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The Headmaster Ritual: The Importance of Management for School Outcomes

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The headmaster ritual: The importance of management for school outcomes[a]

by

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Abstract

The role of school principals largely resembles that of corporate managers and the leadership they provide are often viewed as a crucial component for educational success. We estimate the impact of individual principals on various schooling outcomes, by constructing a principal-school panel data set that allows us to track individual principals as they move between schools. We find that individual principals have a substantive impact on school policies, working conditions and student outcomes. Particularly, students who attend a school with a one standard deviation better principal receive on average 0.12 standard deviations higher test scores. Despite having very rich background information on principals, it is difficult to determine which principal characteristics that form the basis for successful school management. We also find a somewhat mixed picture on what management style characterizes a successful principal. We further show that the scope for principal discretion—for better or for worse—is larger in small schools, in voucher schools and in areas with more school competition.

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"Belligerent ghouls run Manchester schools. Spineless bastards all..."
(The Headmaster Ritual, Marr/Morrisey)

1 Introduction

The role of school principals largely resembles that of corporate managers. Principals hire teachers, decide how they are remunerated, provide support and encouragement for their staff, allocate teachers and students to classes, organize schedules and work groups, make strategic educational and pedagogical decisions, and represent the school in its contacts with educational boards, trade unions and parents. In essence, principals provide management in a complex and knowledge intensive organisation. It is therefore understandable that school principals and the leadership they provide are often viewed as a crucial component for educational success.[1] This interest in school leadership is reflected in the academic literature; numerous of studies have attempted to assess the influence of principals on student achievement and related outcomes. Surveys of this vast research (eg Hallinger and Heck 1996, 1998; Waters et al 2003; Witziers et al 2003; Leitwood et al 2004) all voice the concern, however, that previous studies are mainly of cross-sectional, non-experimental design.

In this paper we overcome many of the problems in the previous literature by using a principal-school panel strategy to estimate the impact of principals on three types of outcomes: (i) school level student performance, (ii) working environment and (iii) strategic school choices. For this purpose we use rich Swedish register data to construct a principal-school panel data set covering the full set of Swedish middle schools between 1996 and 2008, which allows us to track individual principals as they move across schools. Using this data we can apply the framework developed by Bertrand and Schoar (2003) in their seminal study of corporate management styles to assess the importance of principals. We regress school level outcomes on year and school fixed effects, a rich set of time varying school and student characteristics, and a vector of principal fixed effects. The estimates of principal effects give us the entire distribution of the role of school management through principals on schooling outcomes, having controlled for observable and unobservable school heterogeneity.

Our paper is closely related to two concurrent papers that estimate principal fixed effects on student achievement and utilizing principal switches: Branch, Hanushek and

[1] See for example Harris (2006). A Google search on "school leadership" generated three million hits in June 2012.

Rivkin (2012) focus on heterogeneities across schools and find that principals have a larger impact on schools with a worse socioeconomic gradient, while Coelli and Green (2012) find that the impact of a principal increases with tenure.

The contribution of our paper is (i) that we use a larger set of outcomes—from different domains of principal influence—from the full set of Swedish middle schools; (ii) We also relate the different sets of principal fixed effects to each other and to very detailed data on principal characteristics including measures of cognitive and non-cognitive leadership ability, as well as educational and professional background, thus trying to characterize successful principals; (iii) we furthermore relate the distribution of principal effects to different institutional features, assessing where principals have the largest impact. Our findings indicate that individual principals have a substantive impact on our outcomes: student achievement—in terms of test scores, GPA's, share of students passing the grade—and grade inflation, school level wage setting, teacher retention rates, teacher sick leave absence, and on what types of teachers that are being hired. Adding principal fixed effects to a baseline model without such effects increases the adjusted R-squared by between one and five percentage points, depending on the outcome. The estimated effects are economically significant; in particular, a one standard deviation move within the distribution of principal fixed effects corresponds to about twelve percent of a standard deviation change in student test scores and five percent of a standard deviation change in GPAs. These results are close to what Branch, Hanushek and Rivkin (2012) find, but smaller those of Coelli and Green (2012).[2] Since a one standard deviation change in teacher ability has been estimated to correspond to approximately a ten percent of a standard deviation increase in student achievement (see e.g. Rockoff, 2004; Rivkin et al, 2005; Leigh 2010), school managers must be considered to have a substantial effect on student performance.

[2] Branch, Hanushek and Rivkin (2012) who estimate a set of different models find that a one standard deviation move in the distribution of fixed effects is associated with between 4-27 percent of a standard deviation change in students' academic achievement; in the specification most similar to ours the effect is 11 percent of a standard deviation. Collie and Green (2012) find that a one standard deviation better principal is associated with a third of a standard deviation higher graduation rates and one standard deviation better English exam scores; thus corresponding to a 2.6 and a 2.5 percentage points increase, respectively.

We find that principals who are more successful in improving student performance also tend to implement the policies of tougher grade setting standards,[3] low wage dispersion, to hire more female teachers and to hire certified teachers. However, these associations are not significant for all our student performance outcomes simultaneously. We further do not find any significant associations between work-environment managing practises and successful management for student performance. Hence, we conclude that the picture of what managing practices associate with successful management for schools' final output is mixed.

Despite having a large set of observable individual characteristics; including measures of cognitive and leadership skills and educational and professional background, it is difficult to account principal fixed effects to observable factors. This result is well in line with Clark, Martorell and Rockoff (2009) who find little evidence of a relationship between schools performance and the selectivity of the principal's undergraduate institution and work experience of the principal. This echo well to the difficulties of attaching observable characteristics to teacher quality (See for example Rockoff 2004, Rivkin, Hanushek and Kain 2005, Rockoff et al 2011, and Grönqvist and Vlachos 2008). Hence it appears to be as difficult to account for principal quality using observable characteristics as it is for teacher quality.

Finally, we analyze how the institutional environment is related to principal discretion and influence, as opposed to principal quality. We find that principals in relatively smaller school tend to have a stronger impact—for better or for worse—on student performance in terms of final grades and the share and students passing the minimum requirements; on grade inflation; on working environment as measured by the teachers' retention rate. It is presumably easier for an individual principal to exert a strong influence on a small school. We also find that principals in voucher schools and in schools facing a stronger competition exert a stronger influence on student outcomes. Principals in voucher schools exert influence on strategic school policy choices—in terms of wage dispersion, the share of non-certified teachers, and grading standards. Since voucher schools have more discretion in several dimensions, these findings are

[3] Figlio and Lucas (2004) and Betts and Grogger (2003) find that tougher grading standards are associated with higher student achievement.

intuitively appealing. Voucher school principals do not differ in how they influence teacher retention or sick-leave absence, however.

While the literature on corporate managers is voluminous (see the survey by Bertrand, 2009), there has been a surprising lack of attention given to public sector management. This is potentially a serious omission as the constraints on public sector management differ substantially from those in private firms: competitive pressures, the objectives of the owners, and the interaction between "firms" and their "customers" all differ between the private and public sector. Bloom and van Reenen (2007) show that competitive pressures, both in the product market and in the market for corporate control,[4] are associated with higher quality management in the private sector. Related to this, Giroud and Mueller (2009) demonstrate that the scope for managerial slack—and hence the impact of anti-takeover laws on firm management—is higher in non-competitive than in competitive industries. Under the assumption that public firms are more isolated from various forms of competitive pressures that private ones, these results square well with Bloom et al (2011) who find that competitive pressure faced by public hospitals is positively correlated to increased management quality.

Our paper is related to Besley and Machin (2008), who find that public sector principals in the UK are rewarded financially when the schools they head perform well on national tests, and that principal turnover is higher when they perform poorly. Even if our focus is not on principal pay, these results are interesting as they indicate that policy makers believe that principals are important for school results. Our findings show that this is indeed the case, even if there is a range of factors outside principals control that matter.

2 How principals can affect schooling outcomes

Before discussing how to estimate the impact of individual principals on schooling outcomes, it is worth considering how principals can affect the schools they head.

[4] They compare family controlled firms to non-family controlled ones.

Principals have different beliefs on how schools should be successfully run, and they also possess different capacities to implement their desired policies. Even if principals are constrained by outside factors, these abilities and beliefs are likely to translate into different management practices that ultimately affect schooling outcomes.

As suggested by Leithwood et al (2008), when summarizing evidence from the earlier literature, school leaders particularly contribute by building a vision for the school, by motivating and developing the staff, and by (re-)designing the organizational structure at the school level. What can loosely be described as "people skills" or leadership abilities would appear to be valuable characteristics for a principal.[5] In addition, the extents to which organizational talent, negotiating skills, curiosity, and openness to new ideas differ from such abilities they are also likely to affect how principals run their schools. How such differences translate into differences in school management to a large extent depends on constraints imposed by the institutional setting.

2.1 The scope for principal discretion

For ability and personality differences to matter, principals need to have some discretion in their decision making. If the curriculum were centrally set, hiring decisions regulated by the school board, and payment schemes were negotiated above the school level, the scope for leadership to matter would be limited. Market conditions are also important for the impact of individual principals, albeit in subtle ways. If competition between schools is fierce, information is good, detailed contracts can be written, and all students (and their parents') demand the same final product, market constraints will in effect limit the scope for principal discretion. If, on the other hand, students and their parents have heterogeneous demands, they will want the principal who best satisfies these demands to be selected. Any heterogeneity in principal behaviour would then be due to principal selection, or different constraints being imposed on principals, rather than principal discretion.

[5] In their influential article on star principals in urban schools, Haberman and Dill (1999) stress that such principals share a deeply engrained ideology of leadership, accountability, responsibility, and student focus that guides their work. According to Haberman and Dill, such an ideology can be acquired through personal experience, but not taught.

Under more plausible assumptions regarding the informational and the contracting environment, quite standard agency issues will arise—with the principal as the agent. The limits to external control then allow the school principal to run the school according to his or her personal beliefs and capacities.

A finding that principals matter for various schooling outcomes can thus have different interpretations. Either it may be due to a conscious actions by the school board (or whoever is responsible for the hiring of the principal) giving them a principal they desire. Alternatively, it may be due to principals having few constraints on their management. Here we do not aim at distinguishing between these supply- and demand side explanations, but rather to document the importance of the principal for various outcomes.

2.2 Principals in the Swedish school system

In order to understand the role of principals in Sweden, a brief introduction to the Swedish school system is warranted. Compulsory schooling in Sweden usually starts at age seven and lasts for nine years. Five years of primary school are followed by four years of middle school (grades 6-9). Thereafter, a non-compulsory three year upper-secondary program follows. All tiers of schooling are a municipal responsibility regulated by the 1985 *Education Act* (Ministry of Education and Research, 2000) and overseen by the Swedish National Agency for Education. The middle school system is organized around public schools and students are formally free to apply to any school within their residential municipality. Actual admittance is in practice highly regulated with priority given to students residing within a school's catchment area. The *Education Act* provides detailed requirements that all schools have to fulfil.

Sweden has a comprehensive school voucher system that more or less allows free entry of new schools. Voucher schools can be profit or non-profit, secular or religious, but they are all subject to the same regulation as the public schools.[6] Voucher schools are not allowed to charge any fees so their budget is indirectly set by the municipality.[7]

[6] The voucher system is described in more detail by Björklund et al. (2005).

[7] Municipalities are by law compelled to provide the same per-student funding to voucher and municipal schools. Some, but not all, municipalities also let the size of the voucher vary with socio-economic characteristics of the student body.

Within the compulsory school system voucher schools are allowed to screen students based on their non-academic merits only (such as musical or athletic talent), but apart from that they have to be equally open to all.

In the last year of middle school students receive final grades (school leaving certificates) that are used to sort students when applying to upper-secondary school.[8] These grades are given by the teacher in each subject, and should reflect how well the student lives up to certain nationally pre-defined standards. The subject grades are converted into a grade point average (GPA) used in the application process. Teachers are aided in their grade setting by nation-wide standardized tests in Swedish, English, and Mathematics.

Both public and voucher schools are headed by a principal who has the ultimate responsibility for their school. In the public school system the principal is appointed by the municipal school board, consisting of local politicians, whereas in voucher schools the principal is employed by the owners. Principals at larger schools are often aided by assistant principals with certain areas of responsibility. A common, but by no means universal, arrangement is that the main principal is in charge of contacts with school boards and other outside interests, while assistant principals are in charge of everyday activities at the school. Appointing assistant principals and allocating them to different tasks is, however, the responsibility of the principal.

One of the central roles of school management is to recruit new teachers. In Sweden, new hires are usually the responsibility of the principal; once a teacher has been given a position, employment is regulated by employment protection laws and collective agreements, as is standard for the Swedish labour market. It is costly to terminate an employment for reasons other than work shortages; that is, due to changes in the size of the student cohort or to budgetary changes.

A feature of the Swedish system is that teachers at public schools are hired by the municipality rather than the individual school. Therefore teachers may be reallocated across schools in times of staff cutbacks, thus reducing principal control over staffing.

[8] Even if the GPA based on these final grades are not a binding constraint to enter upper-secondary schooling—basically all Swedish students move onto the next tier—they are effectively used to sort students into different programs and schools.

This reallocation is a complex game involving negotiations between the teacher unions and the employers. As a general rule, the teacher with the longest tenure in the municipality has priority to the remaining positions, but shortages of teachers in specific subjects also have to be considered. Therefore hiring decisions at the school level may be subjected to constraints in times when the overall workforce is being reduced. Voucher schools are however not affected by such considerations.

Teacher certification rules also affect the employment decision. Formally, an uncertified teacher cannot be given a permanent position but can only be hired one year at a time. In practice, there have been generous exemptions to this rule and approximately 15 percent of all teachers in the Swedish middle school do not hold a degree entitling them tenured employment. While these rules apply equally to public and voucher schools alike, the share of uncertified teachers is higher among the voucher schools (Skolverket, 2011). The remuneration of teachers is covered by a collective wage agreement that allows for individual wage setting. In principle, wage setting could therefore vary quite substantially between schools. In practice, however, the wage dispersion among Swedish teachers is among the lowest in the OECD area (OECD, 2011).

These institutional constraints aside, school management in Sweden is best described as being highly decentralized. According to a survey by the Swedish National Agency for Education, 99 percent of municipalities state that their public school principals have complete or partial control over who gets hired (Skolverket, 2009; Table 1). 100 percent of principals have control over decisions regarding on-the-job training, 96 percent for actions taken for special-needs students, 92 percent for wage setting, 97 percent for purchases of materials, and 88 percent for the number of employees (given the size of the budget). In an international perspective, the PISA school background survey, as reported by Wössmann et al (2007), indicates that school level autonomy in Sweden—in terms of hiring decisions, wage setting, and filling the curriculum—is larger than the OECD average.

3 Empirical strategy and data

The methodological challenge when assessing the importance of individual principals on the performance of schools is to convincingly separate the influence of principals from other factors such as characteristics of the schools (e.g. staff or educational culture), neighbourhood characteristics, or even temporary effects by specific cohorts of students. For this purpose we have compiled a principal-school panel allowing us to track the influence of principals as they move across schools. In this section, we start by a discussion of our empirical methodology and then move on to describe our data.

3.1 Empirical strategy

Our identification strategy follows the work on corporate management styles by Bertrand and Schoar (2003) closely. To estimate the impact of principals on, for example, student achievement we need to control for other factors affecting outcome. This is done by controlling for average school level differences; general changes in outcome over time; as well as for year-to-year variation in the student population. Having controlled for these factors, we relate the residual variation in student achievement to principal specific fixed effects. Formally, we estimate the following regression:

$$y_{it} = \alpha_i + \alpha_t + \beta X_{it} + \lambda_P + \lambda_{AP} + \varepsilon_{it}$$

where y_{it} is the outcome of school i in period t; α_i are school fixed effects, α_t are time period fixed effects; X_{it} is a vector of time-varying school level control variables; and ε_{it} is an error term. The set of variables of main interest is the vector of principal fixed effects, λ_P, and the vector of fixed effects for assistant principals, λ_{AP}. Principals and assistant principals are defined according to the last role we find them in. As the division of managerial tasks between principals and assistant principals differs across schools, we in most analyses will not distinguish between principals and assistant principals. In order to account for potential serial correlation we correct the standard errors for clustering at the school level by scaling with the estimated Moulton (1986) factor as suggested by Angrist and Pischke (2009).

In our set up, we will only exploit principals that move across schools to identify principal fixed effects; that is, we identify principal fixed effects for those principals who move between schools.[9] Hence, if schools relied solely on incumbent teachers being promoted to the position of principal, we would not be able to estimate any principal fixed effects; likewise if principals tend to stay at one school only. As will be seen in the next section, mobility among Swedish principals is fortunately substantial.

The X_{it} vector is intended to keep the student body constant, separating principal influence from time-varying school characteristics. But in broader perspective student selection to schools may also be affected by the principal, in the same way as we see teacher recruitment as a part of the principal effect. In some sensitivity analyses we therefore exclude the X_{it} vector when estimating our model.

The main limitation to this framework is that principals are not randomly placed in different schools. Rather, the recruitment of principals is considered a matter of great importance both for municipalities and voucher schools. For this reason we cannot fully separate the effect of principal selection from that of principal influence. While we account for mean differences in outcome, our empirical strategy is still problematic if schools change principals in response to a dip in outcome and the new principal takes over just as the school is experiencing a mean reversion, or if a school if on a positive (or negative) trajectory and thereby falsely attributing improving school level outcomes to the principal. Similarly, our strategy is problematic if recruiting a new principal is associated with a whole set of school level policy changes. In the sensitivity analyses we therefore (i) test whether schools are systematically changing principal in response to dips in outcomes and (ii) also include school specific linear trends in our model.

3.2 The school-principal sample

In order to identify the effects of principals we construct a school level panel data set that allows us to track individual principals over time. We base our panel on the Swedish *Teacher register* which contains school codes and personal identifier codes for

[9] It would of course be possible to identify fixed effects for principals who are present only at one school, but for a sub-period of the time the school is in our data set. These principal fixed effects would, however, be sensitive to school level shocks in which case they merely would reflect school-period effects. Therefore, principals observed in only one school are not included in the estimation.

each teacher and principal.[10] While the teacher register itself stretches back to 1979, individual schools can only be identified from 1996; and we therefore restrict our attention to the years 1996-2008. A further restriction is that we do not observe any characteristics of the student body prior to the last year of compulsory schooling (ie. the 9th grade), when students' final grades are recorded. Therefore, we restrict our attention to middle schools with graduating students.

In our sample, we only retain schools in which at least one principal can be observed in at least one other school between 1996 and 2008. As it presumably takes a while for a principal to have an impact on the school they are managing, we also require each principal to have been at least two years at each school. We find 942 schools that fulfil these two conditions, and we keep all observations for these schools; in total 8 847 school-year observations. In these schools there are 673 principals and assistant principals who are observed for two years in at least two different schools. In our analysis we follow Bertrand and Schoar (2003) by estimating effects for these *switcher* principals. On average these switcher principals spend 4.1 years at each school.

[Table 1]

In order to characterize the type of principal transitions we identify the principal effects on, *Table 1* is useful. Panel A displays the transitions between the first and last positions that we observe these 673 switching school managers in: 10 percent are assistant principals when first observed and remain in this position throughout the observations window; 39 percent make a career from being an assistant principal to a principal; 5 percent start off as principals but are observed as assistant principals in the last period; and 46 percent remain principals throughout the period we observe them. Panel B reports the position a school manager leaves and gets when s/he moves between schools: 15 percent of the moves include assistant principals switching school to become assistant principal also in the new school; 23 percent are promoted from an assistant to main principal when switching schools; 6 percent of the switches in our

[10] Principals are identified through the positional codes provided in the Teacher register.

sample are cases when a principal move to a new school to become an assistant principal; and 56 percent of the switches is principals keeping the same position as they move across schools. The career pattern thus depicted by these switcher principals is that most assistant principals are promoted to become main principal and that this often involves a change of school, and also that main principals move across school as a part of their career.

3.3 School level outcomes

The school level outcomes are chosen to reflect (i) students' academic achievement, (ii) school policies, and (iii) teacher working conditions. Our first outcome variable is the average results on standardized nationwide tests in Swedish, English, and Mathematics taken by all students in the 9th grade. When calculating this average, we first convert the individual test results to z-scores for each subject on an annual basis. We then convert the sum of these z-scores into a school average on an annual basis. As these test scores are only available from 2003 to 2008 there will be fewer principals (observed for two years in at least two schools) than the other outcomes when using test scores as outcome measure. Another outcome capturing academic achievement is the average grades in English and Mathematics on the school level (GPA).[11] Screening for upper-secondary education is based on the final grades and is therefore the most important outcome variable for students; the grades are also a broader measure of performance than are test scores. As grades are set by teachers, this variable is admittedly not a fully reliable measure of schooling output or productivity. Even if the grades in English and Mathematics can be inflated by the teacher the grade setting in these subjects is anchored by the standardized exams. The Swedish National Agency for Education also goes through considerable pain making grade criteria unified across schools. Although this is hardly perfect, comparisons between the results on national tests and grades in the same subjects show little systematic variation; for example Björklund et al. (2010 p24) find that the secular trend in Swedish, English and Mathematics grades is only a

[11] We do not use the final grade in Swedish when calculating our GPA measure since approximately half of the students with foreign background take a different Swedish course (Swedish as a second languish) than native students. A comparison of grades between these two courses is difficult. All students however take same standardized exam.

fourth of that in practical-aesthetic subjects (e.g. Sport, Art, Home economics) not anchored by standardized nationwide exams. Again, individual GPAs are converted into z-scores on an annual basis before averaging at the school-year level. As a third output measure on academic achievement we use the share of students who have fulfilled the minimum requirements in English and Mathematics.[12] While test scores and final grades captures the average performance of the school, this measure is aimed at capturing the performance in the lower parts of the achievement distribution.

Our next set of outcomes is related to strategic school policy choices; more precisely, grade setting behaviour, the within school wage dispersion; the share of female teachers; and the share of non-certified teachers. As schools indirectly compete for students, the grade setting behaviour is a margin that can be used to increase the attractiveness of a school. The scope for discretionary grade inflation is substantially larger in practical-aesthetic subjects not anchored by the without a national exam, than in theoretical subjects in which some external monitoring is possible. These grades in practical-aesthetic subjects are important as they are included in the GPA used for sorting students to upper-secondary education. As a first outcome measure of school level policy we therefore use a measure of grade inflation; specifically the difference between the grades in practical-aesthetic subjects and the grades in English and Mathematics.[13] Next, the wage dispersion between teachers is quite low in Sweden (OECD, 2008), but the norm is for wages to be determined at the school level. Principals are of course constrained by their budgets when setting wages, but formally they have substantial discretion to reward teachers on an individual level. As principals are likely to have differing attitudes towards remunerating skillful teachers, the within school wage dispersion—measured as the coefficient of variation—constitutes a second school policy outcome.[14] Principals may also have differing opinions on the importance

[12] We could have included other subjects as well, but as there are national tests in English and Mathematics, grades in these subjects are less open to manipulation. Swedish is excluded since immigrant and non-immigrant students generally take different courses.

[13] A deviation between grades in practical-aesthetic and theoretical subjects need not always be due to grade inflation; a specific school can for example have a profile in practical-aesthetic subjects. However, the results by Björklund et al. (2010) showing that grades in Swedish, English and Mathematics increased with 10 percent between 1989 and 2007, while grades in practical-aesthetic subjects increased with almost 45 percent, strongly supports the interpreting of such deviations as grade inflation.

[14] We use the coefficient of variation in monthly full-time equivalent wages as our measure of wage dispersion.

of a gender balanced teaching staff.[15] Hence, we use the share of female teachers as a third outcome variable in this category. Finally, Principals may have differing opinions on the value of teacher certification, not the least since research on this is not conclusive.[16] The hiring of certified or non-certified teachers can therefore be viewed as a strategic policy choice by the principal, especially since non-certified teachers on average fair lower wages; Hensvik (2012) has for example shown that voucher schools are more likely to hire non-certified teachers with high cognitive skills.

Poor human resource management in public organizations can have negative effects on productivity, as shown, for example, for UK hospitals by Bloom et al. (2009). The third set of outcome variables are therefore related to workplace conditions, arguably something principals can have a strong impact upon. Within this outcome dimension we first use an indicator of teacher retention, defined as the share of teachers who were teaching at a school at time *t* who are also teaching at time *t*+1. In the Swedish context of strict employment laws, most teacher turnover is due to voluntary teacher mobility or work shortages. To the extent that our controls for the student population pick up changes in teacher demand, we expect turnover to be mainly voluntary and hence reflect workplace conditions relative to outside options. The second measure in this category is the share of teachers who have been on long-term sick leave (i.e. more than two consecutive weeks) during a certain year.

3.4 School and principal level characteristics

The time varying school level controls include a rich set of student background characteristics; variables for students and their parents are matched to the school-principal panel and aggregated by school-year. Parental variables are recorded separately for mothers and fathers and include their educational attainment, annual income, age, and immigrant status. Student characteristics, in turn, are gender, birth

[15] Dee (2005) finds that girls learn more when having a female teacher. Swedish evidence is less conclusive; Holmlund and Sund (2008) find no support for the hypothesis that same-sex teachers affect student outcomes. Lindahl (2007) finds that same-sex teachers affect student test scores positively in Mathematics, but not in other subjects.

[16] Kane et al (2006) find at best small effects of teacher certification in the USA, and Rivkin et al (2005) find no correlation between teacher fixed effects and teacher certification. In Sweden, Andersson and Waldenström (2006) find substantive positive effects of certification when using grades (rather than test scores) as the outcome variable. Results on teacher certification are difficult to compare between jurisdictions as the certification process may differ substantially.

year, birth month, immigrant status, and age of immigration.[17] We also include the number of 9th grade students at the school as a control variable.

Once we have estimated the principal fixed effects, we correlate these with various observable principal characteristics. These characteristics include gender and birth year, measures of cognitive ability and non-cognitive leadership ability, upper-secondary school performance and educational attainment, and wage earnings. In addition we have information on whether the principal has a military background. The indicators of principals' cognitive ability and a measure of non-cognitive leadership ability are available from the military draft at age 18. These data are assessable for essentially all Swedish men born between 1951 and 1981. During the enlistment, their cognitive ability was tested using an IQ-type test, and their capacity to lead a group under stressful circumstances was estimated by a certified psychologist. Both these measures have a strong predictive power on future earnings, and draftees who later ended up in management positions scored substantially better on the leadership evaluation than those in other types of high-skilled jobs (See Lindqvist and Vestman, 2011). In order to account for minor changes in the draft procedure over the years, these indicators are percentile ranked on an annual basis. [18]

In Sweden, the GPA from upper-secondary education is used for the application to higher education. This information is available for principals graduating from upper-secondary school in 1970 and later; graduation age is usually the year one turns 19.[19] For higher education, in turn, we construct indicator variables for whether or not the principal (i) has a degree in pedagogics; (ii) has a BA or Master degree; (iii) is a certified subject teacher (ie is certified to teach in at least one theoretical subject); (iv) and the number of years of post-secondary education that the principal has completed.

We also have information the CPI deflated log wage earnings (base year 2005) for all principals. Finally we use an indicator of whether the principal has a military background. In the 1990s a large number of army regiments were closed and many

[17] We also control for the share of missing data for each of those variables.
[18] We refer the interested reader to Lindqvist and Vestman (2011) and Grönqvist and Vlachos (2008) for a thorough description of the Swedish draft procedure and these ability evaluations.
[19] The GPA scores are percentile ranked (in the whole population) on an annual basis.

officers had to search for a civilian alternative career. Some of these former officers ended up in school management.

3.5 Summary statistics

Table 2 shows the summary statistics for the school level control variables and *Table 3* for the outcome variables that we use. In order to get an idea of how representative the switcher principals are, we compare them to the non-switching principals in our school-principal panel; we present all variables separately for switcher and non-switcher principals.

[Table 2]

Looking at the school characteristics reported in *Table 2*, we see that differences between the switcher and non-switcher are small. The only exception being that non-switchers appear to be located at somewhat larger schools. Regarding the outcome variables in *Table 3*, there is some indication that switchers are on average present at lower-performing schools, even if differences are not statistically different. This is in line with findings from the US showing that lower performing schools have difficulties retaining teachers (Hanushek et al., 2004).

[Table 3]

In *Table A.1* in the Appendix we also display descriptive statistics for schools managers. Again we see that differences between switchers and non-switchers are small; the only significant difference being that switcher principals have longer experience—seniority—in their role as a school manager.

4 Results

In this section we start by presenting our estimates of principal fixed effects and some specification tests; these results show that both principals and assistant principals are important for all our outcome dimensions: student performance, strategic school choices

and working environment. We thereafter discuss the estimated size of these fixed effects and how they relate to each other.

4.1 Principal fixed effects

The core results of our analysis are reported in *Table 4* as *F*-tests for school manager fixed effects and adjusted R^2. For each outcome variable, the first row reports the adjusted R^2 and the number of school-year observations when only including school fixed effects, time fixed effects, and time-varying school level controls as explanatory variables. In the second row we add principal fixed effects and report an *F*-test for the joint significance of these (the p-value and the number of additional restrictions in the parenthesis) in addition to the adjusted R^2. In the third row, we also add fixed effects for assistant principals and report an *F*-test of joint significance for these, alongside the *F*-test for principal fixed effects and the adjusted R^2.

[Table 4]

For schooling outcomes (panel A) we first find that both principals and assistant principals affect school level academic achievement as measured by nationwide standardized test; the F-test shows that the fixed effects for both types of school managers are jointly significant.[20] Also when using final grades (GPA), i.e. the more general measure of student performance, as the outcome, we see that the *F*-tests for principal and assistant principal fixed effects are both highly statistically significant. In the final set of regressions capturing student performance in the lower parts of the ability distribution; i.e. when using the share of students who have passed the requirements in English and Mathematics are used as the outcome variable, we again see that both principal and assistant principal fixed effects are highly statistically significant.

[20] The effects are only estimated on a subsample of 276 school managers since we only have information on test scores from 2003. When using the smaller test score sample to estimate schools manager fixed effects on final grades (GPA) we cannot reject the null hypothesis for principals, thus suggesting that final grades is a noisier measure than test scores.

In panel B, we find that school managers are important for a variety of strategic school policy choices. In the upper set of regressions we see that both principals and assistant principals have a significant influence on the grade setting practices at the school; i.e. the extent to which the teachers inflate grades. We next see that school managers are important for wage profiles at schools; the *F*-tests for both principal and assistant principal fixed effects are highly statistically significant when wage dispersion—measured as the coefficient of variation—is used as the dependent variable. Also for the share of female teachers and the share of non-certified teachers, individual heterogeneity among school managers matter.

The results for school level work environment are reported in panel C. We see that adding principal and assistant principal fixed effects are important for affecting the work environment for the teaching staff. The same pattern is found in the final set of regressions; there is a statistically significant relation between the incidence of long-term sick leave and principal and assistant principal fixed effects.

4.2 Robustness of the principal fixed effects

A worry at this stage is that a new principal initially may be exposed to a *honeymoon*-effect; that the change of principal in a school is preceded by poor performance and that the entering principal may be gaining from a mean reversion in outcome; or that the change of principal coincides with a set of school level policy changes from the school board improving the schools performance. In *Table 5* we test for such a systematic component by estimating the baseline model and including indicators capturing systematic deviations in outcomes at schools the two years preceding a change of principal or assistant principal. We find that grade inflation on average is slightly higher two years before a change of school manager and that teacher retention is higher the year before a change of school manager. The overall picture does not suggest that a change of school manager is systematically related to pre-switch changes in outcome; i.e., the estimated school manager fixed effects captures manager influence rather than mean-reversion in outcomes or school level policy changes.

[Table 5]

An alternative way to address the *honeymoon*-effect is to assess whether school managers fair better or worse with tenure at a school. In *Table A.2,* in the Appendix, we therefore estimate our baseline model and include indicators for whether the school manager is at his first or second year at the school. We only find that teacher retention is slightly lower during the first two years at a new school. Hence, the overall pattern neither suggests that a school manager is doing better nor worse the first two years at a school.

In addition, we test how sensitive the estimated principal and assistant principal fixed effects are to the specification of the baseline model. In *Table A.3* in the Appendix, we report the *p*-value (Wilcoxon signed-rank test) when testing for equality of the rank of principals fixed effects in the baseline model and when (i) excluding the time varying covariates from the model, or when (ii) adding a school specific linear trend. We only reject the hypothesis that the rank distribution of school manager effects is unchanged when excluding the time varying covariates or including a school specific linear trend in the specifications with long-term sick absence as dependent variable. Overall, this suggests that the distribution of fixed effects is insensitive to the exact formulation of the model. It also gives us confidence that the distribution of fixed effects in the baseline model is not attributed to an omitted school level trend.

The results in Table 4 indicate that principals have an impact on all included outcomes, and the robustness checks in *Table 5* (and *Table A.4*) does not lead us to believe that the estimated effects capture mean reversions in outcomes as a results of prinicipal switches occuring when schools suffer from temporary dips in outcomes or that switches coincides with other school level changes; e.g. in resources. Similarly, *Table A.2* suggests that the rank distribution of prinical fixed effects is insensitive to the exact formulation of the model. Still, we may worry that there is something intrinsic in the empirical strategy that generates a significant impact of principals for all outcomes. For this reason we also perform a placebo test where all principal spells have randomly been assigned to another school; that is, all spells for switcher principals are kept intact in time but we pretend that the principal is in charge of a different – randomly selected – school rather than the actual school. Reassuringly, the results from this exercise do not

generate significant teacher fixed effect for any of our outcomes; see *Table A.4* in the Appendix.

4.3 Size comparisons

Having established that the variation in the performance of school managers is significantly related to various school level outcomes in a statistical sense, we here inquire whether these effects also are economically significant. We compare the impact of school management for our outcomes when moving along the distribution of fixed effects; in essence, comparing the importance of having a principal in the upper part of the distribution instead of in the lower part. To this end, *Table 6* reports the median and distribution of the school manager fixed effects. Now, even if the estimated school manager fixed effects are unbiased, they are still estimated with a sampling error, and the observed distribution of fixed effects will therefore overstate their true distribution of school manager effects. We therefore apply a "shrinkage estimator" to obtain the true variance of the school manager fixed effects thus accounting for the sampling error, see for example (Rockoff 2004). We follow the iterative procedure used by Leigh (2010) and outlined by Thompson and Sharp (1999) where the true distribution of principal effects is estimated from the principal effects and their standard errors.[21] In *Table 6* we both report the adjusted and the unadjusted standard errors. As the number assistant principals is so small we do not report the influence of the different types of school managers separately in the forthcoming analyses; i.e. both types of principals are included in all analyses, and henceforth we use the terms principal and school manager interchangeably.

[Table 6]

For final grades the shrinkage procedure reduces the variation by half; the adjusted standard error is 0.052. Remember that the unit of measurement is school level averages of z-scored GPAs for each student, so a one standard deviation move within the distribution of principal fixed effects corresponds to about a five percent change of a

[21] We are grateful to Andrew Leigh for sharing his code.

standard deviation in student outcomes. For test scores the impact of the principal is substantially larger: Students who attend a school with a one standard deviation better principal receives 0.119 standard deviations higher test scores. The larger impact on test scores, than on final grades, possibly reflects that principals can induce teachers to inflate grades in order to shield bad school level performance, in order to maintain the school's attractiveness. Final grades are more important for students at this level since they determine the sorting into upper-secondary school.

When instead looking at the share of student who passes the minimum requirements in English and Mathematics, we see that moving a one standard deviation in the distribution of school managers corresponds to a two percentage points increase in the share of students passing the requirements; a 2.1 percent change. With the student level standard deviation in the share of students passing being 0.357, this corresponds to about six percent change of a standard deviation in student outcomes.

Turning next to school policies in the hand of principals, we first look at our measure of grade inflation; that is, the grades in practical-aesthetic subjects relative to grades in English and Mathematics: Grades in practical-aesthetic subjects are inflated with 12 percent of a standard deviation if the school has a principal who is one standard deviation more prone to promote grade inflation. These results are in line with the larger impact of test scores than final grades. In fact, we find grades in practical-aesthetic subjects to a larger extent are related to principals than are grades in theoretical subjects.

When it comes to wage dispersion we first note that in our sample the coefficient of variation in wages is 0.124 on average with a school level standard deviation of 0.028. Hence, a school with a principal who is one standard deviation higher up in the principal-wage-dispersion distribution (0.008) will have a 6.5 percent higher wage dispersion relative to the mean wage dispersion. This amounts to 0.29 of a standard deviation in the school level wage dispersion. The large relative influence of principals on the wage distribution at the school level follows from the low average wage dispersion across Swedish teachers, coupled with the large autonomy of principals in setting the individual wages.

Principals also differ in their propensity to hire female teachers and non-certified teachers. The adjusted standard deviation of principal fixed effects when using the

propensity to hire female teachers and the share non-certified teachers as outcomes is 0.038 and 0.041, respectively. A school having a principal being one standard deviation more likely to hire female teachers will on average have six percent more female teachers; the average is 66.9 percent. Similarly, if the principal is one standard deviation more likely to hire non-certified teachers the school will, on average, have 21 percent more teachers without certification; the average is 19.4 percent. For both these outcomes this corresponds to about 0.4 of a standard deviation. This large influence reflects the large autonomy of the principal in the hiring decision.

As for the principal fixed effects estimated using indicators of workplace conditions as the dependent variable, a change with one standard deviation corresponds to an increase in the teacher retention rate by 5 percentage points. This is 6.6 percent more compared to the mean (0.775) and 0.3 of a standard deviation. Finally, a one standard deviation move in the distribution of the fixed effects based on long term sick leave is associated with a 2.1 percentage point increase in sick leave rates. As the mean of this variable is 0.144 with a standard deviation of 0.068 this again is substantial.

To sum up, we find that the relation between school manager fixed effects and our various measures of academic achievement is similar—or slightly smaller—to the influence of teachers found in the previous literature (eg. Rockoff, 2004; Rivkin et al, 2005; Leigh 2010). One thing to note is that one pathway of principal influence may well be trough the selection of teachers. The large relative influence of principals on school policies and working condition may reflect that the variation across schools, for example when it comes to wages, is small despite a large nominal autonomy of principals. It can also be that the scope for influence is large in these domains.

The size distributions of the school manager fixed effects are relatively insensible to the exact formulation of the model. When excluding the time-varying covariates from the baseline model the estimated principal influence becomes slightly larger, potentially capturing endogenous changes in the student population (see *Table A.5* in the Appendix). Similarly, when adding a school specific linear trend the estimated principal influence becomes slightly smaller (see *Table A.6* in the Appendix). The differences are however small.

4.4 Correlations between principal effects

The next step is to analyze how the different sets of fixed effects are related to each other. Instead of just correlating the fixed effects we regress fixed effects corresponding to one outcome variable on a vector of fixed effects that corresponds to a different one. The error-term in the regressions takes account of the measurement error of the left hand side variable. As the right hand side variable is also measured with error, this leads to a downward bias of an OLS estimator. However, we have an estimate of the precision with which each fixed effect is observed, so we weigh the regression by the inverse of the estimated standard error of each right-hand-side fixed effect. In *Table 7*, we present the results from this exercise. Each cell in the table refers to a different regression where the column variable is the dependent variable and the row variable the independent. Even if the observed patterns are indicative we would like to caution against a causal interpretation.

[Table 7]

In the first three columns, we see that the relations between fixed effects based on students' test scores; final grades and the share of students passing the minimum requirement passed are all positive. This is to be expected but not a mechanical necessity; one could easily imagine that some principals care more about raising average performance while others care more about making sure that students pass the minimum requirements. More interesting is how the fixed effects based on student outcomes are related to the fixed effects that are based on alternative outcomes. Moving down to the fourth row we find that the measure of grade inflation is negatively related to test scores and final grades, though only significantly related to final grades. Principals associated with good student performance are also those who induce their teachers to implement a tougher grade setting regime in core subjects such as mathematics and English. Put differently; some school managers may be using grades in practical-aesthetic subjects to compensate poor average performance in theoretical subjects. We find no relation between grade inflation and share of students passing the minimum requirements.

In the fifth row we find that principals managing schools with a lower wage dispersion are associated with students who perform better at national tests. In row six and seven we find that principals at schools with a larger share of female and certified teachers are associated with better student performance; higher average grades and a larger share of students passing the minimum requirements, but they are not significantly associated with better results at the standardized tests. In rows eight and nine the principals associated with high teacher retention rates and low rates of sick-leave absence are not significantly related to student outcomes.

The picture of what constitutes good school management is mixed. On the one hand we see that principals that appear to inflate grades in practical-aesthetic subjects are principals that do worse in theoretical subjects. One the other hand we see that principals associated with less wage dispersion and a higher share of certified teachers also have higher retention and less long term sick absence. These schools have better results in theoretical subjects, but still inflate grades in practical-aesthetic subjects.

5 Accounting for principal fixed effects

Having established that individual school principals can have an impact on various school policies and student outcomes, the next step is to ask to what extent we can account for these fixed effects. We start by relating the different school manager effects to observable characteristics of the principal. We thereafter relate the distribution of the principal effects to the institutional environment that the principal is working in; i.e. assessing whether the scope for the principal to make a difference is larger in some contexts.

5.1 Observable principal characteristics

It is natural to ask which personal traits and background characteristics that are shared by successful school managers. In order to provide an answer to this we regress the set of principal effects on observable characteristics of the principal. Two caveats should be kept in mind. First, not all sets of fixed effects have an unambiguous normative interpretation; while having a larger share of students passing the minimum

requirements easily can be described as “good”, this does not necessarily hold true for having a larger share of certified teachers. Second, we do not claim to have a theoretically well-founded model of which factors that should correlate with the principal effects. In *Table 8* we therefore only report the results from bivariate regressions of the fixed effects on observable characteristics, so caution must therefore be observed before giving these results a causal interpretation.

[Table 8]

In the first three rows of *Table 8*, we present the correlations between the school manager fixed effects for the three outcomes related to student’ academic achievement and the observable principal characteristics. We find some indication that principals who have a background as subject teachers and/or who have a longer post secondary education tend to be better at improving GPA’s and helping a larger share of students passing the minimum requirement. Principals with a Masters or Bachelors degree—not given at Teacher College—longer tenure at their schools also have a larger share of passed students. There is however no relation between observable characteristics and test score results. Apart from educational background there is no clear pattern indicating that principals’ personality traits—either cognitive or leadership abilities—or their professional background—experience in military management or seniority in the role as a principal—are important for their ability of managing well performing schools.

As for the school policy outcomes—grade inflation, wage dispersion, the share of female teachers, and the share of non certified teachers—it is difficult to arrive at a meaningful interpretation of the few statistically significant effects we find: school managers fuelling grade inflation cannot be characterized by any of the observable variables; principals who themselves are subjects teachers are associated with less wage dispersion; principals with longer average tenure at their schools are associated with less female teachers; principals with higher leadership ability—as assessed at the military draft—are associated with more certified teachers.Turning next to our measures of the working environment in schools we only find that principals with a military background have less long term sick absence at their schools.

The lesson from this analysis is that it is difficult to identify "good" principals either in terms of student performance or working environment, or principals making a difference for strategic school level policies, based on their cognitive or leadership abilities, their length of schooling or educational profile, or whether they have a background in military management. The only exception is some dimensions of principles' educational background that appears to be related to students' grades. Hence, it appears to be as difficult to account for principal quality using observable characteristics as it is for teacher quality.[22] It can also be noted from the last column of *Table 8* that good leadership in Swedish middle schools is not rewarded in terms of higher wage earnings.

5.2 Institutional factors

It is further plausible that the discretion a principal has to his disposal to affect the school is constrained by a number of institutional factors. In this section we therefore analyze how the institutional setting affects the distribution of principal fixed effects. More specifically, we ask the question if the distribution of principal effects is wider in some institutional settings than in others.

First we hypothesise that an individual principal can have a larger influence in small schools than in large ones. We therefore divide the sample of principals based on whether or not the last school where we observe them is above or below the median in number of students. While we do expect principals to have a larger influence in small schools, this influence can be for better or for worse.

Our second institutional indicator is a dummy for whether or not the last school we observe the principal at is a voucher or a public school. Voucher schools are relatively independent from political and legal constraints and to that extent we expect principals to have more discretion. On the other hand, voucher schools are subject to market pressures that can both increase and decrease principal influence. Further, it is theoretically ambiguous as to public or private school boards are better at picking a good principal. The findings in Bloom et al (2009), however, indicate that private hospitals in the UK are better managed than public, something that could also apply to

[22] See Rockoff (2004) and Rivkin et al. (2005) on teacher quality.

Swedish schools. It should here be noted that only six percent of the principals in our sample are observed at voucher schools.

Finally, we divide the sample on whether the municipality where principals were last observed has a below or above median share of voucher students. The share of voucher students is taken to proxy for competitive pressures, but clearly it can correlate with other important municipal characteristics.

To judge whether principals in different institutional settings has a larger discretion, we in *Table 9* run bivariate regressions on the *absolute* value of the principal fixed effect—for each outcome—as a dependent variable on the institutional indicators. A positive sign on an independent variable then indicates that the distribution of outcomes is wider; ie., that there is larger scope for principal discretion.

[Table 9]

The results in the first column of *Table 9* indicate that principals at large schools have less opportunity to influence students' achievement; the coefficients for final grades and the share of passed students are negative and significant. Similarly, principals at large schools have less scope to induce their teachers to inflate the grades. The estimated parameters for the other outcomes are generally negative but not significant. These results suggest that it is easier for principals to influence smaller schools.

The results in column two indicate that principals at voucher school have more influence over student performance in terms of final grades and the share of passed students. We also see that principals at voucher schools have larger opportunities to direct school level policies regarding grade setting standards, and to have larger discretion in wage setting and hiring decision. It should be noted that as voucher schools, on average, are smaller than public schools we cannot separate fully separate the influence of size from organizational autonomy.

The last column shows that competitive pressure only have an impact on student achievement in terms of final grades and the share of students passing the minimum requirement. For these dimension of student performance both the formal independence

of voucher school and a competitive pressure is important for principal influence. When it comes to school level policies competitive pressures appears to be less important as none of the other correlations are significant.

6 Conclusions

Management in the public sector faces a different set of constraints compared to the private sector in terms of competitive pressure, the objectives of the organization, and the interaction with customers and clients. While there is a large literature documenting the importance of leadership in the private sector (see the survey by Bertrand 2009), public sector management has received considerably less attention. One reason for this is that public sector performance, in general, is more difficult to measure and gauge.

In this paper we assess the importance of management in Swedish middle schools by estimating principal fixed effects. Principals provide leadership in a complex and knowledge intense organisation. The benefit of analysing management in a school setting is that we can directly observe the primary outcome of the organization; i.e., students' academic performance. In addition, we have information on a number of indirect outcomes capturing strategic school level choices and working environment.

In the analysis—which is based on principal-school level data that allows us to follow principals as they shift schools—we find that a one standard deviation move in the distribution of principal fixed effects is associated twelve percent of a standard deviation change in test scores, five percent of a standard deviation change in GPA's, and two percent of a standard deviation change in the share of students reaching the minimum requirements. These results correspond to what Branch, Hanushek and Rivkin (2012) find in concurrent work, and the impact of principals is about the same as have been found for teachers (Rockoff, 2004; Rivkin et al, 2005; Leigh 2010). Hence, school managers must be considered to have a substantial effect on student performance.

We also find that principals significantly—both statistically and economically—affect strategic school level variables in terms of grade inflation, school level wage setting, the share of certified teachers and female teachers, and schools' working environment in terms of teacher retention rates and sick leave absence.

It is however difficult to characterize a successful principal either by correlating principal fixed effects for different outcomes to each other, or by correlating principal fixed effects to a large set of observable individual characteristics. This result is well in line with Clark, Martorell and Rockoff (2009) who find little evidence that the selectivity of the principal's undergraduate institution and pre-principal work experience affect school performance, as well as the difficulties of attaching observable characteristics to teacher quality (See for example Rockoff 2004, Rivkin, Hanushek and Kain 2005, Rockoff et al 2011, and Grönqvist and Vlachos 2008).

Our results also suggest that principals in smaller schools have a larger influence on students' academic performance as measured by final grades and the share and students passing the minimum requirements; on grade inflation; on working environment as measured by the teachers' retention rate. It thus appears to be easier for principals to exert a strong influence on a small school.

Furthermore, we find that principals in voucher schools and in schools facing a stronger competition have a larger scope to exert influence on student outcomes in terms of final grades and the share and students passing the minimum requirements. Principals in voucher schools also exert influence on strategic school policy choices—in terms of wage dispersion, the share of certified teachers, and grade inflation. Our findings suggest that both competitive pressure and formal independence make way for principals to have an impact, for better or for worse.

While we have documented that the principal is an agent with a large influence on school performance in several important dimensions, it is difficult to describe who the good principals are based on detailed observable characteristics. The picture of what managing styles, in terms of e.g., strategic policy decisions, that successful principals adopt is also mixed.

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Appendix

Table A.1. Descriptive statistics of school manager observables

	Principal level sample			
	Switchers		Non-switchers	
	Mean	St.dev.	Mean	St.dev.
Male	.579	.494	.447	.497
Year of birth	1951	6.951	1952	9.406
Seniority	**8.409**	**2.624**	**3.659**	**2.685**
Tenure	4.110	2.157	3.336	2.637
Cognitive ability	65.676	22.456	62.781	23.793
Leadership ability	64.374	28.527	62.865	28.119
High school GPA	68.147	25.744	66.619	25.253
Pedagogical education	.750	.433	.8259	.379
BA/Master degree	.391	.488	.334	.472
Subject teacher	.153	.360	.177	.382
Years of post-secondary edu	1.93	.61	1.87	.69
Former army officer	.024	.152	.027	.163
Wage	7.898	.526	7.677	.830

The "School-principal matched sample" refers to the set of school-year observations for schools that have at least one principal observed in multiple schools with at least a two-year stay in each school. This sample includes observations for these schools in years for which they have other principals that we do not observe in multiple schools (see section 3.2 for details). The "Principal level sample" refers to the set of principals who are observed in the matched sample, and where "Switchers" are observed in multiple schools with at least a two-year stay in at least two schools. t-ratio tests are used to test the null of equal means in the Switcher and Non-switchers distributions. Numbers in bold typeface indicate that this hypothesis is rejected at the 10 percent level.

Table A.2. Effects of the effect of school manager tenure

	(1) Test scores	(2) Final grades	(3) Students passed	(4) Grade inflation	(5) Wage dispersion	(6) Female teachers	(7) Non-cert teachers	(8) Teacher retention	(9) Long-term sick absence
1st year	0.007	0.004	0.001	0.003	0.001	-0.002	0.003	-0.006	0.002
	(0.012)	(0.006)	(0.002)	(0.005)	(0.001)	(0.001)	(0.002)+	(0.004)	(0.002)
2nd year	0.024	0.005	0.000	0.000	-0.000	-0.002	0.002	-0.010	0.000
	(0.014)+	(0.005)	(0.002)	(0.006)	(0.001)	(0.001)+	(0.002)	(0.005)*	(0.002)
Obs	2474	8847	8847	7902	8847	8847	8847	8847	8089
Adj R2	0.77	0.77	0.87	0.60	0.44	0.81	0.80	0.28	0.50

Note: Reported in the table are the results from fixed effects panel regressions. For each dependent variable (reported in columns) the regressions include school, year, principal and assistant principal fixed effects, as well as school level controls. In addition indicators for the school managers first and second at a school are included. Robust standard errors correcting for clusters on the school level are reported in parenthesis. +/*/** significant at 10/5/1 percent level

Table A.3. Wilcoxon signed-rank test of school manager fixed effects having the same distribution when excluding time-varying covariates or adding a school specific linear trend

	(1) Test scores	(2) Final grades	(3) Students passed	(4) Grade Inflation	(5) Wage dispersion	(6) Female teachers	(7) Non-cert teachers	(8) Teacher retention	(9) Long-term sick absence
No covariates	0.817	0.969	0.335	0.609	0.153	0.298	0.418	0.901	0.049
Linear trend	0.093	0.375	0.418	0.098	0.729	0.335	0.232	0.203	0.041

Note: For each dependent variable (in columns) we report the p-value for rejecting the hypothesis that the rank of principal and assistant principal fixed effects is unchanged when (first row) excluding the time varying covariates from the baseline model and (second row) when adding a linear trend to the baseline model. The baseline model includes school, year, principal and assistant principal fixed effects, as well as time varying school level controls.

Table A.4. Placebo test: Estimates of school manager fixed effects when allocating principal spells randomly to schools

	F-test on fixed effects for			
Panel A: Academic achievements	Principals	Ass. principals	N	Adj R2
Test scores	.	.		0.667
Test scores	1.00 (0.495; 257)	.	2474	0.667
Test scores	0.98 (0.576; 257)	0.76 (0.879; 46)	2474	0.665
Final grades	.		8847	0.718
Final grades	0.91 (0.943; 572)		8847	0.716
Final grades	0.90 (0.950; 572)	0.76 (0.962; 100)	8847	0.715
Students passed			8847	0.847
Students passed	0.85 (0.994; 572)		8847	0.845
Students passed	0.86 (0.989; 572)	0.96 (0.581; 100)	8847	0.845
	F-test on fixed effects for			
Panel B: School policies	Principals	Ass. Principals	N	Adj R2
Grade inflation			7902	0.490
Grade inflation	0.86 (0.991; 543)		7902	0.484
Grade inflation	0.86 (0.988; 543)	0.98 (0.550; 102)	7902	0.484
Wage dispersion			8847	0.302
Wage dispersion	0.76 (0.999; 572)		8847	0.290
Wage dispersion	0.77 (0.999; 572)	1.28 (0.085; 100)	8847	0.292
Female teachers	.		8847	0.744
Female teachers	0.94 (0.856; 572)		8847	0.742
Female teachers	0.93 (0.875; 572)	0.72 (0.982; 100)	8847	0.741
Non certified teachers			8847	0.733
Non certified teachers	0.99 (0.582; 572)		8847	0.733
Non certified teachers	0.98 (0.622; 572)	1.12 (0.200; 100)	8847	0.759
	F-test on fixed effects for			
Panel C: Working conditions	Principals	Ass. Principals	N	Adj R2
Teacher retention			8847	0.119
Teacher retention	0.89 (0.970; 572)		8847	0.112
Teacher retention	0.89 (0.962; 572)	0.84 (0.870; 100)	8847	0.110
Long term sick absence			8089	0.357
Long term sick absence	0.85 (0.995; 572)		8089	0.349
Long term sick absence	0.86 (0.992; 572)	0.99 (0.487; 100)	8089	0.349

Note: Reported in the table are the results from fixed effects panel regressions. For each dependent variable (reported in column 1) the fixed effects included are row 1: school and year fixed effects; row 2: principal, school and year fixed effects; row 3: principal, assistant principal, school and year fixed effects. All regressions include school level controls. Reported are the F-test for joint significance of the principal fixed effects (column 2), and assistant principal fixed effects (column 3). For each F-test we report the value of the F-statistic, the p-value, and the number of constraints. The statistics reported in the first 6 rows are based on data from 2003-2008 since test-score data are not available before 2003. The statistics reported in the last 3 rows are based on data from 1996-2007 since data on sick absence are not yet available for 2008. Standard errors are corrected for clusters on school level.

Table A.5. Size distribution of school manager fixed effects when excluding time-varying controls

	Median	Adjusted standard deviation	Unadjusted standard deviation
Test scores	-.0061	.160	.234
Final grades	-.0024	.075	.121
Students passed	-.0009	.027	.042
Grade inflation	.0121	.128	.172
Wage dispersion	.0018	.009	.015
Female teachers	.0002	.037	.043
Non certified teachers	.0005	.041	.049
Teacher retention	-.0028	.052	.102
Long term sick absence	.0035	.021	.037

The school manager fixed effects are retrieved from fixed effects panel regressions. For each dependent variable (reported in columns) the regressions include school, year, principal and assistant principal fixed effects, but without school level controls. Column 2 reports the standard deviation of the fixed effects adjusted for estimation error, whereas column 3 report the unadjusted standard error for the fixed effects.

Table A.6. Size distribution of school manager fixed effects adding a school specific linear trend

	Median	Adjusted standard deviation	Unadjusted standard deviation
Test scores	.0152	.093	.289
Final grades	.0014	.085	.129
Students passed	-.0001	.030	.046
Grade inflation	.0090	.074	.143
Wage dispersion	.0020	.005	.016
Female teachers	-.0015	.033	.040
Non certified teachers	.0012	.027	.045
Teacher retention	-.0046	.106	.133
Long term sick absence	-.0011	.023	.044

The school manager fixed effects are retrieved from fixed effects panel regressions. For each dependent variable (reported in columns) the regressions include school, year, principal and assistant principal fixed effects, and school level controls and in addition a school specific linear trend. Column 2 reports the standard deviation of the fixed effects adjusted for estimation error, whereas column 3 report the unadjusted standard error for the fixed effects.

Tables

Table 1. Transitions between positions and schools among school managers who switch schools 1996-2008

	to:	Ass. principal	Principal	
	from:			
A. First & last position	Ass. principal	10	39	*49*
	Principal	5	46	*51*
		15	*85*	*100*
B. All switches between schools	Ass. principal	15	23	*38*
	Principal	6	56	*62*
		21	*79*	*100*

Panel A shows the percentage of school managers who stay in the same or switch position between the first and last position in which we observe them. Panel B shows the percentage of school managers who stay in the same or switch position when they switch school. There are 673 school managers in our sample who switch schools between 1996 and 2008**.** In sum we observe 973 switches between schools.

Table 2. Descriptive statistics of covariates

	School-principal matched sample		Principal level sample			
			Switchers		Non-switchers	
	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Mothers years of schooling	12.61	1.04	12.60	0.78	12.61	1.07
Fathers years of schooling	11.37	1.19	11.41	0.82	11.40	1.14
Immigrant	0.107	0.111	0.110	0.089	0.116	0.115
2^{nd} generation immigrant	0.139	0.161	0.146	0.138	0.155	0.168
Age at immigration	0.833	0.967	0.833	0.723	0.912	0.989
Log wage father	6.80	0.68	6.79	0.54	6.77	0.69
Log wage mother	6.59	0.60	6.58	0.48	6.57	0.63
Mothers age	43.5	1.58	43.6	0.96	43.6	1.42
Fathers age	45.7	1.94	45.7	1.08	45.7	1.64
Female students	0.484	0.079	0.483	0.039	0.484	0.055
Students birth year	1983	20.76	1984	6.97	1981	19.44
Students birth month	6.27	0.47	6.29	0.21	6.27	0.33
No wage observation father	0.083	0.065	0.084	0.046	0.087	0.061
No wage observation mother	0.059	0.063	0.060	0.048	0.063	0.066
No edu observation mother	0.023	0.028	0.022	0.016	0.025	0.026
No edu observation father	0.088	0.059	0.086	0.035	0.092	0.049
No age observation mother	0.017	0.022	0.017	0.011	0.018	0.017
No age observation father	0.034	0.034	0.034	0.020	0.036	0.028
Number of students	94.6	45.3	93.26	32.6	100.0	42.4
Sample size	8847		673		4058	

The "School-principal matched sample" refers to the set of school-year observations for schools that have at least one principal observed in multiple schools with at least a two-year stay in each school. This sample includes observations for these schools in years for which they have other principals that we do not observe in multiple schools (see section 3.2 for details). The "Principal level sample" refers to the set of principals who are observed in the matched sample, and where "Switchers" are observed in multiple schools with at least a two-year stay in at least two schools. t-ratio tests are used to test the null of equal means in the Switcher and Non-switchers distributions. Numbers in bold typeface indicate that this hypothesis is rejected at the 10 percent level.

Table 3. Descriptive statistics of outcome variables

	School-principal matched sample		Principal level sample			
			Switchers		Non-switchers	
	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Test scores	-0.029	0.403	-0.044	0.306	0.009	0.378
Final grades	0.000	0.324	-0.005	0.247	0.009	0.310
Students passed	0.852	0.152	0.857	0.093	0.838	0.144
Grade inflation	0.001	0.261	0.004	0.174	0.004	0.215
Wage dispersion	0.124	0.028	0.123	0.015	0.123	0.022
Female teachers	0.669	0.100	0.675	0.077	0.678	0.092
Non certified teachers	0.192	0.115	0.198	0.090	0.191	0.109
Teacher retention	0.775	0.178	0.764	0.077	0.759	0.156
Long term sick absence	0.144	0.068	0.149	0.039	0.142	0.054

The "School-principal matched sample" refers to the set of school-year observations for schools that have at least one principal observed in multiple schools with at least a two-year stay in each school. This sample includes observations for these schools in years for which they have other principals that we do not observe in multiple schools (see section 3.2 for details). The "Principal level sample" refers to the set of principals who are observed in the matched sample, and where "Switchers" are observed in multiple schools with at least a two-year stay in each school. There are no statistically significant differences in the means between the Switcher and Non-switcher distributions of these outcome variables.

Table 4. Estimates of school manager fixed effects

	F-test on fixed effects for			
Panel A: Academic achievements	Principals	Ass. principals	N	Adj R2
Test scores	.	.	2474	0.667
Test scores	1.41 (<0.0001; 252)	.	2474	0.672
Test scores	1.43 (<0.0001; 252)	2.03 (<0.0001; 45)	2474	0.681
Final grades	.		8847	0.718
Final grades	1.14 (0.0169; 572)		8847	0.719
Final grades	1.16 (0.0069; 572)	2.15 (<0.0001; 100)	8847	0.723
Students passed			8847	0.847
Students passed	1.37 (<0.0001; 572)		8847	0.849
Students passed	1.38 (<0.0001; 572)	1.70 (<0.0001; 100)	8847	0.850
	F-test on fixed effects for			
Panel B: School policies	Principals	Ass. Principals	N	Adj R2
Grade inflation			7902	0.490
Grade inflation	2.05 (<0.0001; 542)		7902	0.512
Grade inflation	2.03 (<0.0001; 542)	1.51 (0.0008; 100)	7902	0.514
Wage dispersion			8847	0.302
Wage dispersion	1.44 (<0.0001; 572)		8847	0.321
Wage dispersion	1.45 (<0.0001; 572)	1.51 (0.0009; 100)	8847	0.326
Female teachers	.		8847	0.744
Female teachers	3.06 (<0.0001; 572)		8847	0.770
Female teachers	3.03 (<0.0001; 572)	2.26 (<0.0001; 100)	8847	0.774
Non certified teachers			8847	0.733
Non certified teachers	2.66 (<0.0001; 572)		8847	0.756
Non certified teachers	2.68 (<0.0001; 572)	3.25 (<0.0001; 100)	8847	0.759
	F-test on fixed effects for			
Panel C: Working conditions	Principals	Ass. Principals	N	Adj R2
Teacher retention			8847	0.119
Teacher retention	1.28 (<0.0001; 572)		8847	0.134
Teacher retention	1.27 (<0.0001; 572)	1.40 (0.0056; 100)	8847	0.139
Long term sick absence			8089	0.357
Long term sick absence	1.56 (<0.0001; 572)		8089	0.384
Long term sick absence	1.56 (<0.0001; 572)	1.47 (0.0017; 100)	8089	0.387

Note: Reported in the table are the results from fixed effects panel regressions. For each dependent variable (reported in column 1) the fixed effects included are row 1: school and year fixed effects; row 2: principal, school and year fixed effects; row 3: principal, assistant principal, school and year fixed effects. All regressions include school level controls. Reported are the F-test for joint significance of the principal fixed effects (column 2), and assistant principal fixed effects (column 3). For each F-test we report the value of the F-statistic, the p-value, and the number of constraints. The statistics reported in the first 6 rows are based on data from 2003-2008 since test-score data are not available before 2003. The statistics reported in the last 3 rows are based on data from 1996-2007 since data on sick absence are not yet available for 2008. Standard errors are corrected for clusters on school level.

Table 5. Estimates of effects before changing principal

	(1) Test scores	(2) Final grades	(3) Students passed	(4) Grade inflation	(5) Wage dispersion	(6) Female teachers	(7) Non-cert teachers	(8) Teacher retention	(9) Long-term sick absence
1 year before	-0.020	0.005	0.000	0.002	0.001	0.002	0.000	0.030	0.002
	(0.015)	(0.004)	(0.001)	(0.005)	(0.001)+	(0.001)+	(0.002)	(0.004)**	(0.002)
2 years before	0.005	-0.002	-0.001	0.014	0.000	0.002	-0.002	0.000	-0.000
	(0.018)	(0.005)	(0.002)	(0.005)*	(0.001)	(0.001)	(0.002)	(0.005)	(0.002)
Obs	2474	8847	8847	7902	8847	8847	8847	8847	8089
Adj R2	0.77	0.77	0.87	0.60	0.44	0.81	0.80	0.29	0.50

Note: Reported in the table are the results from fixed effects panel regressions. For each dependent variable (reported in columns) the regressions include school, year, principal and assistant principal fixed effects, as well as school level controls. In addition indicators at the school level for the year before, and two years before the, the change of principal is included. Robust standard errors correcting for clusters on the school level are reported in parenthesis. +/*/** significant at 10/5/1 percent level.

Table 6. Size distribution of school manager fixed effects

	Median	Adjusted standard deviation	Unadjusted standard deviation
Test scores	-.0020	.119	.211
Final grades	-.0024	.052	.105
Students passed	.0001	.021	.038
Grade inflation	.0036	.118	.150
Wage dispersion	.0018	.008	.015
Female teachers	.0004	.038	.044
Non certified teachers	.0003	.041	.049
Teacher retention	-.0036	.051	.102
Long term sick absence	.0037	.021	.037

The fixed effects are retrieved from the regressions reported in *Table 4*, row 3. Column 1 report the median fixed effect for each outcome variable. Column 2 reports the standard deviation of the fixed effects adjusted for estimation error, whereas column 3 report the unadjusted standard error for the fixed effects.

Table 7. Correlations between fixed effects

	Dependent variable:							
	Test scores	Final grades	Passed students	Grade infl.	Wage disp.	Female teacher	Non-cert. teachers	Teacher retention
Independent variable:								
Test scores		**.213**						
		(0.033)						
Final grades	**0.588**		**1.861**					
	(0.093)		**(0.081)**					
Passed students	**1.023**	**0.238**						
	(0.230)	**(0.010)**						
Grade inflation	-0.103	**-0.102**	0.005					
	(0.070)	**(0.030)**	(0.012)					
Wage dispersion	**-2.168**	-.005	0.015	**-0.686**				
	(0.715)	(0.005)	(0.015)	**0.363**				
Female teachers	0.045	**0.057**	**0.200**	**0.604**	0.051			
	(0.327)	**(0.016)**	**(0.044)**	**0.108**	(0.115)			
Non certified	-0.303	**-0.056**	**-0.054**	-0.172	**0.805**	**-0.213**		
teachers	(0.204)	**(0.018)**	**(0.050)**	0.113	**(0.125)**	**(0.042)**		
Teacher retention	-0.027	0.040	0.164	**0.143**	**-0.819**	**0.208**	**-0.265**	
	(0.066)	(0.038)	(0.106)	**0.048**	**(0.271)**	**(0.091)**	**(0.081)**	
Long -term sick	-0.024	0.020	0.057	0.016	-0.040	**0.075**	0.007	**-0.036**
leave	(0.276)	(0.013)	(0.037)	0.136	(0.095)	**(0.032)**	(0.028)	**(0.013)**

Each entry in the table comes from a different regression, and corresponds to the coefficient from a weighted regression of the fixed effects from the row variable on the fixed effects from the column variable. Observations in these regressions are weighted by the inverse of the standard errors on the independent (column) variable. Coefficients that are significant at the 10 percent level are highlighted in bold.

Table 8. Correlations between fixed effects and school manager observables

		Observable school manager characteristics												
		Male	Year of birth	Seniority	Tenure	Cognitive ability	Leadership ability	High school GPA	Pedagogical education	BA/ Master	Subject teacher	Yrs of post second education	Former army officer	Wage
School manager fixed effects														
Test scores	coef.	.0493	.0030	-.0067	-.0073	.00097	.00024	-.0035	-.0545	.0445	.0322	.0084	.0059	.0390
	s.e.	.0301	.0020	.0101	.0121	.00123	.00096	.0035	.0375	.0310	.0383	.0234	.0789	.0242
	N	292	292	292	292	96	96	19	292	292	292	286	292	291
Final grades	coef.	-.012	-.00085	.00083	.0032	.00075	-.000059	**.00087**	.0093	.005	**.023**	**.014**	-.026	.0066
	s.e.	.0094	.00067	.0018	.0021	.00041	.00033	**.0003**	.011	.0095	**.013**	**.0077**	.03	.0094
	N	669	669	672	672	182	182	**217**	672	672	**672**	**663**	672	669
Students passed	coef.	-.0015	-.000029	.00032	**.0014**	.00025	.000041	.00019	-.0017	**.0063**	**.0083**	**.0047**	-.0042	.0016
	s.e.	.0034	.00024	.00064	**.00077**	.00015	.00012	.0001	.0038	**.0034**	**.0046**	**.0028**	.011	.0036
	N	669	669	672	**672**	182	182	217	672	**672**	**672**	**663**	672	669
Grade inflation	coef.	.0149	.0006	-.0043	-.0029	-.0002	.0004	.0019	-.0200	.0113	-.0090	-.0066	.0141	-.0192
	s.e.	.0137	.0010	.0031	.0036	.0004	.0003	.0014	.0168	.0146	.0196	.0115	.0451	.0146
	N	638	638	642	642	182	182	27	642	642	642	634	642	637
Wage dispersion	coef.	-.00078	-.00000	.000052	.00009	-.00000	.000022	.00000	-.0007	-.00093	**-.0031**	-.00072	-.0034	.00076
	s.e.	.0013	.00009	.00024	.00029	.00005	.000036	.00005	.0014	.0013	**.0017**	.001	.0041	.0014
	N	669	669	672	672	182	182	217	672	672	**672**	663	672	669
Female teachers	coef.	.0041	-.000033	-.00073	**-.0016**	.00027	.000055	.000095	.0047	-.0034	.0032	-.00063	.013	.0017
	s.e.	.0039	.00028	.00073	**.00089**	.0002	.00016	.00013	.0044	.0039	.0053	.0032	.013	.0043
	N	669	669	672	**672**	182	182	217	672	672	672	663	672	669
Non certified	coef.	-.0031	-.00037	-.0021	-.0012	-.00016	**-.00032**	-.00012	-.0029	-.0022	-.0085	-.0033	-.014	**-.0086**
teachers	s.e.	.0044	.00031	.00082	.001	.00023	**.00018**	.00016	.005	.0044	.006	.0036	.014	**.0047**
	N	669	669	672	672	182	**182**	217	672	672	672	663	672	**669**
Teacher retention	coef.	.014	.00015	-.0019	-.0024	.00025	-.00035	-.00014	.01	.00051	.014	.0024	-.0035	-.006
	s.e.	.0094	.00067	.0018	.0021	.00038	.0003	.0003	.011	.0095	.013	.0076	.03	.01
	N	669	669	672	672	182	182	217	672	672	672	663	672	669
Long term sick	coef.	-.0031	-.000075	-.00025	-.00059	-.000097	-.00006	-.00000	.0028	-.0035	-.0032	.00061	**-.018**	-.0043
absence	s.e.	.0031	.00022	.00057	.0007	.00013	.0001	.0001	.0035	.0031	.0042	.0025	**.0099**	.0033
	N	669	669	672	672	182	182	217	672	672	672	663	672	669

Each block of entries in this table comes from a different regression, and corresponds of the *coefficient* (top)/*standard error* (middle)/*number of observations* (bottom) from a regression of the estimated principal fixed effects on observable principal characteristics. Coefficients that are significant at the 10 percent level are highlighted in bold.

Table 9. Correlations between *absolute value* of fixed effects and institutional variables

		Observable school and municipality characteristics		
		School with number of pupils above median	Private School	Municipality with private-school share above median
Principal fixed effects				
Test scores	coef.	-0.0115	-0.0056	0.0022
	s.e.	0.0196	0.037	0.0196
	N	292	292	292
Final grades	coef.	**-0.0157**	**0.0399**	**0.0163**
	s.e.	**0.0069**	**0.0149**	**0.0073**
	N	**672**	**672**	**672**
Students passed	coef.	**-0.0049**	**0.0205**	**0.0100**
	s.e.	**0.0025**	**0.0052**	**0.0025**
	N	**672**	**672**	**672**
Wage dispersion	coef.	-0.0009	**0.0099**	0.0011
	s.e.	0.0009	**0.0019**	0.0008
	N	672	**672**	672
Female teachers	coef.	0.0004	0.0053	0.0041
	s.e.	0.0028	0.0059	0.0030
	N	672	672	672
Non certified teachers	coef.	-0.0038	**0.0280**	0.0031
	s.e.	0.0032	**0.0069**	0.0038
	N	672	**672**	672
Teacher retention	coef.	**-0.0133**	0.0078	-0.0031
	s.e.	**0.0067**	0.0143	0.0070
	N	**672**	672	672
Long term sick absence	coef.	-0.0024	-0.0003	-0.0018
	s.e.	0.0019	0.0042	0.0018
	N	672	672	672
Grade inflation	coef.	**-0.0373**	**0.0619**	0.0079
	s.e.	**0.0094**	**0.01878**	0.0095
	s.e.	**642**	**642**	642

Each block of entries in this table comes from a different regression, and corresponds of the *coefficient* (top)/*standard error* (middle)/*number of observations* (bottom) from a weighted regression of the *absolute value* of the estimated principal fixed effects on observable principal characteristics. Coefficients that are significant at the 10 percent level are highlighted in bold. Standard errors in column three are adjusted for clustering at the municipal level.