The headmaster ritual[a]

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December, 2010

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 principals are important for student outcomes, school policies and the working conditions at the school; in particular for students' GPA and for teachers' retention and sick-absence. In fact, principals that are associated with higher wage dispersion and non-certified teachers in the school are also blessed with good student achievement. It proves difficult however to relate students achievement to any observable principal characteristic, but higher levels of post-secondary education for the principal is related to a larger share of students passing their graduation. We also find that the scope for principal discretion—for good or for worse—is larger in small schools and in voucher schools.

Keywords: Principals, School Management
JEL-codes: D, I, J

[a] We have benefited from discussions and comments from Marianne Bertrand, Henrik Cronqvist, Andrew Leigh and from seminar participants at the Institute for Labour Market Policy Evaluation (IFAU), the Swedish Institute for Social Research (SOFI), and the IFN conference on schooling 2009, EALE/SOLE 2010. Staffan Brantingson at Statistics Sweden has provided services beyond the call of duty.
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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 intense 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 estimate 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 existing studies are mainly of cross-sectional, non-experimental design. Due to these shortcomings, it is not surprising that there is a lack of consensus regarding the impact of principals on schooling outcomes. Estimates vary wildly depending on sample characteristics, the choice of conditioning variables, and how principal behavior is being measured.

In this paper we estimate the impact of principals on a set of schooling outcomes. 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, time varying school and student characteristics, and a vector of principal fixed effects. The estimates of principal effects give us the whole distribution of the role of school management through principals on schooling outcomes, having controlled for observable and unobservable school heterogeneity. We then relate the different sets of principal fixed effects to each other

[1] See for example Harris (2006). A Google search on “school leadership” generated more than one million hits in April 2009.

and to detailed data on principal characteristics including measures of cognitive and non-cognitive ability, as well as educational background. A similar strategy is also used by concurrent work be Branch, Hanushek and Rivkin (2009), Clark, Marotell and Rockoff (2009).

Our findings indicate that individual principals have a substantive impact on student achievement, 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 percent, depending on the outcome.

The estimated effects are economically significant; a one standard deviation move within the distribution of principal fixed effects corresponds to about an eight percent change of a standard deviation in student outcomes. Among the other outcomes, individual principals are particularly strongly related to retention rates and sick leave absence. By relating the different sets of fixed effects to each other we find that principals associated with good human resource management.

Trying to explain the fixed effects using observable principal characteristics prove to be difficult but one finding stands out: principals with a strong academic background appear to be better getting their students to pass their graduation. When comparing the how the institutional environment is related to the principal fixed effects, we find that principals at private schools on average tend to have a positive influence on student achievement An alternative interpretation is therefore that principals at private schools lower the grading standards.

Finally, we analyze how the institutional environment is related to principal discretion and influence, as opposed to principal quality. We find that principals tend to have a stronger impact on school outcomes at relatively small schools and on private voucher schools. As it presumably is easier for an individual principal to exert a strong influence on a small school, and as voucher schools have more discretion in several dimensions, these findings are intuitively appealing. There is no indication, however, that competitive pressures are correlated with the degree of principal influence or discretion.

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 on 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,[2] are associated with higher quality management in the private sector. Relatedly, 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 (2009) who find that public hospitals score low relative to private ones on the management index developed by the authors.

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 factor 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. 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

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

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.[3] 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.

Under more plausible assumptions regarding the informational and the contracting environment, quite standard agency issues will arise—with the principal as the agent.

[3] 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.

The limits to external control then allow the school principal (i.e. the agent) 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 of 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.[4] Voucher schools are not allowed to charge any fees so their budget is indirectly set by the municipality.[5] 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.

[4] The voucher system is described in more detail by Björklund et al. (2005).
[5] Usually the voucher is around 75 percent of the per student cost in the municipal schools. Some municipalities also let the size of the voucher vary with socio-economic characteristics of the student body.

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.[6] 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 sometimes 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 difficult 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. 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

[6] 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.

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 are 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, 2008). 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, 2008).

These institutional constraints aside, school management in Sweden is best described as being highly decentralized. According to a recent survey, 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 the 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. After 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. In order to account for potential serial correlation our model is estimated allowing for clustering of the error term at the school level.

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.[7] 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.

[7] 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.

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 For example, our empirical strategy may be 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. Our strategy may similarly be problematic if recruiting a new principal is associated with a whole set of school level policy changes. However, as our identification is based on observing principals in at least two schools, we only have a problem if it is always the same principals who come to experience the mean reversion or to benefit from of simultaneous policy changes. We will also present specification tests of whether schools are systematically changing principal in response to dips in the outcomes.

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 each teacher and principal.[8] 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 on 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 8 942 school-year observations. In these schools there are 758 principals and assistant

[8] Principals are identified through the positional codes provided in this register.

principals who are observed for two years in at least two different schools. In our analysis we follow Bertrand and Schoar (2003) by only estimate effects for these *switcher* principals.[9]

[Table 1]

In order to characterize the type of principal transitions we identify on, *Table 1* is useful. Panel A displays the transitions between the first and last positions that we observe these 758 switching school managers in: 11 percent of are assistant principals when first observed and remain in this position throughout the observations window; 35 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 49 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; 22 percent are promoted from an assistant to main principal when switching schools; 6 percent of the switches in our sample are cases when a principal move to a new school to become an assistant principal; and 57 percent of the switches is principals keeping the same position as they move across schools. Principals switch to, on average, larger schools than they leave. 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 to larger schools with larger responsibility and more prestige.

3.3 School level outcomes

The school level outcomes are chosen to reflect (i) school productivity, (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. When calculating this average, we first convert the individual test results to z-scores for each

[9] A less conservative approach would be to also allow for non-switcher principals in the estimation as fixed effects, but since estimated effects for non-switchers principals are sensitive to school level shocks (see footnote 7) we have excluded them from the analysis.

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 school productivity is the average grades in English and Mathematics on the school level (GPA). 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 National Agency of 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 grades 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 fourth of that in practical-aesthetic subjects (e.g. Sport, Art, Home economics) not anchored by the national exam. 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 school productivity we use the share of students who have fulfilled the minimum requirements in English and Mathematics.[10] While test scores and final grades captures the average performance of the school, this last productivity measure is aimed at capturing the performance in the lower parts of the ability 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 grade inflation is substantially larger in

[10] As some students with an immigrant background do not take the same Swedish courses as non-immigrants, we exclude Swedish from this analysis. 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.

practical-aesthetic subjects not anchored by the without a national exam than, than in theoretical subjects that to a larger extent are constrained by the national exams.[11] 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. 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 regarding remunerating skilful teachers, the within school wage dispersion—measured as the coefficient of variation—constitutes a second school policy outcome.[12] Principals may also have differing opinions on the importance of a gender balanced teaching staff.[13] Hence, we use the share of female teachers as a third outcome variable in this category. Finally, Principals may have differing opinions on the signalling value of teacher certification, not the least since research is not conclusive on this matter.[14] 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 (2010) has for example shown that voucher schools are more likely to hire non-certified teachers with high cognitive skills.

In their study of management practices among UK hospitals, Bloom et al (2009) find that public hospitals score particularly low on "people" management, thereby affecting

[11] Björklund et al. (2010) has shown that the grades in Swedish, English and Mathematics increased with around 10 percent between 1989 and 2007, while grades in practical-aesthetic subjects increased with almost 45 percent during the same period.
[12] We use the coefficient of variation in monthly full-time equivalent wages as our measure of wage dispersion.
[13] 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 I other subjects.
[14] 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.

productivity negatively. 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 construct 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 year, birth month, immigrant status, and age of immigration.[15] We also include the number of students in the school as a control variable.

Once we have estimated the principal fixed effects, we will correlate these with various observable principal characteristics. These characteristics include gender and birth year, measures of cognitive ability and non-cognitive leadership ability, and upper-secondary school performance and educational attainment.

The indicators of principals' cognitive ability and a measure of 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

[15] We also control for the share of missing data for each of those variables.

management positions scored substantially better on the leadership evaluation than those in other types of high-skilled jobs (See Lindqvist and Vestman, 2010). In order to account for minor changes in the draft procedure over the years, these indicators are percentile ranked on an annual basis. [16]

In Sweden, the GPA from upper-secondary education is used for the application to higher education. This information is unfortunately only available in central record from 1985 and as students usually graduate the year they turn 19, and we are only able to match GPA scores to a small number of principals in our sample.[17] Much better records of the principals' higher education exist, however. From these records, 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 use an indicator of whether the principal has a military background. In the 1990s a large number of army regiments were closed and many officers had to search for an 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-

[16] We refer the interested reader to Lindqvist and Vestman (2009) and Grönqvist and Vlachos (2008) for a thorough description of the Swedish draft procedure and these ability evaluations.
[17] The GPA scores are percentile ranked (in the whole population) on an annual basis.

switchers appears 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. Though the focus of this paper is not to analyze principal mobility, it is worth noting that this is in line with findings from the US showing that lower performing schools have difficulties retaining teachers (Hanushek et al, 2004).

[Table 3]

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 productivity as measured by nationwide standardized test;

the F-test shows that the fixed effects for both types of school manager are jointly significant.[18] 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 for student outcomes capturing 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.

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 to make the school more attractive. 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. For all four school policy variables we see that the fit of the model is improved when including fixed effects for principals and assistant principals.

The results for school level work environment are reported in panel C. We see that adding principal and assistant principal fixed effects to the model with the teacher retention rate as the dependent variable increases the fit; that is, school managers 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.

A few worries 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

[18] The effects are only estimated on a subsample of 276 school managers since we only have information on test scores from 2002.

changes improving the schools performance. In *Table 5* we test for such a systematic component by estimating the baseline model and including indicators for the two years preceding the change of principal (or assistant principal). For the outcomes related to student performance and working conditions we do not find any indication that outcome would be systematically different a change of principal. When it comes to policy variables, however, we see that schools appear to have a systematically larger share of female teachers and fewer certified teachers two years before changing principal. We must therefore exercise some caution when interpreting these staffing outcomes.

[Table 5]

As an additional, we test how sensitive the estimated principal (and assistant principal) fixed effects are to the specification of the baseline model. In *Table A.1* 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 linear trend. Reassuringly, the rank of fixed effects remain largely unchanged, thus convincing us that our results are sensitive the exact specification of the model. We only reject the hypothesis that the distribution of principal fixed effects is unchanged when excluding the time varying covariates in the specifications with non-certified teachers and long-term sick absence as dependent variables.

4.2 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 mean and distribution of the principal fixed effects. Now, even if the estimated principal 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. We therefore

have to apply a "shrinkage estimator" to obtain the true variance of the principal 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.[19] In *Table 6* we both report the adjusted and the unadjusted standard errors. As the number assistant principals are so small we do not report the influence of the different types of school managers separately in the forthcoming analysis.

[Table 6]

For final grades the shrinkage procedure reduces the variation with about a third; the adjusted standard error is 0.081. 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 an eight percent change of a 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 0.19 standard deviations higher test scores. The larger impact on test scores, than on final grads, possibly reflects that principals can induce teachers to inflate grades in order to shield bad school level performance, so that the school does not lose in 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 three percentage points increase in the share of students passing the requirements; a 3.5 percent change. With the student level standard deviation in the share of students passing is 0.357, this corresponds to about eight percent change of a standard deviation in student outcomes.

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

Since a one standard deviation change in teacher ability has been estimated to correspond to approximately a ten percent increase in student achievement (see e.g. Rockoff, 2004; Rivkin et al, 2005; Leigh 2010), school managers must be considered to have a large effect on student performance.

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 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 are to a larger extent related to principals than 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 0.029. Hence, a school with a principal who is one standard deviation higher up in the principal-wage-dispersion distribution (0.016) will have a 13 percent higher wage dispersion relative to the mean wage dispersion. This amounts to 0,55 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 0.039 and 0.044, 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 23 percent more teachers without certification; the average is 19.4 percent. For both these outcomes this corresponds to around 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 almost 11 percentage points. This is 14 percent more compared to the mean (0.773) and 0.6 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 3.6 percentage point increase in sick leave rates. As the mean of this variable is 0.143 with a standard deviation of 0.068 this again is substantial.

To sum these effects up, we find quite a substantial relation between school manager fixed effects and all outcome dimensions.

4.3 Correlations between principal effects

The next step of our analysis is to investigate how the different sets of fixed effects are related to each other. Instead of just correlating the fixed effects we regress a vector of fixed effects that corresponds 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, the precision with which each fixed effect is observed is known, so we weigh the regression by the inverse of the 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.

[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 passed are 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. Moving down the columns we find that the measure of grade inflation is negatively related to all the student outcomes; though only significantly related to final grades. Some school managers thus

appear to use grades in practical-aesthetic subjects to compensate poor performance in theoretical subjects. In the fifth we find a positive and significant relation between both students' final grades the share of passed students on one hand and the school level wage dispersion on the other. In the sixth row we see that there is no significant relation between the share of female teachers and either of the student outcome variables, while in the seventh row we read that share of non-certified teachers is negatively related to final grades, but not to the share of students that pass the minimum requirements.

In the eighth row we find that test scores and the share of students passing is related to the teacher retention rate. The sign of this correlation suggest that a good working environment for teachers is likely to be a good environment for student learning. However, we would like to caution against a causal interpretation.

The fifth column reports a quite strong positive relation between wage dispersion and the share of non-certified teachers. This is what is expected since non-certified teachers have shorter tenure and are on average paid less. The high negative correlation between wage dispersion and sick leave absence reported in the final row of column five could reflect that there is higher wage dispersion in well functioning schools with a more active management, incentivising teachers.

Column six reports a strong negative relation between the share of female and the share of non-certified teachers. Again, this could be an indication that some principals are relatively prone to hire teachers who do not fit the stereotype of a teacher. Thus, the correlation could suggest an active staff management. The positive relation between teacher retention rates and the share of female teachers substantiates this interpretation; female teachers are more likely to be certified and thus with a tenured position at the school.

The final three correlations, reported in columns seven and eight show that a higher incidence of long term sick leave is correlated high a higher share of non-certified teachers and lower teacher retention. The lower teacher retention could be an indication of some teacher seeking to leave schools with bed working conditions.

All in all, the findings suggest that some principals take a more active role in finding a particular teacher profile, and care less about formal qualifications. A high degree of wage dispersion appears to be a sign of a well functioning school—it correlates with

good student outcomes, and a higher teacher retention—but one must be careful when interpreting this causally.

5 Accounting for principal fixed effects

Having established that individual school principals can have an impact on various school policies and student outcomes, we now ask to what extent we can account for these fixed effects. We start by relating the different sets of school manager fixed effects to observable individual characteristics including gender, detailed ability measures, and indicators of educational attainment. Thereafter we relate both the size and the distribution of the fixed effects to the institutional environment that the principal is working in. The purpose of this is both to analyze if certain institutional environments are better in finding good principals, and to analyze what institutional settings that enhance—for better or for worse—principal discretion.

5.1 Observable principal characteristics

It is natural to ask which personal characteristics that are shared by successful school managers. In this section, our attempt is to provide a tentative answer to this question by regressing the sets of fixed principal effects on various observable principal characteristics. 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 that pass the minimum requirements easily can be described as "good", this does not necessarily hold true for having a large 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 fixed effects. In Table 8 we therefore only report the results from bivariate regressions of the fixed effects on observable characteristics.[20], these results should therefore not be given a casual interpretation.

[20] In order to account for measurement error in the dependent variable, these bivariate regressions are weighted by the inverse of the standard error of each fixed effect; ie., of each dependent variable.

[Table 8]

[Interpretation of Table 8 to be written]

5.2 Institutional factors

It is plausible that some institutional settings are better at locating high quality principals, allocating them to the schools where their competences are best used, and to make them perform well. As discussed in section 2, it is further plausible that the discretion a principal has to affect school policies is constrained by a number of institutional factors. In this section we therefore analyze how the institutional setting affects both the size and the distribution of principal fixed effects.

First we hypothesise that an individual principal potentially can have a larger influence on small schools than on large ones. We therefore divide the sample of principals based on whether or not the last school we observe them at is above or below the median 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. Regarding principal quality, it is theoretically ambiguous whether 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 ones, something that also can apply to 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 systematically perform better than in others, we run bivariate regressions for each vector of principal fixed

effects.[21] In the first column of *Table 9*, we see that there is little indication that principals in large schools differ in their influence on school level outcomes.

[Table 9]

Looking next at column two, in the first row we find quite a large positive effect of principals in voucher schools on students' GPA. This could either indicate that principals in such schools are better at raising student achievement, but a less benevolent interpretation is that voucher school principals lower the grading standards. This less benevolent interpretation is given some support by the result that the share of students who pass the minimum requirements in Mathematics and English is not affected by these principals. Principals at voucher schools also score significantly higher than other principals regarding the degree of wage dispersion, while a lower share of non-certified teachers,[22] and teacher retention rates. These principals are also particularly prone to hire female teachers, and have larger problems with long term sick absence.

The findings in columns two and three are interesting to contrast. Principals do not perform better in terms of student outcomes in municipalities with a high share of voucher students. Principals in schools associated with a substantial competition do however have a higher wage dispersion; a lower share of female teachers and less long-term sick absence; i.e. consistent with a more active school management.

Turning now to the issue of principal discretion, we ask the question if the distribution of principal fixed effects is wider in different institutional settings. We do this by replicating table 8, but instead using the *absolute* value of the fixed effects as the dependent variable. 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. These results are reported in *Table 10*.

[21] To account for measurement error in the estimated fixed effects these regressions are weighted with the inverse of the standard error of the fixed effects. In the regressions with the share of voucher students as the independent variable, standard errors are clustered at the municipal level.
[22] Note that on average, voucher schools have a lower share of certified teachers than public schools.

[Table 10]

The results in the first column indicate that principals at large schools have less influence on school policies and student outcomes than principals at small ones, just as expected. All the estimated coefficients have negative signs.

That principals at voucher schools have more discretion is clear from the results in column two. All the estimated coefficients are positive. In particular, the variation in final grades, wage dispersion, and the share of non-certified teachers is substantially larger among principals at voucher schools,

The last column indicates that competitive pressures appear to have little impact on principal discretion. In other words, it appears as if the higher degree of formal independence that voucher schools enjoy—rather than school competition *per se*—is what matters for principal discretion.

6 Conclusions

To be concluded...we have…we find…

References

Andersson, C. and N. Waldenström (2007), "Teacher certification and student achievement in Swedish compulsory schools", IFAU WP 2007:6.

Bertrand, M. (2009), "CEOs", forthcoming *Annual Review of Economics*.

Bertrand M. and A. Schoar (2003) "Managing With Style: The Effects of Managers on Firm Polcies", *Quarterly Journal of Economics* 118:4, 1169-1208.

Besley, T. and S. Machin (2008), "Are Public Sector CEOs Different? Leadership Wages and Performance in Schools", mimeo LSE.

Björklund, A., M. Clark, P.-A. Edin, P. Fredriksson, and A. Krueger (2005), *The market comes to education in Sweden: An evaluation of Sweden's surprising school reforms*, Russel Sage Foundation, New York.

Bloom, N., C. Propper, S. Seller and J. van Reenen (2009), "Management Practices in Hospitals", mimeo Stanford University.

Bloom, N. and J. van Reenen (2007), "Measuring and Explaining Management Practices Across Firms and Countries", *Quarterly Journal of Economics* 122:4, 1351-1408.

Böhlmark, A. and M. Lindahl (2008), "Does School Privatization Improve Educational Achievement? Evidence from Sweden's Voucher Reform", IZA DP 3691.

Dee, T. (2005), "A Teacher Like Me: Does Race, Ethnicity or Gender Matter? ", *American Economic Review* 95:2, 158-165.

Grönqvist E. and J. Vlachos (2008), "One Size Fits All? The Effects of Teacher Cognitive and Non-Cognitive Abilities on Student Achievement", IFAU WP 2008:5.

Haberman, M. and V. Dill (1999), "Selecting Star Principals for Serving Children in Poverty", *Instructional Leader* 12:1, 1-5 and 11-12.

Hallinger P. and R.H. Heck (1996), "Reassessing the Principal's Role in School Effectiveness: A Review of Empirical Research, 1980-1995", *Educational Administration Quarterly* 32:1, 5-44.

Hallinger P. and R.H. Heck (1998), "Exploring the Principal's Role to School Effectiveness: A Review of Empirical Research, 1980-1995", *School Effectiveness and School Improvement* 9:2, 157-191.

Hanushek, E.A., J.F. Kain and S.G. Rivkin (2004), "Why Public Schools Lose Teachers", *Journal of Human Resources* 39:2, 326-354.

Harris, S. (2006), *Best Practices of Award-Winning Secondary School Principals*, Corwin Press.

Hensvik, L. (2010), "Competition, wages and teacher sorting: four lessons from av voucher reform", IFAU WP 2010:8

Holmlund, H, and Krister Sund (2008), "Is the gender gap in school performance affected by the sex of the teacher?", *Labour Economics* 15:1, 37-53.

Kane, T., J. Rockoff, and D. Staiger (2006), "What does certification tell us about teacher effectiveness? Evidence from New York city", NBER WP 12155.

Leigh, A. (2010) "Estimating Teacher Effectiveness from Two-Year Changes in Students' Test Scores", *Economics of Education Review* 29 480–488

Leithwood, K., A. Harris, and D. Hopkins (2008), "Seven Strong Claims About School Leadership", *School Leadership and Management* 28:1, 27-42.

Leithwood, K., K.S. Seashore Louis, S. Anderson, and K. Wahlstrom (2004), "Review of Research: How Leadership Influences Student Learning", The Wallace Foundation.

Lindahl, E. (2007), "Gender and ethnic interactions among teachers and students – evidence from Sweden", IFAU WP 2007:25.

Lindqvist, E. and R. Vestman (2010), "The Labor Market Returns to Cognitive and Noncognitive Ability: Evidence from the Swedish Enlistment", *American Economic Journal: Applied Economics*, .forthcoming

Ministry of Education and Research (2000), Education Act 1985: 1100, http://www.sweden.gov.se/content/1/c6/02/15/38/1532b277.pdf (2007-10-15).

OECD (2008), *Education at a Glance 2007*, OECD: Paris.

Rivkin, S., E. Hanushek, and J. Kain (2005), "Teachers, schools, and academic achievement", *Econometrica*, 73, 417-458.

Rockoff, J. (2004), "The impact of individual teachers on student achievement: Evidence from panel data", *American Economic Review*, 94, 247-252.

Thompson, S. G. and S. J. Sharp (1999). "Explaining heterogeneity in metaanalysis: A comparison of methods". *Statistics in Medicine*, 18(20), 2693–2708.Skolverket (2007), "Fact sheet: Compulsory school", http://www.skolverket.se/content/1/c4/12/15/en_grundskola.pdf (2007-10-15).

Skolverket (2008), "Personal i grundskolan 2007/08", Skolverket dnr 71-2008:4.

Skolverket (2009), "Resursfördelning utifrån förutsättningar och behov", Skolverket Rapport 330, http://www.skolverket.se/publikationer?id=2204 (2009-05-06).

Waters, T., R.J. Marzano and B. McNulty (2003), "Balanced Leadership. What 30 Years of Research Tell Us About the Effect of Leadership on Student Achievement", McREL Working Paper.

Witziers, B., R.J. Bosker, and M.L. Krüger (2003), "Educational Leadership and Student Achievement: The Elusive Search for an Association", *Educational Administration Quarterly* 39:3, 398-425.

Appendix

Table A.1. Wilcoxon signed-rank test of principal fixed effects having the same distribution when excluding time-varying covariates or adding a 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-ter sick abse
No covariates	0.2613	0.7103	0.8585	0.9040	0.4643	0.6574	0.0037	0.1671	0.0376
Linear trend	0.0729	0.8195	0.3071	0.2089	0.9514	0.1471	0.4520	0.6729	0.1215

Note: For each dependent variable (in columns) we report the p-value for rejecting the hypothesis that the rank 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.

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	11	35	*46*
	Principal	5	49	*54*
		16	*84*	*100*
B. All switches between schools	Ass. principal	15	22	*37*
	Principal	6	57	*63*
		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 758 school managers in our sample who switch schools between 1996 and 2008. In sum we observe 840 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	12.59	1.07	12.60	0.82	12.58	1.08
Fathers years of schooling	11.36	1.21	11.40	0.87	11.36	1.16
Immigrant	0.109	0.114	0.113	0.097	0.118	0.118
2nd generation immigrant	0.270	0.198	0.282	0.175	0.291	0.204
Age at immigration	0.843	0.996	0.852	0.787	0.927	1.007
Log wage father	6.79	0.70	6.77	0.58	6.75	0.72
Log wage mother	6.58	0.62	6.56	0.51	6.55	0.65
Mothers age	43.5	1.63	43.5	1.03	43.5	1.46
Fathers age	45.7	2.03	45.87	1.21	45.6	1.73
Female students	0.483	0.081	0.482	0.044	0.483	0.057
Students birth year	1983	20.91	1984	6.81	1981	20.34
Students birth month	6.27	0.49	6.29	0.23	6.27	0.36
No wage observation father	0.084	0.068	0.085	0.050	0.088	0.065
No wage observation mother	0.059	0.066	0.061	0.052	0.064	0.068
No edu observation mother	0.023	0.030	0.023	0.018	0.025	0.029
No edu observation father	0.089	0.061	0.087	0.038	0.093	0.053
No age observation mother	0.017	0.024	0.017	0.013	0.019	0.019
No age observation father	0.035	0.036	0.035	0.021	0.037	0.031
Number of students	94.5	45.3	**90.3**	**34.2**	**98.4**	**42.7**
Sample size	8942		758		4110	

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. 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	-0.022	0.398	-0.042	0.303	-0.003	0.373
Final grades	-0.002	0.329	-0.014	0.267	0.004	0.311
Students passed	0.851	0.153	0.854	0.103	0.837	0.144
Grade inflation	0.002	0.261	0.004	0.176	0.005	0.216
Wage dispersion	0.124	0.029	0.124	0.019	0.124	0.024
Female teachers	0.669	0.100	0.675	0.079	0.679	0.092
Non certified teachers	0.194	0.118	0.201	0.093	0.193	0.111
Teacher retention	0.773	0.181	0.758	0.089	0.755	0.164
Long term sick absence	0.143	0.068	0.148	0.041	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: Student outcomes	Principals	Ass. principals	N	Adj R2
Test scores	.	.	2367	0.685
Test scores	1.24 (0.0109; 235)	.	2367	0.695
Test scores	1.29 (0.0038; 235)	2.31 (<0.0001; 41)	2367	0.704
Final grades	.		8942	0.720
Final grades	1.34 (<0.0001; 624)		8942	0.727
Final grades	1.36 (<0.0001; 624)	2.00 (<0.0001; 110)	8942	0.731
Students passed			8942	0.846
Students passed	1.21 (0.0004; 624)		8942	0.848
Students passed	1.20 (0.0006; 624)	1.47 (0.0012; 110)	8942	0.849
Grade inflation			7610	0.483
Grade inflation	1.60 (<0.0001; 553)		7610	0.507
Grade inflation	1.63 (<0.0001; 553)	1.41 (0.0048; 98)	7610	0.510
	F-test on fixed effects for			
Panel B: School policies	Principals	Ass. Principals	N	Adj R2
Wage dispersion			8942	0.318
Wage dispersion	1.39 (<0.0001; 624)		8942	0.338
Wage dispersion	1.35 (<0.0001; 624)	1.55 (0.0002; 110)	8942	0.344
Female teachers	.		8942	0.746
Female teachers	2.72 (<0.0001; 624)		8942	0.777
Female teachers	2.70 (<0.0001; 624)	2.11 (<0.0001; 110)	8942	0.780
Non certified teachers			8942	0.746
Non certified teachers	2.36 (<0.0001; 624)		8942	0.770
Non certified teachers	2.36 (<0.0001; 624)	1.97 (<0.0001; 110)	8942	0.774
	F-test on fixed effects for			
Panel C: Working conditions	Principals	Ass. Principals	N	Adj R2
Teacher retention			8942	0.138
Teacher retention	1.24 (<0.0001; 624)		8942	0.154
Teacher retention	1.22 (0.0002; 624)	1.51 (0.0005; 110)	8942	0.160
Long term sick absence			8157	0.358
Long term sick absence	1.57 (<0.0001; 624)		8157	0.388
Long term sick absence	1.58 (<0.0001; 624)	1.41 (0.0030; 110)	8157	0.393

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.

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	-0.014	-0.003	0.000	0.014	0.001	0.002	-0.002	-0.005	-0.000
	(0.014)	(0.005)	(0.002)	(0.005)*	(0.001)	(0.001)*	(0.002)	(0.004)	(0.001)
2 years before	0.013	-0.003	-0.001	0.003	-0.000	0.003	-0.005	0.009	-0.002
	(0.017)	(0.005)	(0.002)	(0.006)	(0.001)	(0.001)**	(0.002)**	(0.005)*	(0.002)
Obs	2367	8942	8942	7610	8942	8942	8942	8942	8157
Adj R2	0.79	0.78	0.88	0.60	0.46	0.82	0.81	0.31	0.51

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 clustered on the school level are reported in parenthesis.

Table 6. Size distribution of school manager fixed effects

	Median	Adjusted standard deviation	Unadjusted standard deviation
Test scores	-.0064	.192	.238
Final grades	-.0003	.081	.121
Students passed	-.0008	.030	.046
Grade inflation	.0021	.119	.161
Wage dispersion	.0011	.016	.024
Female teachers	.0008	.039	.061
Non certified teachers	.0002	.044	.069
Teacher retention	-.0011	.107	.162
Long term sick absence	-.0008	.036	.053

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 inflatio	Wage disp.	Female teacher	Non-cert. teachers	Teacher retention
Independent variable:								
Test scores		**.893**						
		(0.105)						
Final grades	**0.264**		**1.702**					
	(0.036)		**(0.078)**					
Passed students	**0.050**	**0.241**						
	(0.013)	**(0.011)**						
Grade inflation	-0.011	**-0.335**	-0.202					
	(0.027)	**(0.057)**	(0.169)					
Wage dispersion	-0.003	**0.015**	**0.033**	0.306				
	(0.005)	**(0.007)**	**(0.017)**	0.274				
Female teachers	0.025	-0.025	0.026	0.084	-0.102			
	(0.011)	(0.017)	(0.044)	0.127	(0.090)			
Non certified	0.020	**-0.043**	-0.014	**-0.220**	**0.533**	**-0.276**		
teachers	(0.017)	**(0.019)**	(0.046)	**0.120**	**(0.094)**	**(0.043)**		
Teacher retention	**0.083**	-0.080	**0.337**	-0.060	-0.394	**0.237**	-0.155	
	(0.049)	(0.052)	**(0.131)**	0.047	(0.285)	**(0.114)**	(0.104)	
Long -term sick	0.010	0.016	0.038	**-0.236**	**-0.170**	0.038	**0.108**	**-0.022**
leave	(0.016)	(0.015)	(0.039)	**0.134**	**(0.079)**	(0.034)	**(0.031)**	**(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 principal observables

		Observable principal characteristics									
		Male	Year of birth	Cognitive ability	Leadership ability	GPA	Pedagogical education	BA/Master	Subject teacher	Years of post second.	Former army officer
Principal fixed effects											
Test scores	coef.	**0.041**	0.0004	0.0011	-0.0001	-0.0025	-0.0503	0.0197	-0.0070	-0.0105	-0.0839
	s.e.	**(0.025)**	(0.0018)	(0.0011)	(0.0010)	(0.0034)	(0.0349)	(0.0275)	(0.0339)	(0.0205)	(0.0578)
	N	276	276	91	91	19	276	276	276	271	276
Final grades	coef.	-0.0080	0.0005	0.0004	**0.0003**	**0.0015**	0.0125	-0.0047	0.0084	0.0045	-0.0317
	s.e.	(0.0073)	(0.0005)	(0.0003)	**(0.0002)**	**(0.0008)**	(0.0083)	(0.0073)	(0.0097)	(0.0058)	(0.0212)
	N	730	730	200	**199**	**28**	734	734	734	723	734
Students passed	coef.	0.0029	0.0003	0.0001	0.0001	**0.0010**	0.0028	0.0044	**0.0097**	**0.0055**	-0.0040
	s.e.	(0.0027)	(0.0002)	(0.0001)	(0.0001)	**(0.0004)**	(0.0031)	(0.0027)	**(0.0036)**	**(0.0022)**	(0.0081)
	N	730	730	200	199	**28**	734	734	**734**	**723**	734
Wage dispersion	coef.	-0.0016	0.0001	-0.0001	0.0001	-0.0001	0.0006	-0.0005	-0.0003	0.0008	0.0028
	s.e.	(0.0014)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0016)	(0.0014)	(0.0019)	(0.0011)	(0.0046)
	N	730	730	200	199	28	734	734	734	723	734
Female teachers	coef.	**0.0057**	**0.0004**	0.0001	0.0001	-0.0002	**0.0089**	-0.0053	0.0031	0.0012	**0.0309**
	s.e.	**(0.0034)**	**(0.0002)**	(0.0001)	(0.0001)	(0.0003)	**(0.0039)**	(0.0034)	(0.0043)	(0.0026)	**(0.0098)**
	N	**730**	**730**	200	199	28	**734**	734	734	723	**734**
Non certified teachers	coef.	-0.0045	**-0.0006**	-0.0000	-0.0002	0.0008	0.0011	-0.0043	-0.0064	**-0.0051**	-0.0124
	s.e.	(0.0038)	**(0.0003)**	(0.0002)	(0.0001)	(0.0007)	(0.0045)	(0.0039)	(0.0053)	**(0.0031)**	(0.0119)
	N	730	**730**	200	199	28	734	734	734	**723**	734
Teacher retention	coef.	**0.0206**	-0.0004	-0.0001	**-0.0006**	-0.0010	-0.0093	-0.0071	-0.0060	-0.0018	-0.0244
	s.e.	**(0.0092)**	(0.0006)	(0.0003)	**(0.0003)**	(0.0009)	(0.0108)	(0.0094)	(0.0122)	(0.0073)	(0.0257)
	N	**730**	730	200	**199**	28	734	734	734	723	734
Long term sick absence	coef.	**-0.0055**	0.0000	0.0000	-0.0001	-0.0002	0.0047	-0.0030	0.0008	0.0014	**-0.0286**
	s.e.	**(0.0031)**	(0.0002)	(0.0001)	(0.0001)	(0.0004)	(0.0036)	(0.0031)	(0.0040)	(0.0024)	**(0.0097)**
	N	**727**	727	199	199	27	731	731	731	721	**731**
Grade inflation	coef.	-0.004	0.0006	-0.0009	**0.0005**	0.0004	-0.0097	0.0014	-0.0137	-0.0034	-0.0090

	s.e.	0.011	0.0007	0.0004	**0.0003**	0.0012	0.0128	0.0111	0.0146	0.0087	0.0255
	N	627	627	181	**181**	27	631	631	631	623	631

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 estimated principal fixed effects on observable principal characteristics. In these regressions observations are weighted with the inverse of the standard error of the estimated fixed effects. Coefficients that are significant at the 10 percent level are highlighted in bold.

Table 9. Correlations between 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.	0.0397	0.0014	-0.0129
	s.e.	0.0258	0.0627	0.0257
	N	276	276	276
Final grades	coef.	**-0.0221**	**0.0310**	0.0033
	s.e.	**0.0072**	**0.0135**	0.0072
	N	**734**	**734**	734
Students passed	coef.	0.0002	-0.0037	-0.0005
	s.e.	0.0027	0.0052	0.0027
	N	734	734	734
Wage dispersion	coef.	-0.0010	**0.0141**	**0.0043**
	s.e.	0.0014	**0.0027**	**0.0014**
	N	734	**734**	**734**
Female teachers	coef.	0.0012	0.0046	**-0.0084**
	s.e.	0.0033	0.0057	**0.0033**
	N	734	734	**734**
Non certified teachers	coef.	**0.0125**	**-0.0197**	-0.0049
	s.e.	**0.0037**	**0.0070**	0.0038
	N	**734**	**734**	734
Teacher retention	coef.	-0.0099	0.0179	0.0141
	s.e.	0.0090	0.0168	0.0090
	N	734	734	734
Long term sick absence	coef.	-0.0033	**-0.0126**	**-0.0065**
	s.e.	0.0030	**0.0052**	**0.0030**
	N	731	**731**	**731**
Grade inflation	coef.	0.0132	0.0243	0.0005
	s.e.	0.0107	0.0204	0.0107
	s.e.	631	631	631

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 estimated principal fixed effects on observable principal characteristics. In these regressions observations are weighted with the inverse of the standard error of the estimated fixed effects. 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.

Table 10. 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.	-.0152	**.0922**	.0130
	s.e.	.0104	**.0254**	.0102
	N	276	**276**	276
Final grades	coef.	**-0.0221**	**0.0153**	0.0059
	s.e.	**0.0047**	**0.0090**	0.0048
	N	**734**	**734**	734
Students passed	coef.	**-0.0064**	**0.0129**	**0.0067**
	s.e.	**0.0018**	**0.0034**	**0.0018**
	N	**734**	**734**	**734**
Wage dispersion	coef.	**-0.0030**	**0.0173**	0.0019
	s.e.	**0.0011**	**0.0020**	0.0011
	N	**734**	**734**	734
Female teachers	coef.	-0.0010	**0.0129**	-0.0004
	s.e.	0.0023	**0.0039**	0.0023
	N	734	**734**	734
Non certified teachers	coef.	**-0.0085**	**0.0302**	0.0021
	s.e.	**0.0026**	**0.0047**	0.0026
	N	**734**	**734**	734
Teacher retention	coef.	**-0.0181**	**0.0360**	-0.0025
	s.e.	**0.0071**	**0.0133**	0.0072
	N	**734**	**734**	734
Long term sick absence	coef.	**-0.0053**	0.0019	-0.0017
	s.e.	**0.0020**	0.0034	0.0020
	N	**731**	731	731
Grade inflation	coef.	**-0.0172**	0.0215	0.0009
	s.e.	**0.0071**	0.0135	0.0071
	s.e.	**0.0071**	0.0135	0.0071

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. In these regressions observations are weighted with the inverse of the standard error of the estimated fixed effects. 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.

Table 11. Persistence of Principal Effects: Real Data and Placebo Data

	Real data	Placebo data
Dependent variable		
Test scores	0.230	-.025
	(0.036)	(0.082)
	[0.133]	[0.001]
Final grades	0.119	-0.137
	(0.047)	(0.053)
	[0.009]	[0.015]
Passed students	0.157	-0.240
	(0.039)	(0.072)
	[0.023]	[0.024]
Wage dispersion	0.227	0.087
	(0.031)	(0.055)
	[0.071]	[0.006]
Female teachers	0.230	-0.012
	(0.032)	(0.056)
	[0.071]	[0.000]
Non certified teachers	0.210	0.257
	(0.033)	(0.059)
	[0.056]	[0.041]
Teacher retention	0.125	-0.132
	(0.025)	(0.069)
	[0.036]	[0.008]
Long term sick leave	0.335	-0.028
	(0.036)	(0.056)
	[0.112]	[0.001]