2015 had the same principal in charge, the 190 that have instead changed the principal, and the residual group of 24 schools for which we were not able to recover any information. In this case, our initial 24 missing schools do not seem to identify a clear pattern in terms of sample selection.[37]

We then consider the sub-group of schools that changed the principal (the following three columns) and compare the characteristics of schools that we have been able to interview in 2015 (114) with those that went missing (76). The third column identifies whether the difference in the mean values of each variable in the two samples is significant.

In the next three columns of Table A3, we further take into account the missing observations due to the match with the administrative INVALSI and MIUR: in fact, of the initial 114 schools, after the match we lose 32 schools. Thus, we compare the characteristics of the matched schools (82 schools) with those that were not (32). Again, the third column identifies the differences in terms of initial conditions between the two samples.

[36] In this last analysis we are excluding the so-called "chain method" schools. The different balanced samples results are in Table 6 of the paper.

[37] We refer to the previous subsection of this Appendix for additional details on reasons for attrition at different stages of the creation of the final dataset.

Table A3: Attrition, following the initial sample over time

	Principal changed			Interviewed in 2015			Matched w admin data			First vs last
	No	Yes	Missing	No	Yes	Δ	No	Yes	Δ	Δ
Management index	2.14	1.91	1.82	1.83	1.97	-.13**	1.96	1.97	-.01	.17**
SES	0.08	0.02	0.27	-0.08	0.10	-.18**	0.37	-0.00	.37***	.08
Score in Math	47.83	46.62	55.49	43.84	48.30	-4.46***	49.21	47.95	1.26	-.12
Score in Italian	67.08	65.68	59.07	63.57	66.95	-3.38**	70.08	65.73	4.36*	1.35
Region: North-West	0.26	0.25	0.29	0.16	0.32	-.16**	0.44	0.27	.17*	-.01
Region: North-East	0.24	0.16	0.03	0.07	0.23	-.16***	0.19	0.24	-.06	-.01
Region: Centre	0.13	0.17	0.33	0.17	0.18	.00	0.22	0.16	.06	-.02
Region: South	0.37	0.41	0.33	0.61	0.28	.32***	0.16	0.33	-.17*	.04
Inst. sup.	0.27	0.37	0.08	0.37	0.37	.00	0.34	0.38	-.03	-.11*
Lyceum	0.44	0.33	0.46	0.28	0.36	-.08	0.47	0.32	.15	.12*
Technical	0.20	0.16	0.38	0.20	0.14	.06	0.09	0.16	-.06	.05
Vocational	0.09	0.13	0.08	0.16	0.13	.03	0.09	0.15	-.05	-.06
Number of schools	127	190	24	76	114		32	82		

Note: Asterisks denote that the difference between the two samples is significant at *10%, **5%, ***1% levels. First vs last Δ refers to the difference between the schools that did not change principal (n=127, first column) and the schools that were matched to the INVALSI and MIUR administrative data (n=82).

Overall, Table A3 confirms the presence of a typical selection of better students/schools between the two waves of data collection. Missing schools in 2011 had on average students with a lower background and educational achievements, while we also lose schools mainly from the southern and less developed regions.

Finally, the last column of Table A3 compares the 2011 average characteristics of the final sample of the original switching schools to those that did not change their principal that we use in our empirical analysis. In particular, we evaluate the difference between the 127 that did not change principal and those that changed principal, were interviewed, and matched with administrative data (82 schools). Unlike the previous evidence, here we observe no differences in terms of student background and test scores, and only a statistically significant but negligible discrepancy in terms of managerial quality. If any, we find some asymmetries in terms of composition by school type.

B Additional tables and figures

Table B1: Descriptive statistics

	2011				2015				Δ
Variable	Obs	Mean	Median	Std. dev.	Obs	Mean	Median	Std. dev.	
Outcome variables									
Score in Mathematics	12,894	51.321	50.943	17.364	10,620	53.089	52.381	22.141	1.768***
Score in Italian	12,816	71.303	73.750	15.876	10,620	61.219	63.934	17.691	-10.084***
Aspirations: Degree or higher	12,894	0.411	0.000	0.492	10,620	0.572	1.000	0.495	0.161***
Aspirations: Own edu > parents' edu	12,894	0.231	0.000	0.422	10,620	0.339	0.000	0.473	0.108***
Students' characteristics									
Female	12,894	0.511	1.000	0.500	10,620	0.535	1.000	0.499	0.024***
1st or 2nd gen immigrant	12,894	0.119	0.000	0.323	10,620	0.152	0.000	0.359	0.033***
Books in the house: 0-10	12,894	0.077	0.000	0.266	10,620	0.089	0.000	0.284	0.012**
Books in the house: 11-25	12,894	0.196	0.000	0.397	10,620	0.144	0.000	0.351	-0.052***
Books in the house: 26-100	12,894	0.315	0.000	0.465	10,620	0.296	0.000	0.457	-0.019**
Books in the house: 101-200	12,894	0.196	0.000	0.397	10,620	0.253	0.000	0.434	0.056***
Books in the house: 201-500	12,894	0.216	0.000	0.411	10,620	0.219	0.000	0.413	0.003
Mother's edu: below secondary	12,894	0.301	0.000	0.459	10,620	0.265	0.000	0.441	-0.036***
Mother's edu: secondary	12,894	0.475	0.000	0.499	10,620	0.490	0.000	0.500	0.016*
Mother's edu: tertiary	12,894	0.225	0.000	0.417	10,620	0.245	0.000	0.430	0.021***
Father's edu: below secondary	12,894	0.317	0.000	0.465	10,620	0.293	0.000	0.455	-0.024***
Father's edu: secondary	12,894	0.462	0.000	0.499	10,620	0.471	0.000	0.499	0.009
Father's edu: tertiary	12,894	0.221	0.000	0.415	10,620	0.236	0.000	0.425	0.015**
Mother's job: at home	12,894	0.363	0.000	0.481	10,620	0.299	0.000	0.458	-0.064***
Mother's job: self-employed	12,894	0.108	0.000	0.310	10,620	0.125	0.000	0.330	0.017***
Mother's job: high-skilled	12,894	0.132	0.000	0.338	10,620	0.136	0.000	0.343	0.005
Mother's job: medium-skilled	12,894	0.223	0.000	0.416	10,620	0.228	0.000	0.419	0.005
Mother's job: low-skilled	12,894	0.174	0.000	0.379	10,620	0.212	0.000	0.409	0.037***
Father's job: at home	12,894	0.041	0.000	0.198	10,620	0.053	0.000	0.224	0.012***
Father's job: self-employed	12,894	0.303	0.000	0.459	10,620	0.290	0.000	0.454	-0.013*
Father's job: high-skilled	12,894	0.259	0.000	0.438	10,620	0.216	0.000	0.412	-0.043***
Father's job: medium-skilled	12,894	0.152	0.000	0.359	10,620	0.156	0.000	0.363	0.004
Father's job: low-skilled	12,894	0.245	0.000	0.430	10,620	0.285	0.000	0.452	0.040***
Student is ahead	12,894	0.029	0.000	0.168	10,620	0.005	0.000	0.067	-0.024***
Student is regular	12,894	0.792	1.000	0.406	10,620	0.845	1.000	0.362	0.053***
Class size	12,894	21.843	22.000	4.132	10,620	20.211	21.000	4.844	-1.632***
SES	12,727	0.209	0.192	0.963	10,591	0.121	0.173	0.965	-0.088***
Region: Centre	12,894	0.167	0.000	0.373	10,620	0.190	0.000	0.392	0.023***
Region: North-East	12,894	0.213	0.000	0.410	10,620	0.312	0.000	0.463	0.099***
Region: North-West	12,894	0.301	0.000	0.459	10,620	0.410	0.000	0.492	0.109***
Region: South and Islands	12,894	0.319	0.000	0.466	10,620	0.088	0.000	0.284	-0.230***
Managerial quality									
Management index	172	2.049	2.023	0.459	137	2.152	2.182	0.506	0.103
ΔMI					135	0.043	0.000	0.439	
MI: Leadership	172	2.236	2.333	0.532	137	2.365	2.333	0.639	0.129
MI: Targets	172	1.870	1.800	0.513	137	1.949	2.000	0.544	0.079
MI: Operations	172	2.350	2.250	0.677	137	2.522	2.500	0.718	0.172*
MI: Monitoring	172	2.236	2.200	0.630	137	2.416	2.400	0.625	0.180*
MI: People	172	1.690	1.600	0.367	137	1.669	1.600	0.412	-0.021
SP characteristics									
Age	172	57.837	59.000	4.855	137	57.526	58.000	5.467	-0.312
Tenure as principal within school	172	4.831	4.000	4.505	137	4.569	3.000	3.523	-0.262
Overall tenure (as SP or teacher) within school	172	6.785	4.000	7.222	137	7.022	4.000	7.334	0.237
Female	172	0.355	0.000	0.480	137	0.431	0.000	0.497	0.076
Job experience outside school	172	0.419	0.000	0.495	137	0.467	0.000	0.501	0.049
School was chosen	172	0.843	1.000	0.365	137	0.825	1.000	0.382	-0.018
Principal manages multiple schools	172	0.035	0.000	0.184	137	0.088	0.000	0.284	0.053*
School characteristics									
Number of students	172	793.512	773.000	273.653	137	876.350	872.000	288.807	82.839*
Number of teachers	172	81.657	78.000	24.044	137	93.109	85.000	34.089	11.453***
Number of admin staff	172	26.052	24.000	8.869	137	26.679	26.000	9.216	0.627
Number of female teachers	172	53.820	51.500	19.429	137	62.190	58.000	23.486	8.370***
Number of permanent teachers	172	65.401	64.000	20.314	137	72.847	69.000	25.864	7.446**

Note: Descriptive statistics referred to the full sample used in the main analysis. Δ is the average change between 2015 and 2011, where differences and corresponding p-values are reported. * p<.10 ** p<.05 *** p<.01. Sources: INVALSI (outcome variables and student characteristics), WMS (managerial quality and principal characteristics), MIUR (school chatacteristics).

Table B2: Probability that principal changes by 2015, by 2011 school-specific attribute (estimated one by one)

Dep. variable	(1) Principal has changed
SES	0.103
	(0.098)
Share of foreign students	-0.316
	(0.635)
Share of students ahead	-0.646
	(0.909)
Share of regular students	0.297
	(0.331)
Average class size	-0.030*
	(0.017)
Number of students	0.000
	(0.000)
Number of teachers	0.000
	(0.002)
Number of admin staff	0.010***
	(0.004)
Number of female teachers	0.000
	(0.002)
Number of permanent teachers	0.002
	(0.002)
Principal's age	0.030***
	(0.009)
Principal's tenure as SP within school	0.013*
	(0.007)
Overall tenure within school (as SP or teacher)	-0.003
	(0.006)
Principal's gender	0.083
	(0.093)
Principal has had experience outside	-0.037
	(0.093)
School was chosen	0.017
	(0.125)
Principal manages multiple schools	0.425***
	(0.047)
Observations	118

Note: * p<.10 ** p<.05 *** p<.01. All coefficients are estimated in separate regressions. Dependent variable is a dummy taking value one if the principal has changed in between 2011 and 2015. School-level characteristics are measured in 2011.

Table B3: Effect on student scores and student aspirations, robustness checks

	(1)	(2)	(3)	(4)
Panel A				
Dep. variable	Score: Maths			
Management index	3.741**	4.334**	3.716**	3.997**
	(1.587)	(1.696)	(1.722)	(1.881)
Observations	23,318	23,514	22,254	16,095
R-squared	0.372	0.384	0.385	0.392
School-year clusters	308	309	291	210
Panel B				
Dep. variable	Score: Language			
Management index	2.566**	2.673**	3.147**	1.366
	(1.180)	(1.292)	(1.247)	(1.776)
Observations	23,318	23,436	22,176	16,036
R-squared	0.437	0.451	0.447	0.469
School-year clusters	308	309	291	210
Panel C				
Dep. variable	Aspirations: Degree or higher			
Management index	0.041**	0.041**	0.044**	0.054***
	(0.018)	(0.019)	(0.018)	(0.020)
Observations	23,318	23,514	22,254	16,095
R-squared	0.309	0.317	0.322	0.321
School-year clusters	308	309	291	210
Panel D				
Dep. variable	Aspirations: Own edu > parents' edu			
Management index	0.049***	0.036**	0.044***	0.046***
	(0.018)	(0.015)	(0.015)	(0.011)
Observations	23,318	23,514	22,254	16,095
R-squared	0.160	0.327	0.333	0.321
School-year clusters	308	309	291	210
Sample	Whole	Whole	Single school	Younger SP
School FE	✓	✓	✓	✓
Area × Year FE	✓	✓	✓	✓
Principal characteristics	✓	✓	✓	✓
School characteristics	✓	✓	✓	✓
Student characteristics	✓	✓	✓	✓
Controls	SES	Non-linear		

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. All regressions include area-year fixed effects, where areas are North-West, North-East, Centre, South. The set of additional controls is identical to that included in Table 1. In Column 1 the SES index replaces information on the number of books in the house and the parents' education and job status. Column 2 also controls for the square of tenure within the school. Column 3 excludes cases where the principal manages multiple schools. Column 4 only considers principals up to 60 years of age (below the 75th percentile).

Table B4: School-level measures of teachers and class characteristics

Dep. variable	(1) % female teachers	(2) % tenured teachers	(3) Student-teacher ratio	(4) Class size
Lagged unempl. rate	0.004	0.002	0.104	-0.117
	(0.002)	(0.004)	(0.074)	(0.118)
Observations	309	309	309	309
R-squared	0.047	0.056	0.032	0.222
Year FE	✓	✓	✓	✓
Area FE	✓	✓	✓	✓

Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors. All regressions include year and area fixed effects, where areas are North-West, North-East, Centre, South.

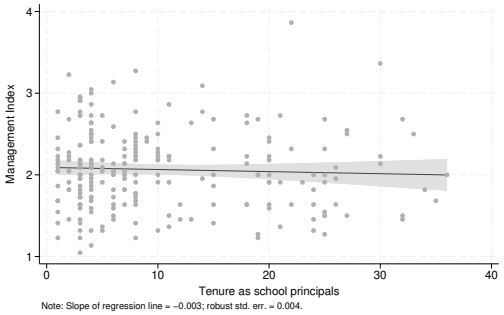
Table B5: Effects on student scores, text analysis

Dep. variable	(1)	(2)	(3)	(4)
	Scores			
	Math		Language	
Management index		3.563**		2.741**
		(1.636)		(1.119)
Dealing w/ disability	-1.796	-2.108	-1.765	-2.008*
	(1.734)	(1.589)	(1.349)	(1.181)
Jobs and college	0.818	0.359	2.073**	1.719*
	(1.008)	(1.017)	(1.022)	(1.011)
Discipline	-0.514	-1.135	-0.098	-0.574
	(1.468)	(1.338)	(1.010)	(0.970)
Projects and grants	1.299	0.288	-0.688	-1.467
	(1.421)	(1.540)	(1.592)	(1.584)
Teaching methods	3.110**	2.504**	1.219	0.752
	(1.249)	(1.216)	(0.893)	(0.849)
Teachers' training	-1.038	-0.428	0.986	1.440
	(2.898)	(2.945)	(2.340)	(2.468)
Observations	23,514	23,514	23,436	23,436
R-squared	0.385	0.385	0.452	0.452
School-year clusters	309	309	309	309
Sample	Whole	Whole	Whole	Whole
School FE	✓	✓	✓	✓
Area × Year FE	✓	✓	✓	✓
Principal characteristics	✓	✓	✓	✓
School characteristics	✓	✓	✓	✓
Student characteristics	✓	✓	✓	✓

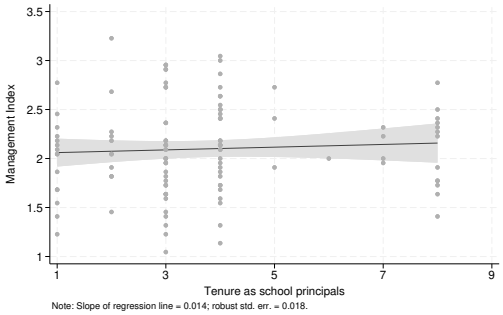
Note: * p<.10 ** p<.05 *** p<.01. Robust standard errors clustered at school level. Whole sample (309 school-year clusters). All regressions include school fixed effects and area-year fixed effects. The set of additional controls (principal, school, and student characteristics) is identical to that included in Table 1.

Figure B1: Tenure as principal and management index

(a) Whole sample of school principals



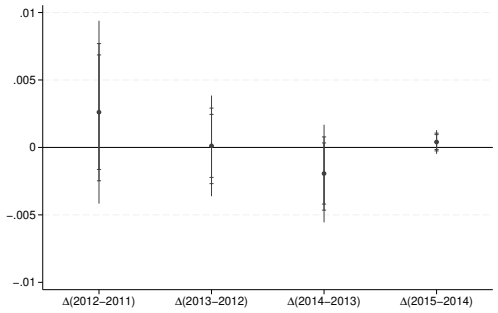
(b) Those who became principals after 2006 only



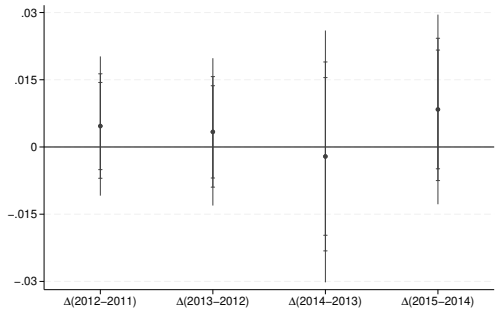
Note: Each dot represents a principal's assigned managerial index and the number of years of tenure as a principal. Both variables measured at the time of the interview. The slope of the regression line of management index on the years of tenure as principal and corresponding 95% confidence intervals with robust standard errors are also shown.

Figure B2: Management index in 2015 and student dynamics pre-2015

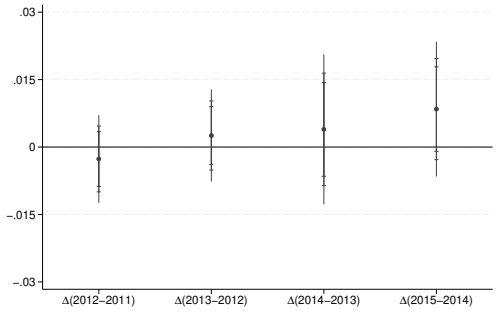
(a) Δ Students



(b) Δ Entries



(c) Δ Exits



Note: Event-study analysis based on the model: $MI_{j,2015} = \lambda_1(S_{j,2012} - S_{j,2011}) + \lambda_2(S_{j,2013} - S_{j,2012}) + \lambda_3(S_{j,2014} - S_{j,2013}) + \lambda_4(S_{j,2015} - S_{j,2014}) + \varepsilon_j$, where $MI_{j,2015}$ is the management index in 2015 and $S_{j,t}$ is the value in year t of: the school's total number of students (panel a); the school's share of students who transfer from another school (panel b); and the school's share of students who transfer to another school (panel c). Sample of switcher schools only (56 schools). Confidence intervals at 90, 95 and 99 percent level are shown.

C The World Management Survey questionnaire

This section includes the full set of questions of the education survey used in this study. For brevity, we do not include the scoring grids of each question, but only give the example of one specific survey question, Q7, which concerns the tracking of performance in schools.[38] Q7 asks: "*What kind of main indicators do you use to track school performance? What sources of information are used to inform this tracking? How frequently are these measured? Who gets to see this performance data? If I were to walk through your school, how could I tell how it was doing against these main indicators?*" Principals were encouraged to provide specific examples when needed to illustrate and clarify the key points, while the interviewers were trained to take notes during the conversation and to score each answer using the following WMS scoring grid:

- A score of 1 defines an environment in which performance is reviewed infrequently or in an un-meaningful way (e.g. only success or failure is noted).
- A score of 3 suggests that the performance is reviewed periodically with successes and failures identified; results are only communicated to senior staff members (e.g. department heads); no clear follow up or action plan is adopted.
- To obtain a score equal to 5, the school performance has to be constantly reviewed, based on indicators; all aspects are followed up to ensure continuous improvement; results are communicated to all staff.

Table C1: Questions of the World Management Survey

Section: Definition	Questions
Leadership: "Leadership vision"	Q1. A) What is the school's vision for the next five years? Do teachers/ staff know and understand the vision? B) Who does your school consider to be your key stakeholders? How is this vision communicated to the overall school community? C) Who is involved in setting this vision/ strategy? When there is disagreement, how does the school leader build alignment?
Leadership: "Clearly defined accountability for leaders"	Q15. A) Who is accountable for delivering on school targets? B) How are individual school leaders held responsible for the delivery of targets? Does this apply to equity and cost targets as well as quality targets? C) What authority do you have to impact factors that would allow them to meet those targets (e.g., budgetary authority, hiring and firing)? Is this sufficient?

[38] The full WMS education survey be downloaded from https://worldmanagementsurvey.org/data/dwms-public-sector/wms-methodology/.

Continuation of Table C1

Leadership: "Clearly def. leadership and teacher roles"	Q16. A) How are the roles and responsibilities of the school leader defined? How are they linked to student outcomes/ performance? B) How are leadership responsibilities distributed across individuals and teams within the school? C) How are the roles and responsibilities of the teachers defined? How clearly are required teaching competences defined and communicated? D) How are these linked to student outcomes/ performance?
Operations: "Standardisation of instructional processes"	Q2. A) How structured or standardized are the instructional planning processes across the school? B) What tools and resources are provided to teachers (e.g., standards-based lesson plans and textbooks) to ensure consistent level of quality in delivery across classrooms? C) What are the expectations for the use of these resources and techniques? D) How does the school leader monitor and ensure consistency in quality across classrooms?
Operations: "Personalization of Instruction and Learning"	Q3. A) How much does the school attempt to identify individual student needs? B) How are these needs accommodated for within the classroom? How do you as a school leader ensure that teachers are effective in personalising instruction in each classroom across the school? C) What about students, how does the school ensure they are engaged in their own learning? How are parents incorporated in this process?
Operations: "Data-Driven Planning and Student Transitions"	Q4. A) Is data used to inform planning and strategies? If so how is it used – especially in regards to student transitions through grades/ levels? B) What drove the move towards more data-driven planning/ tracking?
Operations: "Adopting Educational Best Practices"	Q5. A) How does the school encourage incorporating new teaching practices into the classroom? B) How are these learning or new teaching practices shared across teachers? What about across grades or subjects? How does sharing happen across schools (community, state-wide etc), if at all? C) How does the school ensure that teachers are utilising these new practices in the classroom? How often does this happen?

Continuation of Table C1

Monitoring: "Continuous Improvement"	Q6. A) When problems (e.g., within school/ teaching tactics/ etc.) do occur, how do they typically get exposed and fixed? B) Can you talk me through the process for a recent problem that you faced? C) Who within the school gets involved in changing or improving process? How do the different staff groups get involved in this? D) Does the staff ever suggest process improvements?
Monitoring: "Performance Tracking"	Q7. A) What kind of main indicators do you use to track school performance? What sources of information are used to inform this tracking? B) How frequently are these measured? Who gets to see this performance data? C) If I were to walk through your school, how could I tell how it was doing against these main indicators?
Monitoring: "Performance Review"	Q8. A) How often do you review (school) performance – formally or informally– with teachers and staff? B) Could you walk me through the steps you go through in a process review? C) Who is involved in these meetings? Who gets to see the results of this review? D) What sort of follow-up plan would you leave these meetings with? Is there an individual performance plan?
Monitoring: "Performance Dialogue"	Q9. A) How are these review meetings structured? B) Do you generally feel that you do have enough data for a fact-based review? C) What type of feedback occurs during these meetings?
Monitoring: "Consequence Management"	Q10. A) Let's say you've agreed to a follow-up plan at one of your meetings, what would happen if the plan was not enacted? B) How long does it typically go between when a problem is identified to when it is solved? Can you give me a recent example? C) How do you deal with repeated failures in a specific department or area of process?
Targets: "Target Balance"	Q11. A) What types of targets are set for the school to improve student outcomes? Which staff levels are held accountable to achieve these stated goals? B) How much are these targets determined by external factors? Can you tell me about goals that are not externally set for the school (e.g., by the government or regulators)?
Targets: "Target Inter-Connection"	Q12. A) How are these goals cascaded down to the different staff groups or to individual staff members? B) How are your targets linked to the overall school-system performance and its goals?

Continuation of Table C1

Targets: "Time Horizon of Targets"	Q13. A) What kind of time scale are you looking at with your targets? B) Which goals receive the most emphasis? C) Are the long-term and short-term goals set independently? D) Could you meet all your short-run goals but miss your long-run goals?
Targets: "Target Stretch"	Q14. A) How tough are your targets? How pushed are you by the targets? B) On average, how often would you say that you and your school meet its targets? How are your targets benchmarked? C) Do you feel that on targets all departments/ areas receive the same degree of difficulty? Do some departments/ areas get easier targets?
Targets: "Clarity and Comparability of Targets"	Q.17 A) If I asked one of your staff members directly about individual targets, what would they tell me? B) Does anyone complain that the targets are too complex? Could every staff member employed by the school tell me what they are responsible for and how it will be assessed? C) How do people know about their own performance compared to other people's performance?
People: "Rewarding High Performers"	Q18. A) How does your evaluation system work? What proportion of your employee pay is related to the results of this review? B) Are there any non-financial or financial bonuses/ rewards for the best performers across all staff groups? How does the bonus system work (for staff and teachers)? C) How does your reward system compare to that of other schools?
People: "Removing Poor Performers"	Q19. A) If you had a teacher who was struggling or who could not do his/ her job, what would you do? Can you give me a recent example? B) How long is underperformance tolerated? How difficult is it to terminate a teacher? C) Do you find staff members/ teachers who lead a sort of charmed life? Do some individuals always just manage to avoid being fired?
People: "Promoting High Performers"	Q20. A) Can you tell me about your career progression/ promotion system? B) How do you identify and develop your star performers? C) What types of professional development opportunities are provided? How are these opportunities personalised to meet individual teacher needs? D) How do you make decisions about promotion/ progression and additional opportunities within the school, such as performance, tenure, other? Are better performers likely to be promoted faster, or are promotions given on the basis of tenure/ seniority?

Continuation of Table C1

People: "Managing Talent"	Q21. A) How do school leaders show that attracting talented individuals and developing their skills is a top priority? B) How do you ensure you have enough teachers of the right type in the school? C) Where do you seek out and source teachers? D) What hiring criteria do you use?
People: "Retaining Talent"	Q22. A) If you had a top performing teacher who wanted to leave, what would the school do? B) Could you give me an example of a star performer being persuaded to stay after wanting to leave? C) Could you give me an example of a star performer who left the school without anyone trying to keep him?
People: "Creating a Distinctive Employee Value Proposition"	Q23. A) What makes it distinctive to teach at your school, as opposed to other similar schools? If you were to ask the last three candidates would they agree? Why? B) How do you monitor how effectively you communicate your value proposition and the following recruitment process?