# A profile of the labour market for school principals in South Africa: Evidence to inform policy

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# A profile of the labour market for school principals in South Africa: Evidence to inform policy

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ABSTRACT

In the past decade there has been a notable shift in South African education policy that raises the value of school leadership as a lever for learning improvements. Despite a growing discourse on school leadership, there has been a lack of empirical-based evidence on principals to inform, validate or debate the efficacy of proposed policies in raising the calibre of school principals. In response, this paper profiles the labour market for school principals in South Africa, highlighting its overarching characteristics with implications for principal policy reforms. A defining feature of this market is that principals are unequally distributed across schools with typically less qualified and less experienced principals overly represented in poorer schools. In part, the patterns of unequal principal sorting across schools are attributable to historically imposed policies that matched teachers and principals to schools along racial lines. However initial matching of new principals to schools continues to persist in line with historical patterns. In a context of low levels of principal mobility and high tenure, policies should be aimed at improving the initial match of principals to schools while developing incumbent principals over their length of tenure. Moreover improving the design and implementation of policies guiding the appointment process for principals is a matter of urgency. A substantial and increasing number of principal replacements are taking place across South African schools given a rising age profile of school principals. Selection criteria need to be amended to identify relevant expertise and skills, rather than relying on observed principal credentials in payroll which are shown to be poor signals of principal quality in school fixed effects estimations.

Keywords: Principal labour market, Principal turnover, Principal appointments, School performance, Retirement, South Africa
JEL codes: J45, J63, J26, I28

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# 1. Introduction

Despite both anecdotal evidence that school principals matter for learning and convincing international quantitative evidence that supports this notion, often too little policy attention is given to harnessing the benefits of school leadership for educational improvements. In reference to Chile, José Weinstein and colleagues sum up the problem well, noting that "Principals form part of a strategic sector that has not been duly explored in its potential for contributing to education progress" (Hanushek, 2013; Weinstein, Munoz and Raczynski, 2011: 286). In South Africa, however, there have been notable shifts in the past decade that raise the value of school leadership and management as critical levers for learning gains and in increasing accountability within the education system. This has been expressed in amendments to legislation, statements and actions of the Department of Basic Education (DBE) and in national policy plans.

In particular, with the release of The National Development Plan (NDP) in 2012, the need to strengthen the policy framework governing principals has arguably gained traction as it explicitly identifies that strengthening school leadership is a national priority (NPC, 2012: 309-310). The NDP proposes policy improvements for school principals in three broad areas: the principal appointment process, managing their performance and providing them with greater powers over school management (ibid:309-310).

Concurrently, quantitative research has failed to keep abreast with needed policy improvements governing schools principals. There is a lack of empirical evidence in the local context to guide and support policy implementation in this area; this is particularly problematic when politically interested groups are likely to have convincing arguments against proposed reforms. In this paper, the overarching quantitative characteristics of the labour market for principals in South Africa are highlighted to inform, support and debate recent policy developments involving school principals. In light of these findings, NDP policy proposals to raise the calibre of school leadership are considered with additional policy recommendations proposed. The intention is to identify the seeds of a better future system of policies while considering current provisions already made to improve school leadership.

In understanding the characteristics of South Africa's principal labour market, five research objectives were established at the outset of the analysis. These objectives also form the structure around which this paper develops. The first was to simply understand who has been appointed to assume responsibility for leading schools and engaging in the extensive and significant range of responsibilities this position requires. What formal preparation and experience have they had to assume such responsibilities? For example, what are their qualification levels and years of experience?

A second and related objective is to identify whether principal characteristics systemically differ across poorer and wealthier parts of the schooling system. In brief, the analysis shows that principals are unequally distributed across schools with typically less qualified and less experienced principals overly represented in poorer schools. The third objective seeks to identify whether these patterns of principal sorting are driven by initial matching of principals to schools and/or the systematic transfer of principals across the system. Understanding the mechanisms informing principal sorting provides insights for designing more suitable policies to improve the distribution of principals across schools.

A fourth objective is to explore dynamics in the principal labour market, identifying the amount of churning among principals both in terms of attrition related moves and within system transfers. The analysis also explores whether incentives exist in the system that direct the transfer of principals across schools in ways that aggravate existing inequalities in the distribution of principals.

The fifth objective is to determine whether credentials, as measured in terms of qualifications and experience, provide a signal of principal quality in South Africa. Local and international evidence on teachers and principals provide mixed evidence that credentials are actually useful signals of quality (Clark, Martorell and Rockoff, 2009; Clotfelter, Ladd and Vigdor, 2010; Hanushek, 2007; Van der Berg, 2008) Yet, credentials form the basis for determining teacher pay and in guiding their promotions in most education systems, including South Africa's (Hanushek, 2007; RSA DoE, 2003a). This study investigates whether qualifications and experience can be used as an appropriate signal of principal quality in the South African context by identifying whether a relationship exists between principals' credentials (as observed in payroll data) and the performance of the schools they lead. The final section collates the evidence that emerges from tackling each of the above research objectives with the intention of informing policy developments affecting school principals.

## 2. Background literature on principals and the South African policy context informing principal leadership

### *International evidence on principals' effectiveness and their distribution across schools*

For years, a large education administration literature, located primarily in the United States and Europe, has purported that school leaders are critical to school effectiveness and student learning. For example, Leithwood *et al* (2004) in their review of case studies on school leadership note that principals are only second to teachers in terms of their importance for student learning and school effectiveness in general. In this literature, much of the anecdotal evidence elucidating the importance of principals has unfortunately been dampened through quantitative analyses noting very small effects of leadership on school outcomes (Witziers, Bosker and Kruger, 2003). These small effects are attributed to the non-representative samples used in analyses, inadequate quantitative methodologies

adopted and narrow definitions used in measuring school leadership (Hallinger and Heck, 1996; Robinson, Lloyd and Rowe, 2008).

In the economics literature, a new and emerging evidence base using large-scale datasets and value-added models provide convincing evidence that school principals matter considerably for student learning (Branch, Hanushek and Rivkin, 2012; Chiang, Lipscomb and Gill, 2012; Coelli and Green, 2012; Grissom, Kalogrides and Loeb, 2012). Value-added models identify the additional value that principals bring to student learning after partitioning out the contributions of individual teachers, the school and the ability and backgrounds of individual students. Widely cited research by Branch *et al* (2012) in Texas schools suggests that highly effective principals can raise the achievement of the average student in these schools by between two and seven months of learning in a school year; ineffective principals lower achievement by the same amount. These are educationally significant effects, second only to the direct effects of individual teacher quality on student learning. But the difference between teachers and principals is that principals affect *all* students in a school rather than just the students a single teacher instructs. The overall impact from increasing principal quality therefore substantially exceeds the benefit from a comparable increase in the quality of a single teacher (Branch, Hanushek and Rivkin, 2013). The obvious implication of this international evidence is that the effective placement and distribution of principals across schools really matters for school effectiveness and student learning.

Research on school principals which has been concentrated in the United States, finds that principals are unequally distributed across schools, with less qualified and less experienced principals disproportionately represented in the poorest parts of the schooling system (Beteille, Kalogrides and Loeb, 2012; Clotfelter et al., 2007; Gates et al., 2006; Branch et al, 2012; Clark et al, 2009; Loeb, Kalogrides and Horng, 2010). Loeb et al (2010) explore the mechanisms that lead to this unequal distribution. They identify that these patterns of principal sorting across schools are attributed not only to initial principal school matches but to the systematic transfer of principals to different types of schools. In other words, the effective distribution of principals across schools depends not only on the initial placement and hire of principals, but the patterns by which they move across schools. Their research emphasises the importance of understanding these dynamics for designing policies that address unequal distributions. Policy has an important role to play in ensuring that principals are distributed as equitably as possible across the school system, ensuring that the right principals are appointed and in raising the performance of existing leadership.

### *Background on policies influencing school leadership in the local context*

Beyond anecdotal evidence or findings from small case studies of schools, there is little to no research that has provided any systematic quantitative evidence linking school principals or their competencies

to school performance in the South African context.[2] Hoadley and Ward (2009) in their review of literature on school management and leadership reiterate earlier remarks by Bush et al (2006) that our understanding is limited of how the actions and behaviours of school leaders in South Africa are contributing to or detracting from school functionality, particularly with respect to producing learning outcomes. One reason for this is that reliable quantitative research is hampered by the lack of representative data linking teachers and principals to students over time. Regardless, in the policy environment, some progress (albeit slow) has been made in raising the value of school leadership and management and imposing increased requirements and standards of expectation on school leaders to achieve learning gains.

With promulgation of the Education Laws Amendment Act in 2007, accountability for school performance was increasingly placed in the hands of principals as legislation required them to plan for academic improvements in schools and report progress against school plans (RSA, 2007). A recent example of how this legislation is used at a provincial level to improve accountability is a recent gazette released by the Western Cape Government Department that imposes binding performance indicators on schools, holding principals responsible for setting performance targets and implementing plans to achieve these targets (Western Cape Government, 2015). The concern, however, is that policies of this nature may not produce the kinds of behavioural change required for school improvement. There is considerable evidence that the majority of principals are complying and developing improvement plans and performance reports in line with legislation (Taylor, 2014). An analysis of the School Monitoring Survey of 2011 indicates that as many as 88 percent of schools had school improvement plans, 78 percent had academic improvement plans and a further 94 percent had academic performance reports (RSA DBE, 2014a: 24). Whether these documents are actually meaningful, of good quality and implemented to improve learning outcomes is another question. Accountability mechanisms must have substance in terms of clear links to school improvement rather than just mimicking a form of accountability that imposes another compliance burden on the system, but is divorced from the object of our attention, improving learning (Pritchett, 2013; Taylor, 2014). This should be key a consideration in the design and implementation of performance management systems affecting principals' work.

For the most part, principals' performance is still assessed in terms of the Integrated Quality Management System (IQMS) agreed to in 2003 (ELRC, 2003). There are a number of weaknesses

[2] The little we know about the practices of school leaders and managers and how their actions influence learning has been informed through a few case studies of schools, particularly exceptional schools that have achieved excellent academic results despite various constraints to educational success. Christie, Butler and Potterton (2007) for example, conducted case studies of 18 schools that achieved good to excellent results in the matric certificate. Their research concluded that effective leadership was a critical success factor explaining student achievement across these schools. More broadly there is some suggestive evidence of the importance of school management for learning in schools (Taylor, 2011; Taylor et al., 2012).

with this system in terms of both its design and implementation, which impedes its ability to introduce the levels of accountability initially intended. It has not provided sufficiently clear standards against which to assess the work of principals (Smit, 2013). Attaining good ratings has been too easy (RSA DBE, 2012). Moreover, many principals have often not been evaluated by their immediate supervisors (circuit managers) as initially proposed by the agreement. In the sample of schools visited by IQMS moderators in 2011/12 only 41 percent of principals had been evaluated by their circuit manager (ibid, 2012: 44).

Finally, the 'carrots and sticks' of IQMS are arguably ineffective in inducing changes in behaviour. In particular, its capacity to introduce notable threats to job security is stifled in the face of stringent labour legislation and substantial union involvement which create significant barriers to dismissals. Van Onselen (2012) indicated that between 2000 and 2011 a total of just 97 educators were permanently struck-off the register by the South African Council of Educators – an average of less than ten a year. Estimations using 2011 terminations data from the DBE point to much larger numbers of dismissals at roughly 350 per year across provincial departments. As a percentage of educators this is still low at about 0.1 percent, although this percentage varies across provincial departments.[3] For example, in a province such as the Western Cape, an educator is six times as likely to be dismissed compared to an educator in a province such as Limpopo. Using the same data, roughly 22 principals were dismissed in 2011, less than 0.1 percent of principals in South Africa. It's quite apparent that once a position is obtained in a school, job security is mostly guaranteed, even for school managers.

A number of statements have been made by national DBE to hold principals accountable for school performance through the introduction of new performance contracts (Khumalo, 2011; Phakathi, 2012). Additionally, proposals for introducing new performance management systems for principals and their deputies have been drafted. For example, as proposed in collective agreement no. 1 of 2008 of the Education Labour Relations Council (ELRC), principals and deputy principals were to be subject to new performance standards with clear assessments linked to leading and managing schools and performance outcomes linked to a notable monetary incentive structure (ELRC, 2008). This agreement proposed very favourable accelerated pay progression for principals assessed at levels at or above 'fully effective'. This proposal, however, was terminated a year later with the ELRC collective agreement no. 4 of 2009. Another draft performance agreement for principals was then proposed by the DBE in June 2011 which would hold principals accountable for the performance of teachers and also student test results. Unfortunately, as identified in a succinct description by Louise Smit (2013) of these ELRC negotiations in the past ten years, introducing more effective performance

[3] In the United States, roughly 21 out of 1 000 teachers are dismissed annually for low performance (Aritomi, Coopersmith and Gruber, 2009).

management for principals has been resisted by teacher unions in the ELRC, where the June 2011 proposal was withdrawn in 2012 (Smit, 2013).

In a context of weak existing accountability systems for school principals, the NDP reiterates the need for introducing performance contracts for principals and deputy principals aimed at improving their performance and targeting their training needs. It also advocates replacing underperforming principals; a proposal supported by current legislation. The Education Amendment Act of 2007 makes provision for tackling poor leadership in poorly performing schools through i) identifying of underperforming schools and ii) taking action to either counsel principals of these underperforming schools or to appoint academic mentors to take over their functions and responsibilities for a period of time as determined by provincial Head of Departments (RSA, 2007). In addition, the Employment of Educators Act makes provision for the dismissal, after an inquiry, of an educator who is unfit for the duties attached to his or her post.

Importantly, the NDP also stresses the importance of making the right principal appointment at the outset. Nationally, processes and short-listing criteria governing teacher and principal appointments are expressed in the Personnel Administrative Measures (RSA DoE, 2003a). After short-listing applicants who meet minimum appointment criteria, interviews are conducted at schools by a panel consisting of parents, the principal, a department representative (who may be the principal) and a union representative whose role is only to "observe" that due process is followed. The panel then submits recommendations of their choice of candidate to the Head of Department who makes the final appointment decision (ibid: 21). In recent years, various reports have highlighted the undue influence of unions in selection processes beyond mere observation. There have also been allegations of bribery, cronyism and concerns that School Government Bodies (SGBs) do not possess the necessary capacities to interview and select the right person for the job (City Press, 2014; NPC, 2012: 309; Taylor, 2014; ELRC, 2014). In improving the appointment process for principals, the NDP recommends reducing the undue influence of unions in the appointment process while providing increased support to SGBs to fulfil their general mandate. It also suggests raising entry level requirements for principals where a prerequisite for principal promotion should be an Advanced Certificate in Education (ACE) in School Management and Leadership. This is an idea that entered the school leadership discourse well over a decade ago. As expressed in the Personnel Administrative Measures (PAMs), observed credentials including qualifications and years of experience are the key criteria guiding principal appointments (RSA DoE, 2003). However, these criteria do not substantially differ from that of an entry level teacher. In addition to raising the minimum entry level criteria for principal appointments, the NDP proposes augmenting the appointment process with competency-based assessments for principal applicants to determine their suitability and identify the areas in which they would need development and support.

It is worth mentioning that the NDP proposals are not just lofty ideals. As discussed, there have been notable attempts to implement more effective performance management systems for principals. Raising minimum criteria for entry into principal positions was also considered many years ago, as early as 2007, through the initial introduction of the ACE programme in school management and leadership and its later review and redesign (Bush et al., 2009; NPC, 2012). More recently, the DBE has set in motion a series of additional actions towards implementing policies in line with the NDP recommendations. In August 2014, a national gazette of a draft policy stipulating the Standard for Principalship was released for public comment (RSA DBE, 2014b). The document outlines the qualities and competencies school leaders should have.[4] As noted by Christie (2010), the setting of "professional standards" for principals forms part of the broader drive for accountability. These standards are likely to form the framework from which competency tests and any forthcoming improved performance management systems for principals are based. Moreover, provincial education departments in the Western Cape and Gauteng have already embarked on a process of piloting competency tests in the principal appointment process (RSA, 2015). This is administered by an independent contractor which prevents political interest groups from interfering in this process. The DBE's commitment to this goal was also expressed in their 2015 Annual Performance Plan where the number of new principal appointments involving competency-testing was introduced as a key performance indicator in tracking the attainment of DBE goals expressed in their Action Plan 2019: Towards Schooling 2030 (RSA DBE, 2015b: 46; RSA DBE, 2015a). At the most basic level this provides more control of the principal appointment process of principals which has been identified as fraught with irregularities.

Despite the steps taken to accelerate policy developments to raise the calibre of school leadership, the findings of the proceeding analysis identify that progress toward implementing these goals has been too slow in light of the aging profile of school principals in South Africa.

## 3. Method and data

The primary dataset used in this study is a panel of schools and their principals, constructed by matching South African payroll data on educators (referred to as Persal data) to administrative data collected on schools including the Annual Survey of Schools (ASS) data, Snap[5] survey data as well as the EMIS master list of schools. Payroll data of individuals working in the public education sector

[4] The document is a marked improvement in establishing clarity around the role and function of the principal where the job descriptions as outlined in PAMs (and reflected in IQMS) do not prioritise the role of the principal as an instructional leadership. The Standards for Principalship, moves beyond outlining the principal job description in terms of compliance and administrative functions alone, to identify explicitly the main role of the principal as one of establishing a culture of teaching and learning.

[5] Snap data has recently been made publically available to researchers through the DataFirst Portal.

was made available to the author for the months September 2004, October 2008, October 2010 and November 2012.[6]

Connecting the administrative datasets is a challenging task. EMIS and payroll data are managed and collated by two distinct national departments and the different datasets were never designed to be used for analyses over time or for linking them together. Furthermore, systems for identifying schools are not common across the two datasets. Payroll-school links are largely possible by matching across two codes in payroll that point to school establishments. The reader is referred to Wills (2015) for a more comprehensive discussion of the matching process. For the total school sample, the number of successful matches is identified in Table 1. In each year, the number of ordinary public schools is identified in the EMIS master list, followed by the number of schools that are matched to at least one principal in payroll. In some schools there may be more than one principal identified in payroll, but the analysis that follows is concerned with the clear institutional leader. A small number of principals that could not be distinguished as the clear institutional leader in a school using the payroll post level rankings or salary indicators are excluded from the analysis. For each year, between 79 and 89 percent of ordinary public schools in EMIS are matched to principals, with the number of successful matches increasing in recent years. Roughly six to ten percent of the non-matching is likely accounted for by principal vacancies in schools as identified in the appendix discussion.

**Table 1: Matching Persal and the EMIS master list of schools**

| | **2004** | **2008** | **2010** | **2012** |
|---|---|---|---|---|
| Number of ordinary schools | 25 847 | 25 014 | 24 761 | 24 502 |
| Schools matched to at least one principal | 20 531 | 22 296 | 22 148 | 21 939 |
| % of schools matched to at least one principal | 79.4 | 89.1 | 89.4 | 89.5 |
| Schools matched to a 'senior' principal | 20 359 | 22 260 | 22 120 | 21 808 |
| % of schools matched to 'senior' principal | 78.8 | 89.0 | 89.3 | 89.0 |

**Source:** EMIS master list and Persal. **Notes:** Educators in the Persal data are identified as principals if their rank title specifies that they are a principal. Where there are two or more principals in a school, only the clear institutional leader or referred to here as the 'senior' principal -identified as having highest post level among principals in a school or the highest salary- is retained in the sample. Schools are identified as public ordinary schools if they are primary, intermediate, combined or secondary schools. The reader is referred to the dissertation's appendix for a fuller treatment of the matching process.

The final constructed dataset includes variables identifying the characteristics of principals and the schools they lead. School characteristics include, *inter alia*; enrolment numbers, school location, the racial composition of the school, teacher numbers and a proxy for school poverty level as measured

[6]Access to Persal data was obtained through the Department of Basic Education in order to assess the degree to which different datasets could be merged with a view to monitoring the movement of staff across schools over time. Access to other non-public datasets were obtained through participation in a research project conducted by The Presidency and titled Programme to Support Pro-poor Policy Development (PSPPD). Assistance from Dr Martin Gustafsson at the Department of Basic Education in understanding the data is acknowledged.

by the DBE's official quintile ranking. The DBE classifies schools into 'wealth' quintiles where the infrastructural development of schools' surrounding areas proxies for the wealth of the enrolled students. Identified as the poorest schools, quintile one to three schools are non-fee paying while quintile four and five schools receive much smaller state funding allocations but are left to determine the amount of school fees charged in consultation with parents.[7]

The dataset also includes information on principal credentials, including traditional qualifications and total experience. In the education payroll data, qualifications of educators are identified using the Relative Educational Qualifications Value (REQV) system which is a value ranking on a scale of 10 to 17. The determination of the REQV ranking is based primarily on the number of recognised full-time professional or academic years of study at an approved university, technikon or college of education while taking into account the level of school education attained (RSA DoE, 2003a). Higher rankings are assigned to more advanced qualifications with implications for promotions, the status of contracts and salary levels. A REQV 10 level, for example, is associated with having at most a Grade 12 academic qualification and no teachers' qualification. At the other end, a REQV level 17 is equivalent to having Grade 12 plus seven years relevant training, which includes at least a recognised master's degree. The minimum requirement for entry into a permanent teaching post is REQV 13 – a grade 12 qualification plus three years of relevant training, which is typically a three year teaching diploma.[8]

In the payroll data, 'years of service' is the only available measure of experience. This is not the same as total work experience in the education sector as individuals may have moved in and out of public education. Nevertheless, it provides a close proxy for total experience in the teaching profession. The payroll data available to the author is very thin in terms of other experience variables. Years served as a principal or a principal's tenure in a school is not directly identifiable. For this reason, the information captured through the questionnaire administered to principals of schools participating in Verification-ANA in 2013 is used to supplement the analysis.[9] Roughly 2 000 school principals

[7] Although quintile rankings provide an imperfect measure of poverty, student performance profiles using official school quintile rankings roughly follow profiles where school poverty is more accurately quantified through asset-based measures of student poverty (Spaull, 2013).

[8] The PAMs identify the minimum qualification criteria for a permanent entry level teacher appointment as a REQV 13 (RSA DoE, 2003a). In practice, however, this has increased to a REQV 14 level. This implies that teachers should possess a four year bachelor degree in teaching or a three year degree in another subject area and one additional year specialising in education.

[9] The Annual National Assessment (ANA) is an assessment of mathematics and language of all students in grades one to six and grade nine. It functions as a strategic tool for monitoring and improving the level and quality of basic education in South Africa. The Universal ANAs are administered by teachers. By contrast, the Verification-ANAs are administered by an independent service provider and tests only grade three, six and nine students in a selected sample of schools in order to verify the credibility of the Universal ANA results. In addition to testing students, a student background questionnaire, an educator questionnaire and a principal questionnaire were administered as part of the 2013 Verification-ANA process.

responded to questionnaire providing individual details on, *inter alia,* academic qualifications and experience.

In addressing the five research objectives, a combination of descriptive and econometric methods are applied to the constructed dataset, although the unit of analysis oscillates between the school and principal level depending on the research question. For example, in assessing the role of the initial match of principals to schools, the characteristics of first-time principals across different types of schools are compared by treating schools as the unit of analysis. However, in examining principal transfer, the principal is the unit of analysis as multivariate analysis is used to identify factors associated with their probability of turnover.

In the final analysis, the panel nature of the dataset is again exploited in estimating the relationship between principal credentials and school outcomes. Where schools participated in the grade 12 (matriculation) certification examinations in years 2008, 2010 and 2012, their school level examination data was linked to the matched payroll-EMIS dataset. The author drew on a school level examination series dataset constructed and used by Gustafsson and Taylor (2013) in modelling the impact of South Africa's 2005 provincial boundary changes on school performance. Further details on the school outcome measures used and the estimation strategy adopted are provided later. For now, the discussion moves to profiling the characteristics of principals in schools.

## 4. A motivation for policy improvements: The rising age profile of school principals

Despite the steps taken to accelerate principal policy developments, the recommendations of the NDP to improve the principal appointment process have not been formally implemented in policies. A substantial number of new principals have been appointed in recent years as explained below. For the most part, this has occurred in the absence of new legislated policies governing the principal appointment process.

Internationally, teachers and principals are getting older and South Africa is no exception in this regard (Pont, Nusche and Moorman, 2008). The average principal was aged 48 years in 2004. In 2012 this average increased to 51 years, closely approaching the average age at 53 years of principals in OECD countries (OECD, 2014). Figure 1 compares the age distribution of principals in 2012 to that in 2004. Whereas 17 percent of school principals were aged 55 or older in 2004, two thirds were this age by 2012. In absolute terms if almost a third of principals were 55 years or older in 2012, and we assume they are likely to retire at sixty years[10], well over 7 000 outgoing principals will have to be

[10] Mandatory retirement age for educators in South Africa is 65 years. However, where pensions are accessible at earlier ages the majority of teachers retire well before 65 years.

replaced between 2012 and 2017 for retirement reasons alone. As a yearly average, this equates to about 1 400 to 1 500 principal replacements for retirement per year, which is roughly equivalent to the *total* number of principal replacements for retirement between 2004 and 2008 (see Table A.4 in the appendix). Replacement requirements in primary schools are particularly large because there are more primary schools than secondary or combined schools in the system and a slightly higher proportion of principals in primary schools are near retirement age (see Figure A.1 in the appendix). The number of principals required to replace retiring principals in primary schools comprises over sixty percent of all anticipated principal replacements for retirement reasons.

Another important observation is that the absolute number of principal replacements required in lower quintile schools substantially outweighs that in wealthier schools because there are simply more poor schools. Despite the use of the term 'quintile' in the ranking of school wealth by the DBE, there is an unequal share of schools represented in lower quintiles.[11] Proportionally, however, more principal retirements are anticipated in wealthier schools given differences in the age profile of principals across schools. In 2012, nearly a half of quintile five schools had incumbent principals aged 55 years or older as opposed to 27 percent of quintile one schools as identified in Figure 2.

An additional complication in finding suitable principal replacements relates to the uneven age profile of teachers. In the recently released report on teacher demand and supply by the Centre for Development and Enterprise, an uneven spread in the age profile of teachers is apparent which has implications for the future supply of school leaders. The report provides an estimated teacher age profile in 2025 on the basis of the 2013 age profile of educators in South Africa, attrition rates and patterns of teacher retirement (CDE, 2015). It then notes that there is a dip in the current population of teachers of at around thirty to 34 years who will move through the system. By 2025, the smallest number of teachers will be forty to 44 years old, which is

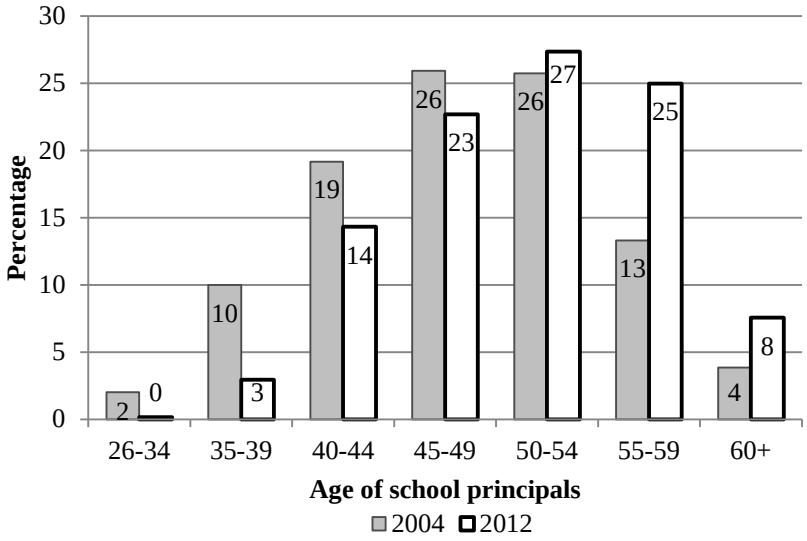
> *…the age at which teachers typically have sufficient experience to be eligible for senior management positions, such as principal, deputy-principal and HoD[12]. The very small pool from which they can be drawn means that less experienced teachers may have to be promoted to those positions (ibid: 18).*

However, this statement is based on the premise that experience is a valid signal of principal quality and should guide the selection process. This notion is challenged in later discussions.

[11] Official school quintile denominations provided by the DBE are not equal, with an unequal share of schools represented in lower quintiles. Since the original disaggregation of schools into wealth quintiles, a larger share of schools has been positioned in lower quintiles, taking advantage of higher allocations per student.

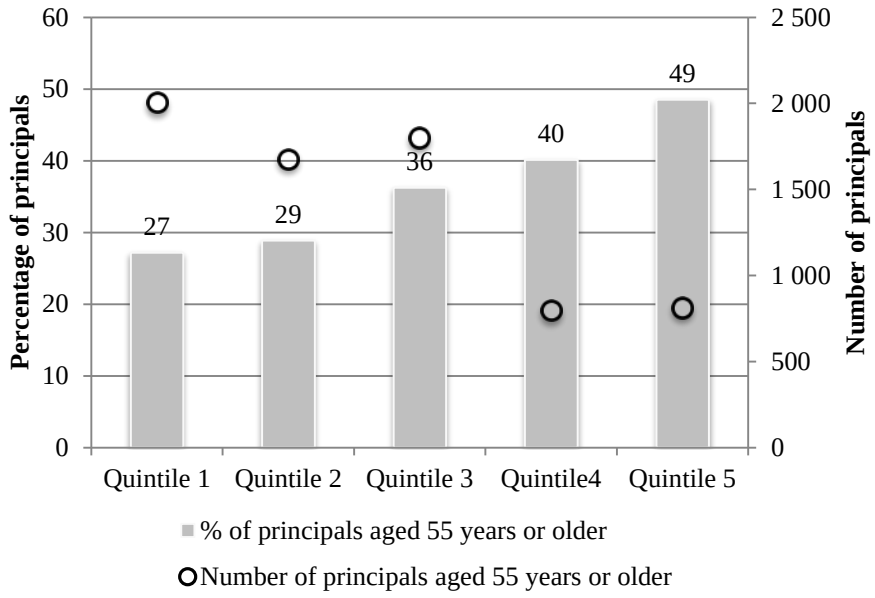
[12] Stands for "head of department".

**Figure 1: The age distribution of South African school principals in 2004 and 2012**




**Source**: Persal-EMIS matched dataset. **Notes**: Calculations are based on a sample of principals in Persal that could be matched to a school and are identified as the clear institutional leader of the school. Educators in the Persal data are identified as principals if their rank title specifies that they are a principal. Where there are two or more principals in a school, only the clear institutional leader (identified as having the highest post level ranking among principals in a school or the highest salary) is retained in the sample. The 2004 sample includes 20 359 principals and the 2012 sample 21 808 principals.

**Figure 2: Incumbent school principals in 2012 aged 55 years or older by school quintile**




**Source**: Persal-EMIS matched dataset. **Notes**: see Figure 1.

In summary, the public education system is facing a substantial and increasing number of principal retirements. Finding suitable replacements and managing leadership transitions poses a notable challenge for schools, provincial administrations and national education planners.[13] However, the rising number of principal retirements also presents an opportunity to raise the calibre of school leadership through the right appointments. As explained in a report on improving school leadership in OECD countries,

> *The imminent retirement of the majority of principals brings both challenges and new opportunities for OECD education systems. While it means a major loss of experience, it also provides an unprecedented opportunity to recruit and develop a new generation of school leaders with the knowledge, skills and disposition best suited to meet the current and future needs of education systems* (Pont, Nusche and Moorman, 2008: 29) .

It is in this context that the paper proceeds to identify additional characteristics of the labour market for principals to inform much needed policy improvements in the area of appointment processes for new principals and in raising the calibre of existing ones.

## 5. Principal's demographic characteristics: Race and gender

As observed by Loeb et al (2010) the sorting of principals to schools is likely to depend on a combination of principal preferences for vacant positions and the recruitment and appointment process. Unique to the South African context is that in addition to the above two mechanisms, the sorting of principals to schools has also been institutionally driven by apartheid policies. Society and the education system were strongly divided along racial lines. The race of teachers and school leaders would have been matched to the race of the students in their schools with separate education departments formed to administer these segregated schools. Policies also favoured the educational advancement of the white race group over others, which meant that white educators would have been exposed to more training and academic opportunities than educators of other races. Although racial controls on schooling were lifted in 1994, state imposed sorting of both teachers and principals across schools has had persistent effects today. The inertia of apartheid policy influences on patterns of educator sorting is particularly strong in the case of principals given that the average principal in 2012 entered the education system 25 years previously, seven years before democratic freedom.

It is not surprising that the racial distribution of principals across schools still closely matches schools' former education department classification. The majority of principals are black at 83 percent of all principals in 2012, but majority race differs considerably across schools. For example, in former

[13] In a forthcoming paper by, I investigate the implications of these leadership replacements for the school environment in the short term (see Wills, 2015b).

Department and Education Training (DET) and homeland schools serving black students, as many as 94 percent and 99 percent of these schools still had black principals in 2012. In schools formerly serving white (House of Assemblies), Indian (House of Delegates) and coloured (House of Representatives) students 85 percent, 87 percent and 82 percent of these schools had incumbent principals that were of the originally matched race as reflected in Table 2.

**Table 2: Principals' race by schools' former department classification, 2012**

| | | Schools' former education department classification | | | | | |
|---|---|---|---|---|---|---|---|
| | All schools | Black | | White (HOA) | Indian (HOD) | Coloured (HOR) | New/ unknown |
| | | DET | Homeland | | | | |
| Black | 83% | 94% | 99% | 7% | 8% | 11% | 94% |
| Indian /Asian | 2% | 1% | 0% | 2% | 87% | 1% | 1% |
| Coloured | 7% | 1% | 0% | 6% | 2% | 82% | 2% |
| White | 8% | 4% | 1% | 85% | 3% | 6% | 3% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

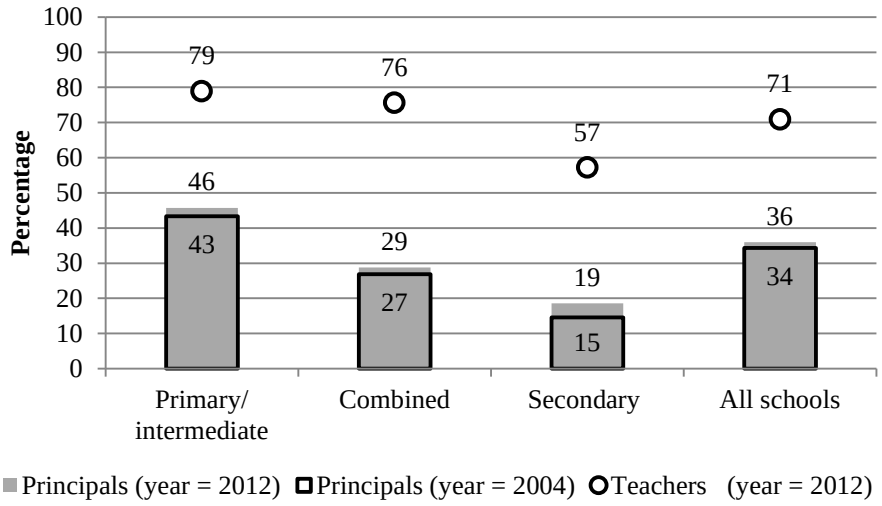
**Source:** Persal-EMIS matched dataset. Data year is 2012. **Notes**: Department of Education and Training (DET) and homelands were responsible for administering black schools. White schools were administered under the House of Assemblies (HOA). Indian and Asian students attended schools administered by the House of Delegates (HOD). The House of Representatives (HOR) administered schools for coloured students. The category 'New/unknown' includes schools opened in post-apartheid or schools for which their former department classification was missing in the EMIS data.

There has been little integration of other race groups into leadership positions in schools that were formerly classified as black or coloured. However, quite a bit of integration has occurred in schools formerly administered under white and Indian departments. This is consistent with shifts in the racial composition of students in these schools. Former white schools have seen a decline in the percentage of principals that are white from 93 percent in 2004 to 85 percent in 2012 as larger proportion of both black and coloured teachers lead these schools. Similarly, in former Indian schools the percentage of principals who are Indian in these schools declined from 91 percent in 2004 to 87 percent in 2012 as a larger proportion of black principals fill these leadership posts.

Before turning to identifying the qualifications and experience of principals, the striking gender disparity in school leadership positions is worth mentioning and has been noted in earlier work by Chisholm (1999). Despite women being overrepresented in the teaching profession, school leadership positions are dominated by men. In 2012, 71 percent of all teachers (including heads of department and deputy principals) were women but they held a mere 36 percent of school principal positions as reflected in Figure 3. There has also been little gender transformation in school leadership positions over the eight year period for which data is observed. The percentage of principals who were women only improved by two percentage points from 34 percent in 2004 to 36 percent in 2012. Moreover, women are particularly poorly represented in secondary school principal positions at only 19 percent in 2012. One reason for this may relate to the inertia of apartheid pay schedules for teachers which

favoured men over women, and explicitly discouraged the appointment of men at the primary level in order to cut costs (Chisholm, 1999: 113). In spite of strides that have been made in improving material benefits for women teachers in post-apartheid, a patriarchal and exclusionary relationship between male and female teachers exits, which manifests in low representation of women in school leadership positions and also in teacher union leadership roles (Govender, 2004: 274). Interestingly, when considering the former department of schools, the gender disparity is most striking in former white schools. Only 23 percent of all principals in these schools were women in 2012 compared to 41 percent of principals who were women in former Department of Education and Training schools serving black students.

**Figure 3: The percentage of principals and teachers who are women by school phase level**




**Source**: Persal-EMIS matched dataset. **Notes**: Teachers include deputy principals and heads of department.

However, the observed gender leadership gap in schools is not unique to South Africa. In the 2013 Teaching and Learning International Survey (TALIS) of over thirty OECD and participating countries, on average nearly half of principals in lower secondary schools were women compared to an average teacher population comprised of 68 percent women across the countries surveyed (OECD, 2014). The TALIS findings also identify that internationally women are the most underrepresented in secondary schools. In future research it would be interesting to explore whether the gender disparity in school leadership positions in South Africa is due to individual preferences, where fewer women actually apply for leadership positions in schools, or whether this reflects the unequal appointment of men over women in the hiring processes.[14] If the latter is the driving factor in this disparity, then a

[14] Individual preferences may in turn be informed by a more complex gender politics in schools and teacher unions which Govender (2004: 278) identifies as an area requiring more research in general.

larger pool of female teachers who are also on average more qualified than the pool of male teachers[15], are being overlooked in promotion post appointments.

## 6. The unequal distribution of principals in terms of qualifications and experience

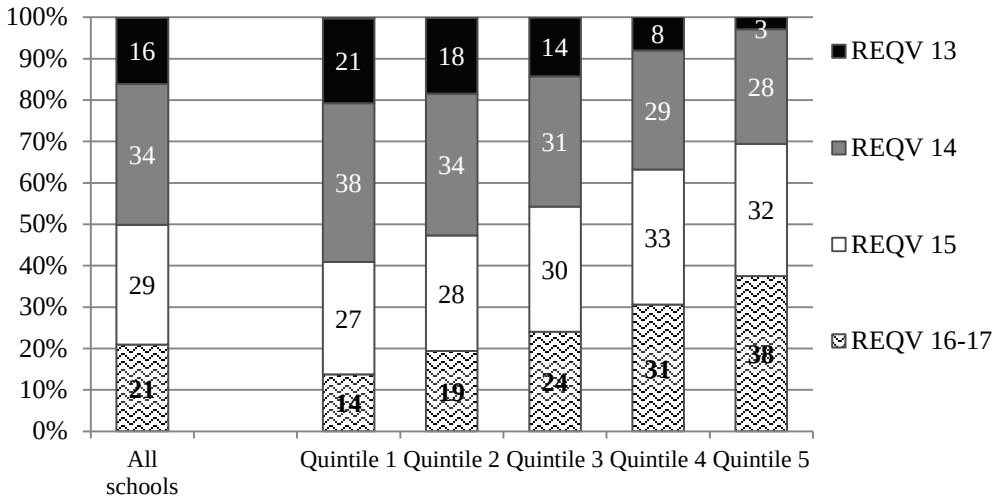
A defining feature of South Africa's labour market for principals is that they are unequally distributed across schools with typically less qualified and less experienced principals overly represented in poorer schools. Figure 4 illustrates the stark differences in the qualification levels of principals depending on the wealth status of schools to which they are appointed.

In 2012, roughly 34 percent of principals matched to schools had REQV 14 signalling a four year bachelors' degree, 29 percent had REQV 15 and 21 percent were very well-qualified with REQV 16 or 17, equivalent to a post-graduate degree. A further 16 percent of schools had principals with a qualification ranking equivalent to an entry level requirement for a permanent teaching post (REQV 13). The poorest schools are significantly less likely to have well-qualified principals than wealthier schools. For example, 38 percent of quintile five schools have very well-qualified principals compared with only 14 percent of quintile one schools.

In part, this unequal distribution is attributable to historically imposed policies that matched teachers and principals to schools along racial lines. However, in the absence of apartheid controls on patterns of principal sorting, newly appointed principals in poorer schools continue to have substantially lower qualifications than those appointed in wealthier schools. This is shown in Figure 5 which presents the qualifications by school quintile of principals newly appointed (incoming) in the period 2008 to 2012 and those of principals exiting the system (outgoing) over the same period. A second feature of the figure is that with the exception of quintile five schools, newly appointed principals have fewer qualifications than outgoing principals. This suggests that principals are increasing their qualifications on the job (a point to which the author returns in the later discussion on credentials as a signal of quality). Wealthier schools have historically had more qualified principals and continue to appoint increasingly better qualified candidates in comparison to poorer schools.

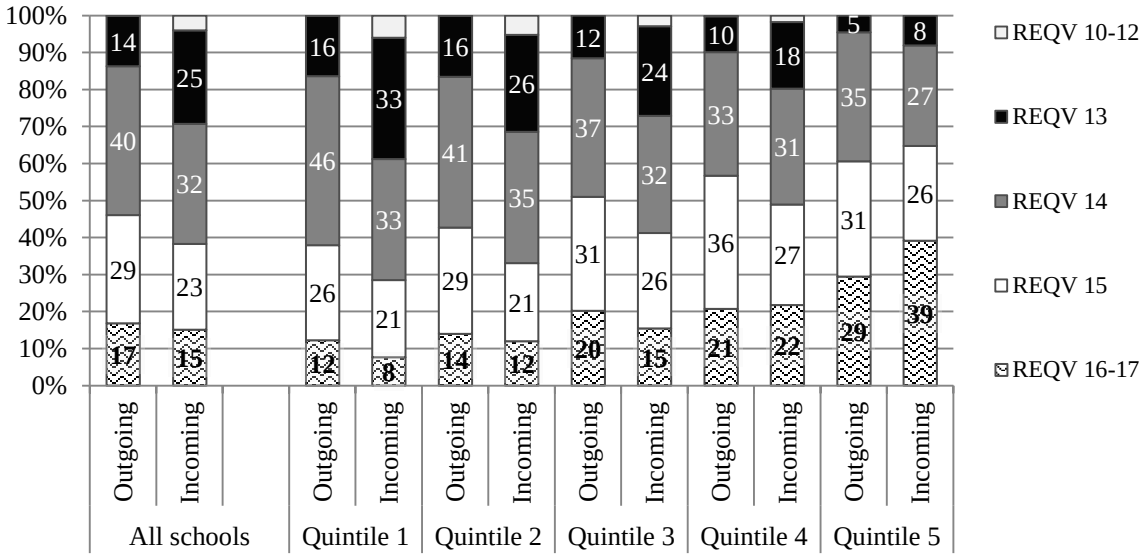
[15] In the 2012 Persal data, a larger proportion of female educators than male educators have REQV levels of 15 or more. Specifically, 22.6 percent of female educators (excluding principals) had REQV levels of 15 or more compared to 17.2 percent of male educators (excluding principals). Furthermore, this gender disparity is at odds with research that finds that students of female teachers fare better than students taught by male teachers, even after controlling for qualifications, across a number of cross-sectional studies of learning in South Africa. Moreover, an aside finding by Wills (2014) is that in the estimation of strike impacts on student achievement, a student's performance is lower in a subject taught by a male teacher.

**Figure 4: Principal qualifications (REQV), 2012**




**Source**: Persal-EMIS matched dataset. **Notes**: Not shown in the figure are almost negligible percentages of principals in each quintile that have a REQV level less than 13 (i.e. under-qualified). Specifically 0.24% (18) of principals in quintile one schools, 0.09% (5) of principals in quintile two and 0.04% (2) of principals in quintile three schools have a REQV level less than 13 (i.e. under-qualified). Percentages add up to one hundred percent in each sub-group.

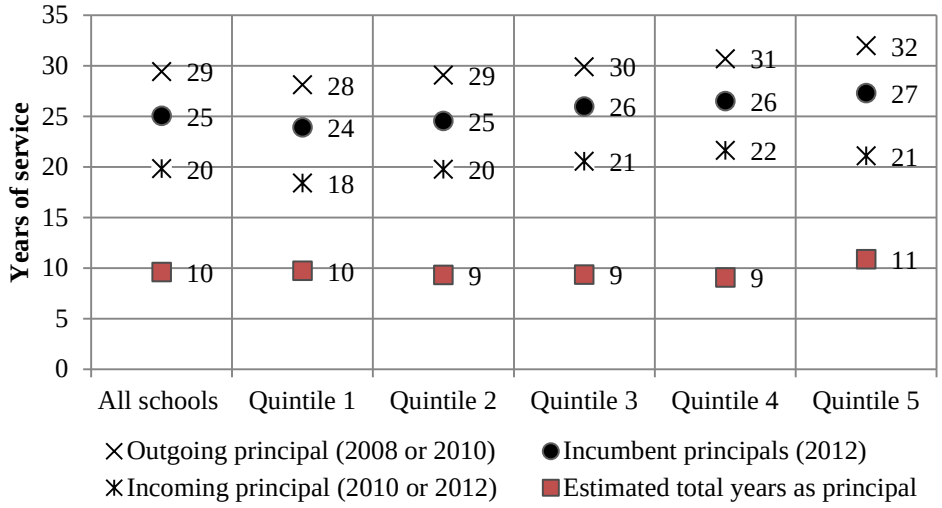
**Figure 5: The qualifications (REQV) of outgoing and newly appointed principals**




**Source**: Persal-EMIS matched dataset. **Notes**: Outgoing principals are those (identified as the clear institutional leader) who leave the public education system either between 2008 and 2010 or between 2010 and 2012. Incoming principals are principals appointed in either 2010 or 2012 that were not identified as principals in Persal in previous periods. The graph shows the percentage of principals in each sub-group of schools who have a specific REQV level. Percentages add up to one hundred percent in each sub-group.

The observed differences in appointment across poorer and wealthier schools are mirrored in the years of experience of newly appointed principals. The typical educator in South Africa has roughly twenty years of experience before accessing a principal position for the first time, as shown in Figure 6. On average they will serve ten years of principalship before exiting the system, as implied through differencing the years of service of newly appointed (incoming) principals from that of outgoing principals. In the poorest (quintile one) schools, however, principal positions can be reached on average three years earlier compared with positions in quintile four and five schools.[16] Access to principal promotion posts in poorer schools is therefore possible with lower qualifications and fewer years of experience. This finding holds even when controlling for compositional differences (including primary and secondary level, school size and teacher numbers) across schools.[17]

**Figure 6: Average years of service of outgoing, newly appointed and incumbent principals**




**Source**: Persal-EMIS matched dataset. **Notes**: Incumbent principals are those who were identified as the clear institutional leader in 2012. Outgoing principals are those principals who leave the public education system either between 2008 and 2010 or between 2010 and 2012. Newly appointed (incoming) principals are those principals appointed in either 2010 or 2012 that were not identified as principals in Persal in previous periods. Years of service in public education are not necessarily equivalent to total years of experience in teaching/school leadership if principals had worked outside of the public education sector. However, it is likely to provide a close proxy.

[16] While principal positions are accessed earlier in poorer schools, these principals are no more likely to remain in this position for longer periods than principals in wealthier schools. Principals exiting the system from quintile one schools had served on average 28 years of service compared with 32 years served by principals exiting quintile five schools.

[17] It may be argued that the unequal distribution in principal credentials across schools is observed given compositional differences of schools in each quintile. Schools in lower quintiles on average have fewer students, with fewer teachers competing for posts. Moreover, where the size of a school is also linked to principal post rankings and salary levels, smaller schools provide less desirable positions than being in larger schools. It follows that it may simply be easier to access promotion posts in certain schools due to their compositional characteristics. To test this, REQV levels and years of service of new incoming principals were regressed against a number of school characteristics. The results are presented in the Table A.1. The coefficients on school quintile still favour wealthier schools, supporting the hypothesis that access to principal promotion posts in poorer schools is possible with fewer years of experience and lower qualifications.

In designing policies to address this inequity, it is necessary to distinguish between two factors underlying principal sorting. First, it is likely driven by the preferences of individuals for posts in wealthier schools as expressed in applications for advertised posts. There may simply be a larger pool of good candidates available for posts in wealthier schools, particularly where teachers are more qualified in these schools. Second, there may be variations in the recruitment and selection process across schools where wealthier schools impose more stringent appointment criteria and/or are more likely follow due process. Due to data constraints it is not possible to disentangle how much each factor weighs on the patterns observed; nevertheless, policies need be targeted at both factors to improve the initial matching of principals to schools.[18] Identifying approaches to directing a good pool of applicants to poorer schools is particularly important, not only for improving the distribution of principals across schools, but to meet a much larger demand for new principals in these schools.

Inequities in the observed credentials of principals across different parts of the schooling system point to resourcing inequities and are clearly important to track given the historical legacy of Apartheid policies. Moreover, if qualifications and experience are a signal of principal quality then the sorting patterns noted above pose concerns about the capacity of school leaders in the underperforming part of the school system to execute their roles and responsibilities.

The next section turns to consider dynamics within the labour market for principals. The discussion first considers how much turnover there is in the principal labour market. It then explores possible determinants of principal moves, and whether the systematic transfer of principals across schools aggravates existing inequalities in the initial sorting of principals to schools.

# 7. Principal labour market dynamics

### *Low levels of turnover*

A defining feature of South Africa's labour market for principals is low levels of turnover. Although this has started to change in recent years, principal turnover rates (which include both attrition and mobility related movements) have historically been low. The average rate of turnover[19] among principals identified ranged between five to eight percent between 2004 and 2012 as reflected in Table 3. These rates of turnover are not dissimilar to those observed among teachers[20] in general; but

[18] To disentangle how much each source weighs on the patterns observed, additional data is needed on the following: vacancies, the number of applications received for specific principal posts and the credentials of those that applied. A survey of principal preferences for certain types of posts would also help to explain how their preferences impact on sorting patterns.

[19] Table 3 provides a description of how the turnover rate was calculated.

[20] Martin Gustafsson's report produced for the Department of Basic Education in 2009 entitled "Teacher supply patterns in the payroll data", identifies six percent year-on-year attrition for educators in South Africa. However, he finds that attrition is halved if you exclude those that exit then return to public education. Depending on the

compared to employee turnover benchmarks in the local public sector and internationally they are comparatively low (see Table A.2). For example, using 12 months of public sector payroll data over a one year period, Pillay, de Beer and Duffy (2012) calculate annual employee turnover rates across 33 South African public sector departments that range between nine percent and 32 percent. As an international benchmark, between twenty to thirty percent of public school principals leave their positions each year in the United States (Miller, 2013: 71; Beteille et al, 2012).

**Table 3: Turnover rates for principals and other educators**

| | Principals | | Other educators^ | |
|---|---|---|---|---|
| | **Turnover for the period** | **Average yearly turnover rates (lower bound) over the period** | **Turnover for the period** | **Average yearly turnover rates (lower bound) over the period** |
| **2004-2008** | 23.4% | 5.8% | - | - |
| **2008-2012** | 28.7% | 7.2% | - | - |
| **2008-2010** | 13.6% | 6.8% | 16.1% | 8.1% |
| **2010-2012** | 16.6% | 8.3% | 16.7% | 8.3% |

**Source:** Persal-EMIS matched dataset. **Notes:** A principal is identified as transitioning by determining whether the school institution at which they held a principal post in the first period was different to their position in the second period. Therefore the calculation considers both mobility and attrition related turnover. Using principals as the unit of analysis, the turnover rate is calculated by dividing the number of principals who transition as a proportion of all identified principals in the first period. Excluded from the denominator and numerator are principals who were identified in the payroll data in the second period but could not be matched to a school. This prevents ratios being inflated due to data matching problems. Yearly rates are arguably lower bound estimates as some principals may have moved more than once in each period. ^Other educators include teachers, departmental heads and deputy principals who can be matched to an ordinary school in EMIS data.

A key reason for low levels of principal turnover is that principal moves within the system are uncommon. Rather the majority of the turnover is accounted for by attrition (i.e. moves out of the public education system). Between 2004 and 2008, attrition accounted for two thirds of principal turnover. This rose to three quarters between 2008 and 2012 given the aging profile of school principals (see Table A.4). With little churning across schools, principal tenure among incumbent school principals closely follows their total years of principal experience. In the Verification-ANA 2013 questionnaire presented to roughly 2 000 school principals from a nationally representative sample of schools, principals were asked about their years of principal experience and tenure as a principal in their current school. The median years of total principal experience was nine years, only one additional year than the median total years served in their current school (Table A.3).

It is worth noting two additional features of the low levels of mobility in the sector. There is little cross-provincial movement of school principals. Less than three percent of principals who moved

definition of attrition used and the data years considered in calculations, rates of attrition may vary notably. Multiple years of data are required to fully account for multiple joining and leaving (Gustafsson, 2009). The turnover rates that have been calculated in this paper for principals and other educators only consider turnover between two points of data but there may be churning that occurs within these data points.

within the system between 2008 and 2012 took up a post in another province. Moreover, over half of newly appointed principals (55 percent) are promoted from within the same school. Table 4 identifies the positions in year t-2 from which newly appointed principals in year t are promoted. As expected a large proportion of newly appointed principals (41 percent) are promoted from deputy principal roles, and a third from head of department roles. Surprisingly, as much as 23 percent of new principals were just in a teaching post two years prior to the appointment.

**Table 4: Positions from which newly appointed principals are promoted**

| | **Percentage** |
|---|---|
| **Position two years prior to appointment** | |
| Deputy principal | 40.8 |
| Head of department | 34.2 |
| Teacher | 23.0 |
| FET/ABET lecturer | 0.1 |
| Administration post | 1.0 |
| Not in the public education system | 1.0 |
| **Total** | **100** |
| **Position two years prior to appointment** | |
| Promoted from within the same school | 55.3 |
| Promoted from a different institution | 44.7 |
| **Total** | **100** |

**Source:** Persal-EMIS matched dataset (2008, 2010 and 2012). **Notes:** Calculations are for 5 262 newly appointed (incoming) principals who are identified in either 2010 or 2012 as principals but were not identified as principals in Persal in previous periods (2008 and/or 2004).

There are likely to be various reasons for low levels of principal mobility, such as; low relocation benefits, language and cultural factors or nepotistic appointment arrangements. The international literature also indicates that low mobility may be related to a lack of accountability measures informing principals' work.[21] Clotfelter et al (2007) identify that in North Carolina in the United States, there was a sharp increase in rates of principal turnover in response to the introduction of the state's test-based accountability system. When hard-stakes performance management systems are in

[21] Low levels of principal mobility pose limitations for future attempts to estimate principal quality effects on learning outcomes in South Africa using value-added methodologies employed by Branch et al (2012); Grissom, Kalogrides and Loeb (2012) and Coelli and Green (2012). In these value-added approaches to measuring principal effectiveness, the estimation strategy relies critically on identifying school leadership changes, that is, instances in which one principal replaces another at a school to assess within-school changes in student outcomes induced by these leadership transitions. Principal effectiveness estimates cannot be generated for all principals; effects are only comparable within small groups of schools connected by principal transfers (Chiang, Lipscomb and Gill, 2012). The comparison groups of schools become limited when there is little mobility of principals across schools, as is the case in South Africa. Much longer panels of data are then necessary to identify enough school to school transitions.

place with principal performance evaluations based on school performance, job security concerns incentivise principals to move schools. To avoid low performance ratings, they are more likely to move from worse to better performing schools, which usually involves moving from poorer to wealthier schools (Branch et al, 2012; Beteille et al, 2012; Clotfelter et al, 2007; Gates et al., 2006; Young and Fuller, 2009).

Where the current design of performance management systems for South African principals in IQMS is only weakly linked to threats of job security, or favourable monetary rewards, it is unlikely to have induced mobility related principal moves. But there may be other incentives at play that influence principal transfer decisions. For example, principals may view positions in wealthier schools or urban schools as more attractive if the associated working conditions in these schools are better than in poorer or rural schools. Furthermore, where salaries are linked not only to qualifications but to school size, principals may seek positions in larger schools as opposed to smaller ones. In the analysis that follows, an attempt is made to identify whether some of the incentives described above influence mobility patterns in the principal labour market.

### *Identifying factors associated with principal turnover: empirical strategy*

Understanding which principal and school factors are associated with the probability of either leaving the system or moving within the system is an analysis problem best handled in a multivariate regression framework. Relying solely on simple descriptive cross-tabulations of turnover rates can provide misleading associations. For example, a cross-tabulation of principal turnover rates by school quintile status indicates that wealthier schools have much higher principal turnover rates than poorer schools. This erroneously implies that principals are more likely to leave wealthier schools when this result is merely an artefact of age differences. Principals in wealthier schools are older on average and are leaving in larger proportions for retirement reasons than those posted in poorer schools as shown earlier in Figure 2.

Initially, principal turnover is modelled using a logistic regression. Then principal turnover is distinguished into two types: leaving the public education sector (i.e. attrition) and within-sector mobility, including school to school moves and transfers to other positions in public education. Usually these two flows are treated as separate components in modelling turnover as certain factors may be differentially associated with each form of turnover (Stuit and Smith, 2012; Boyd et al., 2008). For example, working conditions may be more important for informing a principal's decision to move schools than to move out of the system altogether. Distinguishing between the two data flows requires an estimation technique suitable for modelling a polytomous dependent variable. Typically a

multinomial logit model (MNL) is used in this context.[22] Here principal $i$ is faced with $J$ different choices and is expected to choose the alternative that maximises his or her utility. The probability of making choice $j$ is conditional on observed school and principal characteristics, $X_i$.

$$\Pr(j|X_i, \alpha_i) = \frac{\exp(X_i\beta_j + \alpha_{ij})}{\sum_{k=1}^{J} \exp(X_i\beta_k + \alpha_{ik})}$$

It is noted that choice probabilities are also conditional upon $\alpha_i$, which represent unobserved individual principal effects. Simple multinomial logits are not able to control for the confounding effects of unobserved heterogeneity on predicted probabilities. MNL also imposes the assumption of the independence of irrelevant alternatives (IIA). This requires that an individual's evaluation of an alternative relative to another should not change if a third alternative is added or dropped from the analysis. For example, if a principal is twice more likely to leave the public education system than to stay, adding in the possibility of moving from their current school to another should not alter the former probability. When IIA is violated, the MNL model is incorrectly specified and produces biased and inconsistent estimates. In this application, tests of the IIA assumption are clearly violated.[23]

Unfortunately, the application of available methods[24] that account for the impact of unobserved principal heterogeneity on conditional probabilities and relax the IIA assumption are limited given the nature of this dataset. The panel has a limited time dimension[25] and includes no alternative specific

[22] The use of a multinomial logit regression follows Hanushek, Kain, and Rivkin (2001) in examining teacher mobility across schools and districts in Texas and by DeAngelis and Bradford (2011) in examining principal turnover in public Illinois schools. Authors have also used discrete-time competing risks models to analyse teacher or principal transitions where models include one observation for each year that a teacher or principal was "at risk" of making a transition (Loeb et al, 2010; Gates et al., 2006). The limited number of years and irregular spaced intervals of data on principals available to the author renders the use of a competing risks framework infeasible.

[23] Using a seemingly unrelated regression, akin to applying a Hausman test, results reject the assumption that coefficients are equal across restricted and unrestricted models. Similarly the assumption of equal coefficients is rejected using a small Hsiao test.

[24]Haan and Uhlendorff (2006) propose a strategy for estimating multinomial logit models with unobserved heterogeneity using maximum simulated likelihood. The method allows for the inclusion of random effects in the model which relaxes the IIA assumption and allows for the inclusion of unobserved heterogeneity. However, as a standard feature of the random effects models, the unobserved heterogeneity included is required to be independent of the explanatory variables. In this application, where unobserved principal characteristics are most likely correlated with both observed school and principal characteristics, it is not clear that Haan and Uhlendorff's method is likely to yield notable gains over the standard MNL in effectively controlling for the impact of $\alpha_i$ on the conditional probabilities. It also acknowledged that the multinomial probit model is often assumed to be a better alternative to a multinomial logit in the case of IIA violations. However, evidence suggests this is not necessarily the case. Typically, multinomial probit estimates are very similar to multinomial logit estimates in the case of IIA and some authors argue that the multinomial logit model actually outperforms the multinomial probit model even in the most severe violations of IIA (Kropko, 2008).

[25] The available four waves of panel data for the estimation are further reduced where the outcome variable in question is principal turnover. A principals' post in one period relative to the next is used to calculate the outcome variable, whether they leave their school (i.e. turnover). This reduces the number of waves available for the estimation by one.

explanatory variables that are necessary in application of, for example, a nested logit or mixed logit model. Where $\alpha_i$ may confound estimates of choice probabilities and the IIA assumption is violated, it is not possible to make casual statements from the MNL results. For this reason, the estimation that follows fulfils merely a descriptive exercise where associations are identified by conditioning on other factors such as age that may be drive certain correlations.

However, the robustness of the results to the violation of the IIA assumption is addressed somewhat by also estimating a sequential logit model. Here the process of principal turnover is modelled as a two stage process. In the first stage, a principal makes the decision between transitioning (i.e. turnover) and staying in his or her position. This is equivalent to a simple logistic regression of principal turnover. In the second stage, among those who transition there are two alternatives – moving positions within the system or alternatively leaving the public education system (see the appendix for more details on the model). While modelling the decision to transition in the sequential logit framework overcomes some limitations of the MNL model, intuitively the MNL model is favoured as it provides a more realistic decision choice framework than viewing a principal's transition decision as a two stage process. Nevertheless, key results are only discussed where the two models provide agreeable results.

Multinomial logit models are run to predict choice alternatives as identified in year t+4 for incumbent principals in year t. The variable controls included in the regressions are informed by the set commonly used in studies predicting teacher and principal turnover within the constraints of those available in the administrative dataset. Individual controls include the gender, age and race of the principal. Furthermore, interactions between the gender and age of the principal are included because decisions to move out of a school may differ over the career life cycles of men and women. School controls include its location (urban versus rural), phase level (primary/intermediate, secondary or combined), wealth quintile status, former education department classification, number of teachers per one hundred students, total enrolment expressed in hundreds and provincial indicators. To account for the possibility that principals may move schools in response to the racial composition of the student body, interactions between the race of the principal and a dummy variable that takes on a value of one if the majority of the student body is black are included. In the 2008 payroll data available to the author additional principal controls are present compared with the 2004 data. This motivates a separate specification for incumbent principals in 2008. These additional controls include educational qualifications as measured by the principal's REQV level, the principal's salary expressed in R1 000s, years of service and its square, sick leave days taken which may proxy for motivation, and an indicator for whether the principal moved in the previous period.

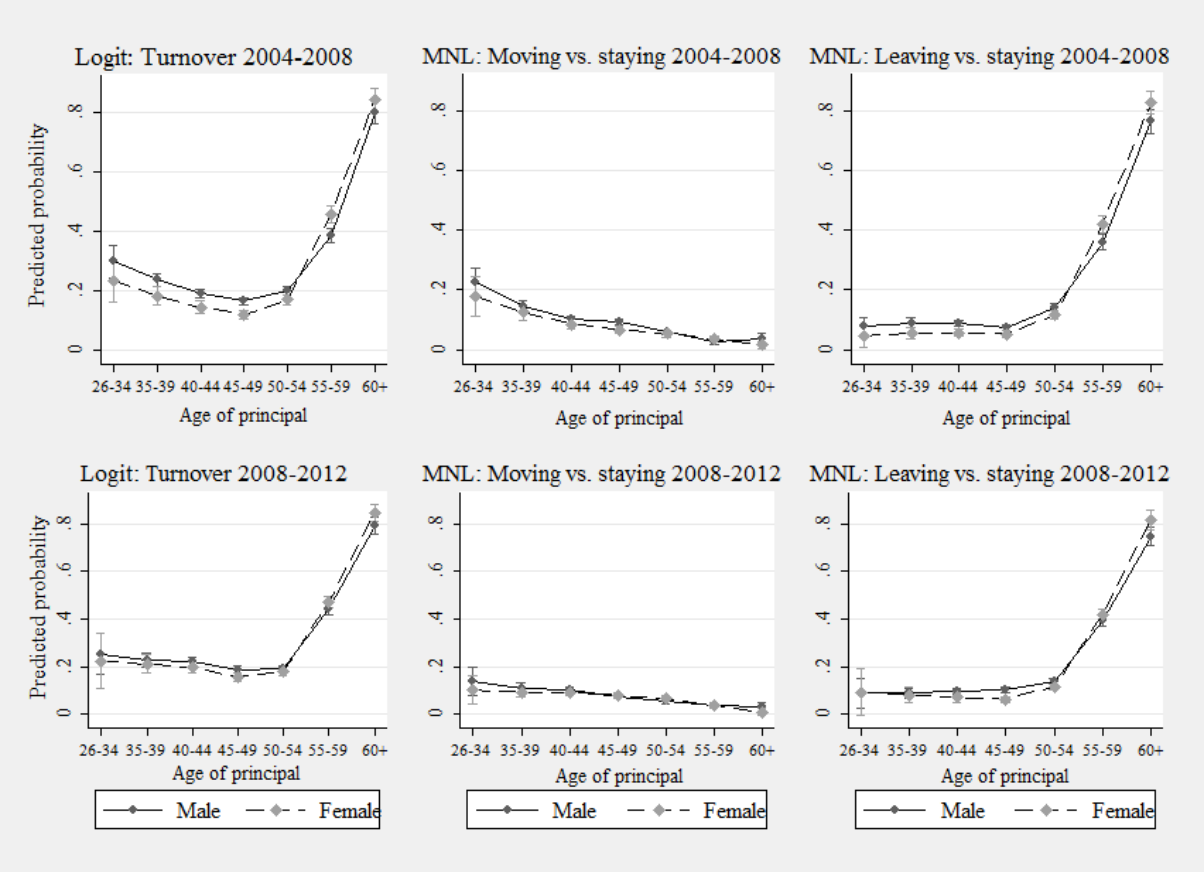
Multinomial logit results and for reference, the sequential logit results are presented in Table A.6. Although the coefficients and their significance provide a clear indication of the direction of observed

correlations between turnover probabilities and individual principal or school factors, the size of the coefficients are not directly interpretable. For this reason, predicted probabilities of key associations are plotted graphically to aid interpretation.

### *Gender and the U-shaped probability of principal turnover by age*

A dominant finding from a logistic regression of principal turnover is the U-shaped pattern observed with respect to principal age. Initially, the probability that a principal will move out of a school declines with age until they reach 45 to 49 years as shown in Figure 7.

**Figure 7: Probabilities of turnover by principals' age and gender**




**Notes:** The first panel of the figure plots the marginal predicted probabilities of principal turnover from the first stage of the sequential logit regression model. The second and third panels of the figure plot marginal predicted probabilities of principal turnover flows from a multinomial logit (MNL) regression. The associated estimation results are presented in Table A.6.

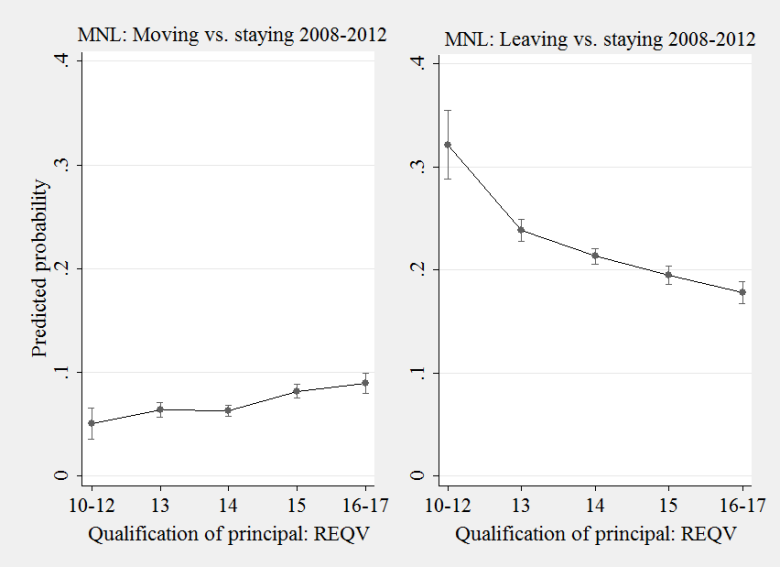
This decline is attributed to the decreasing probabilities of moving within the system as principals get older as suggested by both the multinomial and sequential logit models. As principals near retirement age, however, predicted probabilities of turnover rise dramatically. This U-shaped principal turnover pattern observed is consistent with that found in the international literature on teacher turnover (Harris and Adams, 2005; Ingersoll, 2001). Interestingly, women who are principals are significantly less likely to move out of their positions at younger ages compared with their male counterparts. This is

contrary to expectations that women would be more likely to leave the principal labour market at younger ages to care for children.

### *Qualifications and the probability of principal turnover*

A question that may concern policy-makers is whether those principals that leave the system are likely to be the most qualified. On the contrary, the results indicate that principal transfer patterns are possibly improving the qualification stock of incumbent principals in the public education system. Predicted probabilities of leaving the public education system are highest among principals with fewer qualifications as illustrated in the second panel of Figure 8.[26]

**Figure 8: Probabilities of turnover by principals' qualifications (REQV)**




**Notes:** The figure plots the marginal predicted probabilities of principal turnover (or turnover flows) from a multinomial logit (MNL) regression. The full MNL results are presented in Table A.6.

By contrast, the first panel of the figure indicates that the probability of moving within the system, as opposed to staying in the same school, is higher among principals that are very well-qualified compared with principals with fewer qualifications. A similar conclusion is reached from the sequential logit results, where those with higher qualifications are more likely to choose to move within the system than to leave the system. Together the results suggest that transfer patterns are not associated with a leakage of the most qualified principals out of the education system. Rather higher qualifications afford principals the opportunity to move within the system, potentially to better schools or to higher paying positions. This is an interesting result where research identifies that non-

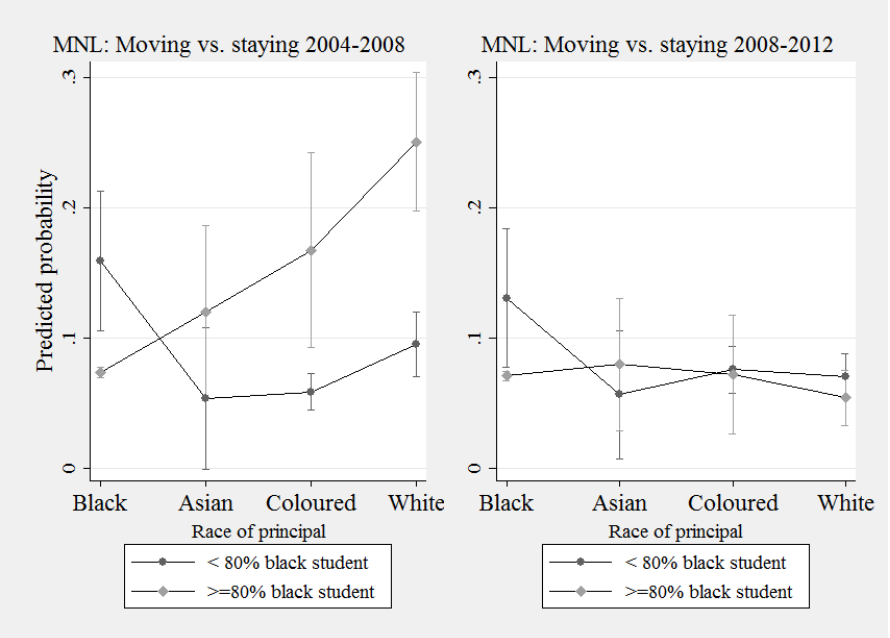
[26] Where principals' REQV levels are less than 13 these would be temporarily employed principals. Their contracts were possibly not renewed given that their qualifications do not meet minimum criteria for permanent employment.

teaching professions in South Africa provide higher levels of return for a given level of educational qualification, regardless of one's level of labour market experience (Armstrong, 2014: 16). Nevertheless, this phenomenon is not unique to South Africa. The U.S. literature identifies that retention rates in education are highest among principals with higher certification scores where these principals are considered more ambitious in 'moving up the career ladder' (Young and Fuller, 2009).

### *Race and the probability of principal turnover*

A clear association exists between the race of the principal and the probability of principal turnover, specifically with respect to the decision to move to another position in the system as opposed to staying in the same school. Compared with black principals, white and Indian/Asian principals are significantly less likely to move within the system. But the association between principals' race and turnover is best interpreted in relation to the racial composition of the student body. For example in the United States, the likelihood that a principal or teacher leaves a school rises as the racial composition of the student body deviates from that of the principal or teacher (Gates et al., 2006; Hanushek, Kain and Rivkin, 2001). In the South African context, there is evidence that the racial composition of students relative to the principal is significantly associated with principals' decisions to move within the system.

**Figure 9: Probability of turnover by principals' race and the student race composition**




**Notes:** The figure plots the marginal predicted probabilities of principal turnover (or turnover flows) from a multinomial logit (MNL) regression. The full MNL results are presented in Table A.6.

As reflected in Figure 9 which plots predicted probabilities of turnover, black principals are more likely to move to another post in the school system if there is non-majority black student enrolment. White principals are more likely to move when the majority race composition of the school is black. In this respect, the historical pattern of principal sorting to schools along racial lines continues to persist through patterns of principal transfers. The significance of this association, however, declined in the second period 2008 to 2012 compared with 2004 to 2008 as evidenced in both the multinomial and sequential logit results.

### *School characteristics and the probability of principal turnover*

In the international literature, principals are identified as using posts in poorer schools as a stepping stone to positions in more affluent schools (Beteille et al, 2012). Therefore, more turnover is expected in poorer parts of the school system. In the South African context, the extent to which school poverty (as measured by DBE quintile status) influences the probability of principal turnover is less clear. Across both the multinomial and sequential logit results, there is no indication that principals are significantly more likely to move out of the poorest quintile one or two schools when compared with principals in quintile four or five schools after conditioning on other covariates. To investigate this further, a transition matrix was generated for the period 2008 to 2012 in Table 5 and shows the quintiles of sending and receiving schools of principals who move between school principal posts. Lateral movements are most common, comprising 45 percent of all moves followed by upward moves to wealthier schools which account for 31 percent of school-to-school moves. A remaining 23 percent of transitions are downwards to poorer schools. Where upward mobility does occur, this is concentrated at the bottom end with principals in initially quintile one or two schools moving into marginally wealthier schools. As expected, lateral moves are most evident among principals in quintile five schools creating a barrier to upward mobility for principals in poorer schools.

The direction and level of significance on other school characteristics in the regressions point to additional incentives that influence transfer patterns. There is some suggestion that principals are less likely to move to another position in the system if they are initially in an urban school post rather than a rural school post. School size is also associated with transfer patterns. The predicted probability of principal turnover is inversely related to school size where this result is consistent across both the multinomial and sequential logit models. This is expected where principal salaries are higher for positions in larger schools. Principal turnover also varies significantly by school phase. Secondary school principals are considerably more likely to leave the education system or to transfer to another position within the system than principals in primary or intermediate schools. What is interesting is that there is movement of principals between phase levels as shown in Table 6. Roughly 17 percent of primary or intermediate school principals that took up a principal position in another school moved

into a secondary school principal role, and 31 percent of principals in secondary schools moved to a primary school post.

**Table 5: Principal mobility: wealth quintiles of 'sending' and receiving schools**

| | | Quintile of receiving school | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **Total** |
| **Quintile of 'sending' school** | **1** | 221 | 107 | 82 | 24 | 4 | **438** |
| | | *50.5%* | *24.4%* | *18.7%* | *5.5%* | *0.9%* | ***100%*** |
| | **2** | 71 | 99 | 61 | 12 | 12 | **255** |
| | | *27.8%* | *38.8%* | *23.9%* | *4.7%* | *4.7%* | ***100%*** |
| | **3** | 49 | 56 | 100 | 22 | 5 | **232** |
| | | *21.1%* | *24.1%* | *43.1%* | *9.5%* | *2.2%* | ***100%*** |
| | **4** | 7 | 16 | 26 | 34 | 22 | **105** |
| | | *6.7%* | *15.2%* | *24.8%* | *32.4%* | *21.0%* | ***100%*** |
| | **5** | 7 | 8 | 14 | 8 | 56 | **93** |
| | | *7.5%* | *8.6%* | *15.1%* | *8.6%* | *60.2%* | ***100%*** |
| | **Total principals** | **355** | **286** | **283** | **100** | **99** | **1 123** |
| | | ***31.6%*** | ***25.5%*** | ***25.2%*** | ***8.9%*** | ***8.8%*** | ***100%*** |

**Source:** Persal-EMIS matched dataset. **Notes:** The transition matrix is calculated for school principals in 2008 (or 2010) who move to a principal post in a different school by 2010 (or 2012). For this group of principals, 1 158 transitions should be observed but data is missing on quintile ranking for some schools. Frequencies are in the top of each cell and percentages are at the bottom. Wealth quintile rankings refer to DBE rankings.

**Table 6: Principal mobility: The phase levels of schools 'sending' and receiving principals**

| | | Phase of receiving school | | | |
|---|---|---|---|---|---|
| | | Primary/ Intermediate | Combined | Secondary | **Total** |
| **Phase of 'sending' school** | Primary/ Intermediate | 446 | 109 | 111 | **666** |
| | | 67.0% | 16.4% | 16.7% | **100%** |
| | Combined | 56 | 77 | 31 | **164** |
| | | 34.1% | 47.0% | 18.9% | **100%** |
| | Secondary | 94 | 44 | 165 | **303** |
| | | 31.0% | 14.5% | 54.5% | **100%** |
| | **Total principals** | **596** | **230** | **307** | **1 133** |
| | | **52.6%** | **20.3%** | **27.1%** | **100%** |

**Source:** Persal-EMIS matched dataset. **Notes:** see Table 5

In summary, this section has identified that the South African labour market for principals is characterised by low levels of mobility. With low numbers of school-to-school transfers, principal transfers within the system do not pose a substantial threat for widening existing inequalities in the distribution of principals across schools. However, among those principals that do move within the system there appear to be incentives operating in the direction of existing inequalities, specifically

where race informs transfer decisions. On a positive note, the analysis indicates that principal transfer patterns are not associated with a leakage of qualified individuals out of the public education system. On the contrary, the least qualified principals are more likely to leave. But a pressing question remains as to whether we should be concerned with principal qualifications at all? Are observed credentials actually a signal for principal quality? This question is addressed in the next section.

## 8. Do principal credentials signal quality?

Internationally, qualifications and experience are usually the key criteria guiding the recruitment of teachers and principals and in determining their pay. South Africa is no exception in this regard. Yet international evidence provides mixed evidence that principal credentials have any bearing on actually raising student performance in schools (Branch, Hanushek and Rivkin, 2009; Clark, Martorell and Rockoff, 2009; Eberts and Stone, 1988). Furthermore, teacher credentials provide weak predictors of student performance across both developed and developing country contexts (Clotfelter, Ladd and Vigdor, 2010; Hanushek, 1986; Hanushek, 2007; Harris and Sass, 2011; Hein and Allen, 2013). In reference to principal credentials in the United States, both Eberts and Stone (1988) and Ballou and Podgursky (1995) find a negative correlation between school performance and principal education as measured by advanced degrees and graduate training. Using a methodology that allows them to obtain more reliable estimates of how principal characteristics impact on student test scores than prior studies, Clark et al (2009) find little evidence of a systematic relationship between school performance and principal education or pre-principal work experience. However, they do find a positive relationship between years of experience in a principal role and school performance, particularly on mathematics test scores and student absenteeism.

Identifying whether observed credentials are a signal of quality has implications not only for designing effective selection processes but it has direct fiscal implications. Across the board, the qualifications of principals as measured through the REQV system in South Africa have been rising. In just four years between 2008 and 2012, about three percent more schools had principals with a REQV level 16 or 17 - roughly equivalent to a post-graduate degree. In the majority of schools, rising principal qualifications is not due to the appointment of more qualified replacement principals compared with outgoing principals. Instead incumbent principals are acquiring higher level qualifications while on the job through in-service training.[27] This was evident in Figure 5 presented earlier which compared the qualifications of newly appointed principals and those of principals exiting the system between the periods 2008 to 2012. While some may consider this a positive indicator of professional development and a signal of leadership quality improvements, the acquisition of higher level qualifications is not necessarily a route to improve skills but a way to advance along

[27] A similar pattern is observed with respect to teachers in general in South Africa who build up their qualifications on the job often over many years (CDE, 2015)

the salary schedule. Unless qualifications improve the proficiencies of school leaders, this is unlikely to translate into improvements for the core outcome of concern, student learning. Rather the system is at risk of what is termed 'rent extraction' where more value is taken out of the system that what is given (Pritchett, 2013: 127). Principals access higher salaries with higher qualifications but fail to match their increased cost with added value, for example through engaging in behavioural change, increased responsibilities or raising their performance.

### *Estimation strategy and data*

There are various challenges associated with estimating unbiased effects of principal credentials on school performance. First, principals are not randomly sorted across schools as discussed extensively in the previous analysis. Different types of principals are attracted to different types of schools. Moreover, certain principals may attract or be attracted to different types of students. In a straightforward ordinary least squares regression, estimates of how principal characteristics affect school performance may be biased through these very patterns of principal sorting to schools. A commonly used approach in dealing with sorting biases is the inclusion of school fixed effects in a simple regression framework. In the following equation school performance is expressed as a function of school and principal characteristics and the characteristics of a school's student body.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 PC_{it} + PA_i + \pi_i + \pi_t + \varepsilon_{it}$$

Here $Y_{it}$ is the measure of performance of school $i$ in year $t$ and $X_{it}$ is a vector of time-variant school characteristics. $PC_{it}$ are time-varying characteristics of principals including their credentials and $\varepsilon_{it}$ is an idiosyncratic error term which is assumed to be serially uncorrelated over time. The term $\pi_i$ reflects school-specific fixed effects and year fixed effects are represented by $\pi_t$. The school fixed effects essentially purge the estimation of any bias associated with unobserved school characteristics that are time-invariant over the sample period observed. Estimates of the relationship between principal characteristics and school performance are identified by comparing school performance associated with different principals working in the same school.

The regression framework also includes a measure of unobserved time-invariant principal ability, $PA_i$. As noted by Clark et al (2009: 8), where principal ability is unobserved a regression of student performance on principal credentials would identify the causal effect of the credential in question plus an ability bias generated by any correlation between the credential and unobserved ability. The ability bias could potentially confound the effects of credentials on performance and cannot be remedied through the inclusion of school fixed effects. However, it is not necessary to correct for the ability bias because this "bias" forms part of the effect of interest. When informing principal selection policies, for example, we would want to know whether one candidate will perform better in a given

school than another candidate. If those among the set of principals with higher qualifications also have more ability or motivation, this is a signal to inform hiring on the basis of qualifications.

The dataset constructed for this study facilitates the use of a school fixed effects strategy as more than one observation per school is available in a panel. Specifically, the estimation sample used is limited to the subset of schools that had grade 12s in each year and could be connected to grade 12 (or otherwise known as matriculation) examination outcomes in those years. Until recently, the matriculation examination in South Africa has been the only national measure of school performance where "much behaviour has understandably been oriented towards grade 12 indicators, in particular 'pass rates', the percentage of students successfully obtaining the certificate or surpassing minimum thresholds in individual subjects" (Gustafsson and Taylor, 2013: 3). Prior to 2008, students typically wrote a minimum of six subjects as part of the grade 12 senior certificate. This changed to seven subjects given a fundamental change in the curriculum system between 2007 and 2008 which saw the removal of the distinction between higher and standard grade examination papers and the introduction of compulsory mathematical literacy for non-mainstream mathematics takers. Coinciding with the year 2008 when the National Senior Certificate (NSC) examination first replaced the Senior Certificate system, the dataset used in the analyses is limited to three of the four available 'waves' of the constructed panel.[28]

The first measure of grade 12 performance used is the much talked about percentage pass rate in the NSC, which is a key measure of school success in South Africa. However, where students choose between a plethora of subjects, it may be argued that overall pass rates in the NSC are not directly comparable across schools if students in some schools on average take easier subjects than in others. For this reason, the second performance measure is limited to focus on improvements in one subject area, mathematics. This follows Gustafsson and Taylor (2013) who solely focus on mathematics performance in estimating provincial boundary change impacts on school performance. The average mathematics score out of one hundred obtained by students is a key indicator of improvements with respect to the quality of mathematics teaching and learning. As noted above, there are two streams of mathematics offered at the FET phase[29] –mathematics and mathematical literacy which attempts to introduce students to mathematical concepts with everyday practical applications. Only mathematics outcomes are considered here.

Due to changes to the matriculation examination system in 2008, only three of the four 'waves' of the constructed panel are used: 2008, 2010 and 2012. A maximum number of 4 503 schools are used in

[28] Excluding the 2004 data-year is also prompted by the lower levels of successful matching of Persal to EMIS data in 2004 compared to later years.

[29] In this context, FET refers to "Further Education and Training" and is the name given to curriculum implemented at the level of grades 10 to 12.

the estimations. It is noted that there are some limitations of these measures of school performance. Tests are not standardised in the usual sense but an independent monitoring board, Umalusi, is in place to monitor the quality of the examinations from year to year. Where these performance indicators may be subject to gaming through limiting the throughput of weak performing grade 11s into grade 12, it is necessary to control for the throughput rate of students in the FET phase in each school in the estimations that follow.

Referred to in the previous sections, two principal credentials recorded in the payroll are considered in the analysis. Principals' REQV levels are included as a continuous variable ranging from 10 to 17. Years of service in the education sector are used as a proxy for years of experience. Additional time-varying principal controls include their gender[30], age and post position in the previous data period observed. Time-varying school controls include total school enrolment and its square, the number of teachers per one hundred students and the percentage of students that are black. Promotion rates are also included where the number of grade 12s in year t is expressed as a percentage of the number of grade 10s in year t-2. At the outset, a key limitation of the analysis is noted. Without student level data identifying their performance, background characteristics and whether they switch schools, it is not possible to control directly for biases that may result from student sorting patterns.

### *Estimation results*

Tables 7 to 9 present the estimation results which are reported for all schools in the data sub-set and then limited to poorer (quintile one to three) schools and wealthier schools (quintile four and five). Where performance is measured as the percentage of examination takers who achieve the NSC, the fixed effects results in Table 7 (controlling for time-varying principal and school characteristics) suggest that when schools have a principal with an additional REQV level, the pass rate rises by 1.5 percentage points. Once the year fixed effects are introduced, however, this effect reduces to half of a percent and is statistically insignificant. For the second measure, the average mathematics score, having a principal with an additional REQV ranking also produces roughly half a percentage point increase in the average mathematics score in the final fixed effects estimation. This is a statistically significant effect but clearly small. When the sample is limited to poorer quintile one to three schools, any observed effects in the final fixed effects regressions are small (less than 0.2 percent) and insignificant. The results suggest that REQV levels do not provide a useful signal of quality where principals with higher REQV levels are no more effective at raising school performance than those with lower REQV levels. By contrast, in wealthier quintile four and five schools there is some evidence that school performance is higher when a school is led by a more qualified principal. However, the positive significant effect in quintile four and five schools is only observed when the

[30] This varies where a principal leadership change occurred in the school.

outcome measure is the school's average mathematics percentage. In these schools, the average mathematics percentage increases by about 1.2 percentage points when the school is led by a principal with one additional REQV level. Where principals in wealthier schools may have been exposed to better pre-service education than principals in poorer schools, this may explain the heterogeneous results across these two groups of schools (Shepherd, 2015).

For the full and sub-samples of schools, additional years of service have little bearing on school performance. For the full sample of schools, coefficients on years of service in the final fixed effects specification suggest a statistically significant *negative* effect of about 0.1 percentage points. For the poorer school sample, the negative coefficient rises to just less than 0.2 percentage points while is close to zero in the wealthier school sample. It is entirely possible that years of experience as a principal, specifically, may provide a more useful indicator of a principal's capacity to execute his or her leadership function than years of service – principal experience may matter more than just teaching experience (Clark et al, 2009). Unfortunately, it is not possible to distinguish between years worked in a principal post from overall teaching experience in the public education sector with the data available. This is a limitation of the analysis.

A potential criticism of the fixed effects results is that there may not be enough variation in the REQV indicator within each school over time relative to the between school variation in REQV levels, resulting in relatively imprecise estimators. This is a valid concern as identified by the notably higher standard errors on REQV and years of service in the fixed effects regression results when compared with the OLS results. Only 29 percent of the standard deviation in REQV in the quintile one to five estimation sample is attributed to within-school variation.

There is relatively more within-school variation in the variable years of service which accounts for 42 percent of the total standard deviation in total years of service. However, when the fixed effects estimates are considered in relation to the OLS results, the author argues that the substantive conclusions that can be drawn from the results are unlikely to change considerably. Even if the 0.5 percentage point increase in a school's NSC pass rate identified in the third OLS model for the quintile one to five sample were true, this is not an educationally significant effect or commensurate with the anticipated impact that higher quality school principals are likely to have on school outcomes. In future research, however, it would be useful to extend the panel to identify more within-school variation in the variables of interest.

**Table 7: Matriculation examination outcomes and principal credentials, schools offering grade 12 (quintile one to five schools)**

| | Average mathematics percentage among mathematics takers | | | | | | Percentage of examination takers who achieve the NSC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **OLS (1)** | **OLS (2)** | **OLS (3)** | **FE (1)** | **FE (2)** | **FE (3)** | **OLS (1)** | **OLS (2)** | **OLS (3)** | **FE (1)** | **FE (2)** | **FE (3)** |
| REQV level (continuous) | 1.704*** | 0.216** | 0.213** | 0.739*** | 0.637*** | 0.573** | 2.798*** | 0.456*** | 0.445*** | 1.546** | 1.506*** | 0.533 |
| | (0.116) | (0.091) | (0.091) | (0.252) | (0.245) | (0.240) | (0.203) | (0.173) | (0.167) | (0.619) | (0.579) | (0.468) |
| Years of service | 0.001 | -0.035* | -0.041** | -0.033 | -0.059 | -0.085** | 0.013 | -0.075** | -0.121*** | 0.371*** | 0.244*** | -0.112* |
| | (0.029) | (0.020) | (0.020) | (0.042) | (0.041) | (0.041) | (0.045) | (0.034) | (0.033) | (0.085) | (0.079) | (0.065) |
| Principal controls | X | X | X | X | X | X | X | X | X | X | X | X |
| School controls | | X | X | | X | X | | X | X | | X | X |
| Year fixed effects | | | X | | | X | | | X | | | X |
| R-squared | 0.045 | 0.457 | 0.460 | | | | 0.043 | 0.370 | 0.408 | | | |
| Within R-squared | | | | 0.008 | 0.084 | 0.096 | | | | 0.040 | 0.209 | 0.294 |
| N | 13 139 | 13 093 | 13 093 | 13 139 | 13 093 | 13 093 | 13 490 | 13 442 | 13 442 | 13 490 | 13 442 | 13 442 |
| N (clusters) | | | | 4 460 | 4 460 | 4 460 | | | | 4 503 | 4 503 | 4 503 |
| F (p-value) | 63.513 | 301.032 | 277.956 | 6.215 | 46.93 | 49.444 | 68.838 | 439.008 | 409.027 | 23.955 | 106.09 | 187.188 |

**Source:** Persal-EMIS matched dataset, connected to matriculation examination data. **Notes:** The unit of observation is the school-year. REQV is entered as a continuous variable ranging from 10 to 17. Time-varying principal controls include their gender, age and position in the previous data period observed. Time-varying school controls include total school enrolment and its square, number of teachers per one hundred students and the percentage of students that are black. Additional time-invariant school controls are included in the OLS regressions. These are school quintile, former department classification, urban location and provincial indicators. Year dummies are entered for 2010 and 2012. The year reference category is 2008. Statistically significant at * p<0.1, **p<0.05, ***p<0.01. Standard errors are shown in parentheses and are clustered at the school level.

**Table 8: Matriculation examination outcomes and principal credentials, poorer schools offering grade 12 (quintile one to three schools)**

| | Average mathematics percentage among mathematics takers | | | | | | Percentage who achieve the NSC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **OLS (1)** | **OLS (2)** | **OLS (3)** | **FE (1)** | **FE (2)** | **FE (3)** | **OLS (1)** | **OLS (2)** | **OLS (3)** | **FE (1)** | **FE (2)** | **FE (3)** |
| REQV level (continuous) | 0.810*** | 0.241** | 0.222** | 0.575* | 0.517* | 0.176 | 1.735*** | 0.567*** | 0.489** | 1.607** | 1.740** | -0.081 |
| | (0.107) | (0.104) | (0.104) | (0.308) | (0.301) | (0.273) | (0.229) | (0.212) | (0.204) | (0.813) | (0.759) | (0.584) |
| Years of service | -0.018 | -0.029 | -0.048** | 0.018 | -0.023 | -0.189*** | -0.016 | -0.036 | -0.116** | 0.756*** | 0.601*** | -0.172 |
| | (0.025) | (0.024) | (0.024) | (0.061) | (0.060) | (0.057) | (0.053) | (0.048) | (0.046) | (0.157) | (0.144) | (0.110) |
| Principal controls | X | X | X | X | X | X | X | X | X | X | X | X |
| School controls | | X | X | | X | X | | X | X | | X | X |
| Year fixed effects | | | X | | | X | | | X | | | X |
| R-squared | 0.011 | 0.140 | 0.156 | | | | 0.019 | 0.212 | 0.272 | | | |
| Within R-squared | | | | 0.014 | 0.100 | 0.137 | | | | 0.052 | 0.225 | 0.327 |
| N | 9 787 | 9 748 | 9 748 | 9 787 | 9 748 | 9 748 | 10 073 | 10 032 | 10 032 | 10 073 | 10 032 | 10 032 |
| N (clusters) | | | | 3 533 | 3 533 | 3 533 | | | | 3 574 | 3 574 | 3 574 |
| F | 11.442 | 47.003 | 49.706 | 7.848 | 40.788 | 55.134 | 21.762 | 97.009 | 124.348 | 20.872 | 92.975 | 177.446 |

**Source:** Persal-EMIS matched dataset, connected to matriculation examination data. **Notes:** The unit of observation is the school-year. REQV is entered as a continuous variable ranging from 10 to 17. Time-varying principal controls include their gender, age and position in the previous data period observed. Time-varying school controls include total school enrolment and its square, number of teachers per one hundred students and the percentage of students that are black. Additional time-invariant school controls are included in the OLS regressions. These are school quintile, former department classification, urban location and provincial dummies. Year dummies are entered for 2010 and 2012. The year reference category is 2008. Statistically significant at * p<0.1, **p<0.05, ***p<0.01. Standard errors are shown in parentheses and are clustered at the school level.

**Table 9: Matriculation examination outcomes and principal credentials, wealthier schools offering grade 12 (quintile four and five schools)**

| | Average mathematics percentage among mathematics takers | | | | | | Percentage of examination takers who achieve the National Senior Certificate | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **OLS 1** | **OLS 2** | **OLS 3** | **FE 1** | **FE 2** | **FE 3** | **OLS 1** | **OLS 2** | **OLS 3** | **FE 1** | **FE 2** | **FE 3** |
| REQV level (continuous) | 1.445*** | 0.123 | 0.047 | 1.888*** | 1.440** | 1.203** | 1.689*** | 0.071 | 0.149 | 1.710* | 1.051 | 1.258 |
| | (0.273) | (0.182) | (0.180) | (0.612) | (0.559) | (0.512) | (0.370) | (0.268) | (0.265) | (0.894) | (0.827) | (0.765) |
| Years of service | -0.056 | -0.034 | -0.027 | -0.064 | -0.073 | -0.035 | -0.069 | -0.112*** | -0.118*** | 0.019 | -0.05 | -0.077 |
| | (0.049) | (0.033) | (0.032) | (0.071) | (0.064) | (0.053) | (0.055) | (0.040) | (0.040) | (0.059) | (0.054) | (0.054) |
| Principal controls | X | X | X | X | X | X | X | X | X | X | X | X |
| School controls | | X | X | | X | X | | X | X | | X | X |
| Year fixed effects | | | X | | | X | | | X | | | X |
| R-squared | 0.04 | 0.596 | 0.609 | | | | 0.038 | 0.511 | 0.519 | | | |
| Within R-squared | | | | 0.022 | 0.081 | 0.16 | | | | 0.008 | 0.154 | 0.18 |
| N | 3 358 | 3 345 | 3 345 | 3 358 | 3 351 | 3 351 | 3 423 | 3 410 | 3 410 | 3 423 | 3 416 | 3 416 |
| N (clusters) | | | | 1 313 | 1 312 | 1 312 | | | | 1 328 | 1 327 | 1 327 |
| F (p-value) | 17.712 | 172.487 | 177.671 | 3.825 | 10.643 | 20.605 | 15.343 | 128.134 | 122.171 | 1.557 | 12.259 | 13.774 |

**Source:** Persal-EMIS matched dataset, connected with matriculation data. **Notes:** The unit of observation is the school-year. REQV is entered as a continuous variable ranging from 10 to 17. Time-varying principal controls include their gender, age and position in the previous data period observed. Time-varying school controls include total school enrolment and its square, number of teachers per one hundred students and the percentage of students that are black. Time-invariant school controls are included in the OLS regressions. These are school quintile, former department classification, urban location and provincial dummies. Year dummies are entered for 2010 and 2012. The year reference category is 2008. Statistically significant at * p<0.1, **p<0.05, ***p<0.01. Standard errors are in parentheses and are clustered at the school level.

### *Measurement error*

In a fixed effects regression, measurement error in the explanatory variable of interest may induce attenuation bias in the coefficients. In reference to REQV as a measure of qualifications, it is necessary to distinguish between two types of potential measurement error. The first would be related to data capturing mistakes in REQV levels assigned to principals. This is unlikely where the calculation of salaries or cash bonuses is dependent on having correct information on REQV levels recorded in payroll data. Any errors in this field are likely to be checked or verified by educators themselves and are arguably not a major concern for the estimation.

A second type of measurement error is that REQV may be a poor signal of actual qualifications. This is a potential concern where the REQV system is a composite measure of academic qualifications and professional training. As noted in a report by Welch (2009), the awarding of a REQV level is complex and extends beyond just counting the years of teacher training after matric. She notes, for example, that an additional REQV level can be awarded for a maximum of two approved qualifications at the same NQF level and identifies that "it is not the qualification itself that carries the REQV level. It is the qualification in relation to other qualifications that the teacher has obtained" (ibid: 2).

In summary, in the majority of schools principal credentials - as measured through REQV levels and years of service - have little observable impact on school performance. Due to the potential concern that REQV levels are not good measures of qualifications, one is cautioned in implying that the educational qualifications of principals are not important for their performance. What is clear, however, is that the REQV level system is not an effective signal of principal quality in the majority of schools. Nevertheless, in the wealthier school sample, REQVs may provide a weak signal of principal quality. These findings hold even though it was not possible to control for unobserved principal ability. Rather the ability "bias" formed part of the effect of interest in the school fixed effects regressions. It is also necessary to point out that the non-effect observed for the full and poorer school sample of schools does not imply that principals do not matter for school performance; rather the value they bring to schools is not signalled through their observed credentials as captured in the payroll system. This is an important finding with implications for the design of recruitment policies and pay schedules, which are closely linked to the REQV system.

However, these results should also be considered against the suggestive evidence presented earlier that higher principal retention rates are associated with higher REQV levels. While the current pay schedule for principals is poorly linked to principal quality as it differentiates pay using the REQV system, a differentiated pay system may be important more generally for principal and teacher retention.

# 9. Discussion: Evidence informing policy

The preceding discussion has highlighted five overarching characteristics of the labour market for principals. In summary:

i. The age profile of principals has been rising, indicating the need for a substantial and increasing number of principal replacements. The number of new principals required to replace retiring principals alone is estimated to be well over 7 000 between 2012 and 2017. While proportionally more retirements are taking place in wealthier schools, the absolute demand for principal replacements is highest in the poorest schools. Moreover, the demand for replacement principals is particularly large at the primary and intermediate school level comprising over sixty percent of anticipated principal replacements due to retirement.

ii. The labour market for principals is dominated by men. While 72 percent of all teachers were women in 2012, they held a mere 36 percent of school principal positions. This gender disparity is most pronounced at the secondary school level and in former white schools.

iii. Principals are unequally distributed across schools with less qualified and less experienced principals represented in greater proportions in poorer schools. In part, the patterns of unequal principal sorting across schools are attributable to historically imposed policies that matched teachers and principals to schools along racial lines. However, initial matching of new principals to schools continues to persist in line with historical patterns, reflecting either differences in the preferences of prospective principals for certain types of schools or variations in the appointment process.

iv. In the majority of schools, principal credentials as measured through REQV levels and years of service have little observable impact on school performance as measured by matriculation outcomes. The value principals bring to schools is not signalled through their observed credentials as captured in the education payroll data. In wealthier quintile four and five schools, the REQV system may provide a weak signal of quality.

v. Despite rising levels of retirement related attrition, low levels of mobility and consequently high levels of average tenure characterise this market. The majority of principal turnover - at roughly two thirds to three quarters - is accounted for by attrition rather than mobility. Low levels of mobility are also expressed in promotion patterns, where well over a half of newly appointed principals are promoted from lower ranks *within* a school. Cross-provincial movements of principals are also uncommon, accounting for less than three percent of all principal moves within the system. Although the number of within sector transfers is low, there is some evidence that among principals who move from school-to-school, transfer patterns tend to exacerbate existing inequalities.

In a sector characterised by low levels of mobility and high levels of tenure, policies should be aimed at improving the initial match of principals to schools while developing the effectiveness of incumbent principals over their length of tenure. Moreover, where observed credentials in payroll provide weak signals of quality, policies guiding the selection and rewarding of principals should extend beyond qualifications and experience to identify expertise and skills that may be better signals of quality. In light of this, the relevance of proposed policies in The National Development Plan (NDP) to improve the calibre of school leadership is considered, and for ease of reference summarised in Table 10. The findings strongly support proposals to i) introduce competency-based assessment in the appointment process and ii) implement performance management for incumbent school principals aimed at increasing the quality of leadership provided to schools. However, the design and implementation of these policies are important for ensuring they generate the desired outcomes and this warrants additional research. In brief, some issues are discussed in this regard.

There is strong evidence that supports the introduction of competency-based testing in the appointment process. At the very least, it will limit the undue influence of unions in the appointment process, especially where an independent contractor manages this process. However, it should be designed to identify competencies that distinguish better quality school leaders from weaker ones. Yet little evidence exists on the types of skills or attributes that matter for school performance in the South African context and in this respect more research is warranted. What is clear though from both local and international literature is the need for principals with a strong instructional focus, prioritising activities that focus on the core business of teaching and learning (Bush et al., 2006; Hallinger and Heck, 1996). It is commonly accepted that principals do not conceptualise their role as leaders of learning where job descriptions and day-to-day activities pivot around fulfilling a compliance and administrative function (Bush and Heystek, 2006; Elmore, 2000). This is emphasised where both job descriptions in PAMs and IQMS prioritise compliance functions over the principal's role as leader of learning. The draft Standards for Principalship (RSA DBE, 2014b) arguably corrects this, re-prioritising the principals' key function as facilitating quality teaching and learning in his or her school. Esteemed competencies in testing must be closely linked to this new prioritisation.

Improving performance management systems for principals (either in the existing IQMS or in designing a replacement system) is complex, involving issues such as what performance criteria are monitored, who evaluates performance and how it is rewarded. Performance must be assessed in terms of standards for leadership and managerial behaviours that are logically linked to learning improvements in schools. Alternatively, performance may be directly measured by overall improvements in student learning. A clear weakness with the existing IQMS is that the evaluation of a principal's role is not treated distinctly from his or her role as teacher (Smit, 2013). IQMS is also not

linked to measurable indicators of school performance. Of course, identifying suitable learning indicators against which to measure performance is a notable challenge in designing a new system.

While the Annual National Assessments (ANA) provide a useful mechanism for diagnosing learning deficits (and are an important addition to accountability more broadly), in their current form they have notable shortcomings. Much progress is needed in ensuring that the ANA's become a truly standardized test before considering them as measures for tracking learning improvements over time, let alone rewarding schools and principals for these improvements.[31] Currently the ANAs are not designed to be compared over time (John, 2012; Taylor, 2013). Furthermore, linking principal performance to student test scores, for example, poses potential threats of introducing perverse incentives. It may increase principal turnover where principals move out of schools with underperforming students and transfer to more attractive schools (Clotfelter et al., 2007). This pattern of transfer typically involves moving out of poorer schools, thereby aggravating existing inequalities in the distribution of principals and reducing the pool of applicants for posts in underperforming schools.

In implementing performance management systems there are also notable challenges. Arranging performance evaluation meetings with principals in over 24 000 public schools is likely to pose logistical problems. This was identified as a clear challenge in the implementation of the existing IQMS, providing few guarantees that direct line managers will conduct evaluations in the future (RSA DBE, 2014c: 98; RSA DBE, 2012). Increased accountability for principals also goes hand-in-hand with capacity improvements at a district level. This extends beyond just creating the capacity to monitor. Districts also need the capacity to *support* principals in their day to day functions, creating reciprocal accountability arrangements[32] in the relationship between central administration and educators (Elmore, 2002).

Finally, performance management is likely to be met with considerable resistance not only from teacher unions at a national level but from principals themselves if they feel the system is unfair or there are too many variables affecting their performance that they feel are outside of their control (Heystek, 2015). In Jan Heystek's conclusion to recent research on principals' perceptions of the

[31] At the time of finalising this paper, a decision was made by the DBE to postpone the administration of the ANAs in 2015 until 2016 with the intention of improving the current design of the tests in meeting the requests of teachers' unions (Nkosi, 2015).

[32] As described by Richard Elmore (2002: 5),

> *For every increment of performance I demand from you, I have an equal responsibility to provide you with the capacity to meet that expectation. Likewise, for every investment you make in my skill and knowledge, I have a reciprocal responsibility to demonstrate some new increment in performance. This is the principle of "reciprocity of accountability for capacity." It is the glue that, in the final analysis, will hold accountability systems together. At the moment, schools and school systems are not designed to provide support or capacity in response to demands for accountability.*

motivational potential of performance agreements, he reflects that these concerns are expressed in a context where principals have no control over the hiring and firing of those they are appointed to lead and where principals' ability to perform is often challenged at the school level by the influence of SADTU on the school environment (ibid, 2015:8). There may also be concerns that implementing a 'one size fits all' approach in assessing principals is unfair given large contextual differences across schools (Christie, 2010). While these may be valid concerns, labour law and union strength is strongly swayed in favour of employees to prevent unfair dismissals.

Improved performance management systems must be packaged carefully to minimise resistance. Proposals are likely to be more palatable where performance evaluations are strongly connected to training and mentoring to actively address areas of non-performance. More generally, carefully crafted packages of policies are necessary to ensure that the individual aims of each are realised. This is particularly relevant in reference to the NDP proposals to delegate more authority to school leaders. Hanushek and Woesmann (2007), in reviewing evidence on strategies for school improvement, note that providing increased decision-making authority to schools has been linked to improved school outcomes, even in developing country contexts. They caution, however, that "Local autonomy without strong accountability may be worse than doing nothing" (ibid 2007:74). The NDP does suggest that more autonomy be given to school principals *conditional* on exhibiting a level of leadership quality. This indirectly implies that this policy be packaged with performance management where a rewarded outcome of satisfactory school assessments is increased autonomy.

The NDP proposal to raise minimum principal qualification criteria to having an Advanced Certificate in Education (ACE) in school leadership and management is less supported by the available evidence. Research has previously evaluated the effectiveness of the ACE programme in raising the quality of school leaders (Bush et al., 2009). While the report by Bush et al makes many positive qualitative links between the programme and its ability to raise principal competencies, preliminary evidence indicated that there was no conclusive improvement in the performance of the schools led by these ACE trained graduates. It is cautioned that unless the revised ACE programme results in improved leadership and management competencies, it is unlikely to act as a useful signal of principal quality. Rather, it may have the unintended consequence of reducing the available pool of potential principal candidates to those who have this certificate. Already the pool of suitable principals is likely to be too small to meet the demand for the substantial number of retirements taking place. Where policy as set out in the PAMs requires that prospective principals possess an education qualification, this rules out hiring individuals who have good management skills and experience but who have not qualified as an educator.

**Table 10: The National Development Plan proposals to improve school leadership – progress and relevance**

| NDP proposals for improving the calibre of school leadership | Level of progress to date in converting a plan to policy | Relevance in terms of *local and international evidence* | Expected resistance to proposed plan |
|---|---|---|---|
| **A: Improving the principal appointment process** | | | |
| Competency-based assessments to inform the appointment process | High. Currently being piloted through the Western Cape and in Gauteng education departments. | High. The unequal distribution of principals across schools is largely due to the initial sorting of principals to schools than to transfer patterns. Initial sorting must therefore be targeted. Address distributional inequalities through improving current appointment processes and limiting union interference. Traditional credentials as measured in payroll (REQV and years of service) are poor signals of principal quality. | Medium |
| Increase the minimum qualification criteria to include having an ACE in School Management and Leadership | Medium. The ACE has been evaluated and revised (Bush et al, 2009). | Low to medium. No significant improvement in school performance observed in schools with ACE trained candidates (Bush et al, 2009). No link between higher principal REQV levels and school performance in the majority of schools. Cannot rule out however, that well-designed training programmes may be of value. | Low |
| **B: Performance management** | | | |
| Performance contracts for school principals | Medium. Draft performance management agreements to replace IQMS for principals resisted. Green Paper on Standards for Principalship. Education Law Amendments Act of 2007. | High. With low levels of principal mobility in South Africa it is necessary to improve the calibre of incumbent principals over the course of their tenure. Reward performance rather than qualifications and seniority. | High |
| Replace underperforming principals with better ones | | | Very high |
| **C: Provide principals with greater powers over school management** | Low to medium. Although policies are supportive of the empowering of principals, there is a strong *a priori* resistance in government institutions to delegating authority (NPC, 2012: 426). | No local evidence exists that links management powers to increased learning in schools. But international evidence generally supports the decentralisation of decision-making to the school-level in improving school performance (Hanushek and Woesmann, 2007). However, increased autonomy must be packaged with accountability measures. | Medium to high. |

It is noted that the ACE programme does make useful provisions for forms of mentoring and on-site training for school principals in raising leadership quality. In light of the evidence presented, the extensive number of principals who are retiring, particularly those from well-functioning schools, provides a pool of available trainers and mentors for growing numbers of newly appointed principals. In this vein, well-developed induction programmes for newly appointed principals are an important consideration given the expected increase in new principal appointments.[33] While efforts have been taken by the DBE to provide induction training to newly appointed principals in the past, there is room for improvement in this regard (Bush and Odura, 2006). In the 2004 and 2007 national Systemic Evaluations, intermediate and foundation phase school principals were asked whether they had received any induction training since their appointment as a principal. Between 62 and 66 percent of principals leading these schools responded positively (see Table A.5). Provided that similar patterns of training hold in recent years, another third of principals could be exposed to induction training.

An additional policy that not considered in the NDP, and is relevant in light of the evidence provided, is introducing monetary incentives to improve the available pool of principal candidates applying for posts in hard-to-staff and poor performing schools.[34] Directing a pool of good applicants to poorer schools is particularly important not only for improving the distribution of principals across schools, but to meet a much larger demand for replacement principals in these schools. In the long-run, however, Clotfelter et al (2007) identify that where the principal labour market is closely linked to the teacher labour market, improvements in the distribution of principals across schools involves altering the labour market for teachers, making high poverty schools more competitive.[35]

In conclusion, this research has contributed to an evidence base on principals to inform policy aimed at improving the quality of school leadership and management. In light of the historical levels of resistance from teacher unions in agreeing to new performance management proposals, it may take many years before more effective performance management system for principals is finalised and then implemented. Nevertheless, the urgency to implement policies to support the right appointments of new principals cannot be reiterated enough in light of the substantial and increasing number of principal retirements. With each new principal placement, the leadership trajectory of the average school is established for almost a decade. Evidence-based policy-making has a strong role to play in getting this right.

[33] In the United States, exposure to induction training has been identified as reducing the likelihood that newly appointed teachers move to other schools or leave the teaching profession (Smith and Ingersoll, 2004).

[34] In recent years, provinces have begun to implement incentives for teachers in hard-to-staff schools (see for example ELRC-KZN chamber, 2014).

[35] This is likely to be challenging in an existing reality where teacher mobility patterns are in the direction of better performing schools (Gustafsson, 2015), even in the absence of test-based accountability measures. It is expected that these better performing schools are also more likely to be wealthier schools.

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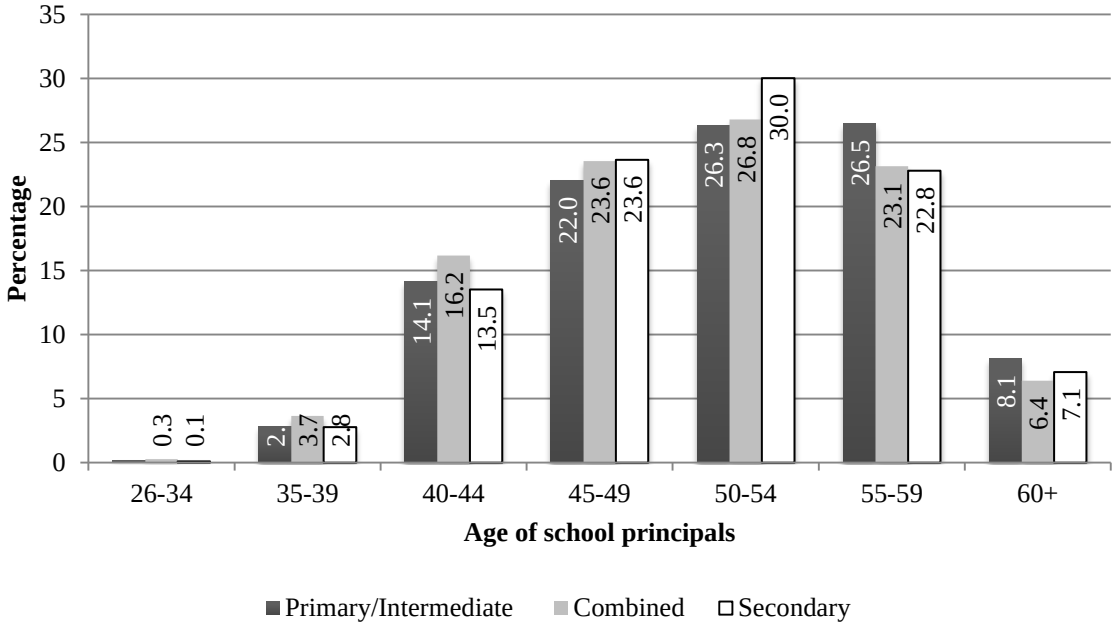
# Appendix

**Figure A.1: Age profile of school principals in 2012 by the phase level of the school they lead**




**Source**: Persal-EMIS matched dataset. **Notes**: Calculations are based on a sample of principals in Persal that could be matched to a school and are identified as the principal of the school. Educators in the Persal data are identified as principals if their rank title specifies that they are a principal. Where there are two or more principals in a school, only the clear institutional leader (identified as having the highest post level among principals in a school or the highest salary) is retained in the sample. The 2012 sample includes 21 810 principals - 12 596 in primary schools, 3 617 in combined schools and 5 597 in secondary schools.

**Table A.1: OLS regressions to identify factors associated with the credentials of newly appointed principals**

| | Dependent variable: REQV level (continuous) | | Dependent variable: Years of service | |
|---|---|---|---|---|
| *DBE wealth quintile:* | | | | |
| Quintile 2 | 0.029 | (0.034) | 0.930*** | (0.266) |
| Quintile 3 | 0.154*** | (0.037) | 1.623*** | (0.290) |
| Quintile 4 | 0.033 | (0.054) | 2.416*** | (0.416) |
| Quintile 5 | 0.236** | (0.075) | 2.897*** | (0.585) |
| *School phase:* | | | | |
| Combined | -0.076* | (0.039) | -0.595* | (0.306) |
| Secondary | 0.097** | (0.035) | -0.790** | (0.274) |
| *Former department classification:* | | | | |
| Independent homeland | -0.036 | (0.048) | 2.073*** | (0.373) |
| Non-independent homeland | -0.026 | (0.048) | 1.312*** | (0.373) |
| House of Assemblies (white) | -0.019 | (0.080) | -1.530** | (0.623) |
| House of Delegates (Indian) | 0.192 | (0.120) | 5.026*** | (0.931) |
| House of Representatives (Coloured) | -0.133 | (0.085) | 2.786*** | (0.661) |
| New School | -0.058 | (0.058) | -0.764* | (0.450) |
| Classification Unknown | -0.157** | (0.070) | -0.114 | (0.545) |
| *Other school characteristics:* | | | | |
| % students that are black | 0.000 | (0.001) | 0.008 | (0.007) |
| Location: Urban | 0.152*** | (0.036) | 1.385*** | (0.277) |
| Total school enrolment | 0.000** | (0.000) | 0.001 | (0.001) |
| Number of educators | 0.002 | (0.004) | 0.064** | (0.029) |
| *Provincial location:* | | | | |
| Eastern Cape | -0.319*** | (0.075) | 3.090*** | (0.587) |
| Free State | 0.138 | (0.091) | 2.332** | (0.710) |
| Gauteng | 0.142* | (0.078) | 1.414** | (0.607) |
| KwaZulu-Natal | 0.136* | (0.077) | 1.509** | (0.598) |
| Limpopo | 0.069 | (0.081) | 4.391*** | (0.630) |
| Mpumulanga | 0.241** | (0.085) | 2.730*** | (0.658) |
| Northern Cape | -0.210** | (0.095) | 1.542** | (0.741) |
| North West | 0.106 | (0.085) | 2.209*** | (0.660) |
| Constant | 14.256*** | (0.099) | 13.054*** | (0.771) |
| R-squared | 0.117 | | 0.088 | |
| Number of newly appointed principals | 5 235 | | 5 237 | |
| F stat (p-value) | 27.678 (0.000) | | 20.093 (0.000) | |

**Source:** Matched Persal-EMIS dataset. **Notes**: Sample includes all newly appointed principals between 2008 and 2010 or 2010 and 2012. Base categories include quintile one schools, schools that were formerly administrated under the Department of Education and Training (black), rural schools, primary or intermediate schools and schools in the Western Cape province. Statistically significant at * p<0.1, **p<0.05, ***p<0.001. Standard errors are in parentheses.

**Table A.2: Benchmarks of annual employee turnover rates**

| | Annual Turnover Rate | Source |
|---|---|---|
| **SA public sector departments** | | |
| Small size (<1000 employees) | 31.5% (mobility & attrition) | Pillay, de Beer and Duffy (2012)* |
| Medium size (1001-5000 employees) | 22.5% (mobility & attrition) | |
| Large (>5000 employees) | 9.2% (mobility & attrition) | |
| **Teacher turnover** | | |
| Botswana 2001 | 14% (attrition) | Educators Macro Indicators Report (2009) in Pitsoe (2013) |
| Swaziland 2002 | 12% (attrition) | |
| United Kingdom (2000) | 15.3% (attrition) | |
| **Principal turnover** | | |
| United States (2005-2009) | 20%-30% | Miller (2013); Beteille, Kalogrides and Loeb (2012) |

**Notes:** *Estimates are obtained from monthly payroll (Persal) data.

**Table A.3: Years of experience and current tenure, principals in Verification-ANA 2013**

| | Total years of experience as a principal* | | | | | | Total years as a principal* at current school (tenure) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | p10 | p50 | p90 | n | Mean | SD | p10 | p50 | p90 | n |
| All schools | 11.0 | 8.3 | 2 | 9 | 22 | 1 713 | 9.6 | 7.5 | 1 | 8 | 20 | 1 705 |
| Quintile 1 | 12.3 | 8.6 | 2 | 11 | 23 | 450 | 10.9 | 8.1 | 2 | 9 | 22 | 447 |
| Quintile 2 | 11.3 | 8.4 | 2 | 10 | 22 | 380 | 9.7 | 7.4 | 1 | 8 | 20 | 378 |
| Quintile 3 | 10.1 | 8.3 | 1 | 8 | 22 | 400 | 9.0 | 7.8 | 1 | 6 | 20 | 398 |
| Quintile 4 | 9.8 | 7.3 | 2 | 9 | 20 | 260 | 8.5 | 6.8 | 1 | 7 | 19 | 259 |
| Quintile 5 | 11.2 | 8.0 | 2 | 10 | 21 | 221 | 9.5 | 6.4 | 2 | 8 | 17 | 221 |

**Source:** V-ANA 2013. **Notes:** Not weighted. *Years as principal include being an acting or permanent principal. The sample is limited to individuals who respond that they are the principal of the school. Of a total of 1 937 individuals who responded to the principal questionnaire, only 1 753 indicated that they were the principal responding. A further 40 are missing data on total years as a principal or acting principal while 48 are missing data on years as principal in the current school. SD = standard deviation; p10 = value at the 10th percentile; p50 = value at the 50th percentile (median); p90 = value at the 90th percentile.

## Table A.4: Principal turnover disaggregated by type

| | 2004-2008 | | 2008-2012 | |
|---|---|---|---|---|
| | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Principal turnover | 4 746 | 23.4 | 6 365 | 28.7 |
| No principal turnover | 15 539 | 76.6 | 15 846 | 71.3 |
| **Total** | **20 285** | **100** | **22 211** | **100** |
| **Turnover by type** | | | | |
| ***Mobility (sub-total)*** | ***1 581*** | ***7.8*** | ***1 618*** | ***7.3*** |
| *Moves to a principal post in another institution* | 864 | *4.3* | 840 | *3.8* |
| *Moves to post in administration* | 477 | *2.4* | 299 | *1.3* |
| *Moves to lower rank in same institution* | 25 | *0.1* | 121 | *0.5* |
| *Moves into lower rank in another institution* | 215 | *1.1* | 358 | *1.6* |
| ***Attrition (sub-total)*** | ***3 165*** | ***15.6*** | ***4 747*** | ***21.4*** |
| *Retirement related (>=56 years in 2008)* | 1 455 | *7.2* | 2 922 | *13.2* |
| *Non-retirement related (<56 years or less)* | 1 710 | *8.4* | 1 825 | *8.2* |
| ***Total turnover*** | **4 746** | ***23.4*** | **6 365** | ***28.7*** |

**Source:** Persal-EMIS matched dataset **Notes:** Compulsory retirement age for educators in South Africa is 65 years; but pensions can be accessed at 60 years without reducing take-home pension amounts. It follows that 60 is likely to be the *de jure* retirement age. Where turnover is identified between year t and t+4 then a principal is identified as likely to retire over the period if they are 56 years or older in year t.

## Table A.5: Induction training for school principals, Systemic Evaluation 2004 and 2007

| | Systemic Evaluation 2004 (Intermediate phase) | | | Systemic Evaluation 2007 (Primary phase) | | |
|---|---|---|---|---|---|---|
| | **All schools** | **Poorest 60% of schools** | **Wealthiest 20% of schools** | **All schools** | **Poorest 60% of schools** | **Wealthiest 20% of schools** |
| Received induction training after appointed principal (%) | 61.99 | 65.18* | 55.45 | 65.62 | 67.30* | 63.00 |
| | (1.65) | (2.07) | (2.69) | (1.01) | (1.30) | (1.65) |
| N (number of principals) | 948 | 579 | 369 | 2 230 | 1 315 | 895 |

**Source:** National Systemic Evaluations 2004 and 2007. **Notes:** Standard errors are in parentheses. *The mean of the poorest sixty percent of schools is statistically significantly different from the mean of the wealthiest twenty percent schools using a 95 percent confidence interval. The wealth of schools is established by identifying the average socio-economic status (SES) of students in the school using an asset-based index of possessions. Where the number of poor and the wealthier schools do not add up to total schools, school SES is missing. **About the surveys:** The Intermediate Phase Systemic Evaluation in 2004 was conducted between September and October. Its main aim was to provide systems-based information about student performance at the intermediate phase in a sample of 998 schools designed to be representative of schools offering grade six. The survey was conducted to assess the competencies of students at the end of grade six in three learning areas: English, Mathematics and the Natural Sciences. Teacher, principal and home background questionnaires were also administered. The 2007 Systemic Evaluation, however, evaluated performance at the grade three level and 2 342 schools were visited. Schools in this sample are representative of schools with at least 15 grade three students.

**The sequential logit model**

Following an explanation by Nagakura and Kobayashi (2007), the sequential logit model first suggested by Martin Buis (2008) can be defined in the following way. In the general form, suppose an individual has J alternatives to choose from which can be divided into H sub-choice sets, $A_1, A_{2,} \dots A_H$. The individual's choice process is separated into two stages. In the first stage, individuals choose between one of the H sub-choice sets and then in second stage choose alternative $j \in A_h$. A multinomial logit model can be applied to model the two stages where the number of J alternatives exceeds three. In this application of the sequential logit model, the principals' decision framework is limited to only three alternatives: staying, moving within the system or leaving. With only three alternatives, each of the two stages in the principal's decision then reduces to a logit model. In the first stage, the sub-choices involve either staying in a position or transitioning out of the school. The second stage involves choosing between moving within the system and moving out of the system. The following models apply:

In the first stage

$$\Pr(y \in A_h) = \frac{\exp(x_i'\delta)}{1+\exp(x_i'\delta)} \text{ for h = 1 or 2}$$

In the second stage

$$\Pr(y = j|A_h) = \frac{\exp(x_i'\gamma)}{1+\exp(x_i'\gamma)}$$

The same set of x covariates (school and principal characteristics) are applied to each stage but by nature of the model the coefficients on covariates are allowed to vary across each stage.

## Table A.6: Sequential logit and multinomial logit estimations of principal transitions

| | Multinomial logit | | | | Stage 1 sequential logit | | | Stage 2 sequential logit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moving vs. staying | Leaving vs. staying | Moving vs. staying | Leaving vs. staying | logit (1 = turnover/transition out of school; 0 = stays in school) | | | logit (1 = move within system; 0 = leave system) | | |
| | 04-'08 | | 08-'12 | | 04-'08 | 08-'12 (1) | 08-'12 (2) | 04-'08 | 08-'12 (1) | 08-'12 (2) |
| ***Principal characteristics*** | | | | | | | | | | |
| Female | -0.396*** | -0.449*** | -0.261** | -0.699*** | -0.419*** | -0.348*** | -0.430*** | -0.002 | 0.391** | 0.348* |
| | (0.119) | (0.128) | (0.114) | (0.132) | (0.089) | (0.085) | (0.087) | (0.173) | (0.176) | (0.184) |
| Age 26-34 | 1.113*** | 0.259 | 0.711** | -0.103 | 0.774*** | 0.639*** | 0.399 | 0.807*** | 0.991** | 0.704 |
| | (0.166) | (0.232) | (0.294) | (0.421) | (0.143) | (0.228) | (0.251) | (0.263) | (0.437) | (0.531) |
| Age 35-39 | 0.568*** | 0.306*** | 0.432*** | -0.134 | 0.451*** | 0.353*** | 0.265*** | 0.217 | 0.755*** | 0.538*** |
| | (0.098) | (0.112) | (0.128) | (0.151) | (0.077) | (0.089) | (0.100) | (0.143) | (0.172) | (0.196) |
| Age 40-44 | 0.129 | 0.221** | 0.320*** | -0.056 | 0.171** | 0.181*** | 0.205*** | -0.117 | 0.557*** | 0.371*** |
| | (0.088) | (0.093) | (0.096) | (0.102) | (0.067) | (0.068) | (0.072) | (0.125) | (0.133) | (0.139) |
| Age 50-54 | -0.430*** | 0.703*** | -0.337*** | 0.339*** | 0.234*** | 0.182*** | 0.03 | -1.159*** | -1.212*** | -0.807*** |
| | (0.097) | (0.083) | (0.109) | (0.081) | (0.064) | (0.063) | (0.066) | (0.125) | (0.130) | (0.140) |
| Age 55-59 | -0.921*** | 1.920*** | -0.420** | 1.792*** | 1.173*** | 1.673*** | 1.299*** | -2.836*** | -3.092*** | -2.288*** |
| | (0.168) | (0.086) | (0.170) | (0.085) | (0.071) | (0.063) | (0.073) | (0.184) | (0.163) | (0.196) |
| Age 60 | 0.581** | 3.833*** | 0.368 | 3.477*** | 3.064*** | 3.561*** | 2.953*** | -3.209*** | -4.200*** | -3.230*** |
| | (0.275) | (0.140) | (0.331) | (0.138) | (0.130) | (0.117) | (0.129) | (0.269) | (0.333) | (0.326) |
| Indian/Asian | -1.306** | -0.225 | -1.150** | -1.504*** | -0.754** | -1.597*** | -1.622*** | -1.307* | -0.127 | -0.245 |
| | (0.615) | (0.458) | (0.576) | (0.417) | (0.375) | (0.346) | (0.352) | (0.723) | (0.856) | (0.854) |
| Coloured | -1.176*** | -0.004 | -0.683** | 0.005 | -0.619*** | -0.286 | -0.329 | -1.075*** | -1.009** | -0.978* |
| | (0.280) | (0.303) | (0.321) | (0.322) | (0.219) | (0.240) | (0.239) | (0.376) | (0.502) | (0.501) |
| White | -0.637** | -0.058 | -0.793** | -0.252 | -0.390** | -0.758*** | -0.610*** | -0.740** | -0.476 | -0.743 |
| | (0.253) | (0.273) | (0.311) | (0.294) | (0.197) | (0.227) | (0.226) | (0.357) | (0.474) | (0.477) |
| >=80% black students | -1.047*** | -0.014 | -0.428* | 0.164 | -0.564*** | -0.213 | -0.14 | -1.081*** | -0.805** | -0.889** |
| | (0.173) | (0.219) | (0.251) | (0.249) | (0.150) | (0.190) | (0.188) | (0.303) | (0.385) | (0.392) |
| Asian * >=80% black students | 1.899*** | 0.415 | 1.219** | 0.861** | 1.114*** | 1.221*** | 1.201*** | 1.536** | 1.039 | 1.134 |
| | (0.541) | (0.421) | (0.543) | (0.405) | (0.338) | (0.328) | (0.333) | (0.754) | (0.824) | (0.853) |
| Coloured* >=80% black students | 2.195*** | 0.294 | 0.729 | 0.185 | 1.299*** | 0.417 | 0.435 | 2.127*** | 1.166 | 0.99 |
| | (0.356) | (0.393) | (0.474) | (0.400) | (0.284) | (0.321) | (0.323) | (0.521) | (0.752) | (0.733) |
| White* >=80% black students | 2.182*** | 0.217 | 0.502 | 0.45 | 1.180*** | 0.684*** | 0.599** | 2.152*** | 0.205 | 0.202 |
| | (0.260) | (0.286) | (0.356) | (0.303) | (0.209) | (0.240) | (0.239) | (0.407) | (0.524) | (0.532) |

| Continued…. | Multinomial logit | | | | Stage 1 sequential logit | | | Stage 2 sequential logit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moving vs. staying | Leaving vs. staying | Moving vs. staying | Leaving vs. staying | logit (1 = turnover/transition out of school; 0 = stays in school) | | | logit (1 = move within system; 0 = leave system) | | |
| | 04-'08 | | 08-'12 | | 04-'08 | 08-'12 (1) | 08-'12 (2) | 04-'08 | 08-'12 (1) | 08-'12 (2) |
| REQV 10-12 | | | -0.116 | 0.796*** | | | 0.527*** | | | -0.849*** |
| | | | (0.187) | (0.117) | | | (0.106) | | | (0.231) |
| REQV 13 | | | 0.045 | 0.210*** | | | 0.166*** | | | -0.261** |
| | | | (0.084) | (0.056) | | | (0.048) | | | (0.115) |
| REQV 15 | | | 0.302*** | -0.142*** | | | 0.004 | | | 0.345*** |
| | | | (0.074) | (0.054) | | | (0.045) | | | (0.102) |
| REQV 16-17 | | | 0.394*** | -0.297*** | | | -0.083 | | | 0.603*** |
| | | | (0.088) | (0.066) | | | (0.055) | | | (0.128) |
| Salary in R1000s in 2008 prices | | | -0.013*** | 0.002 | | | -0.004*** | | | -0.010*** |
| | | | (0.002) | (0.001) | | | (0.001) | | | (0.002) |
| Years of service | | | -0.019 | -0.091*** | | | -0.102*** | | | 0.037 |
| | | | (0.021) | (0.016) | | | (0.012) | | | (0.029) |
| Years of service squared | | | 0 | 0.003*** | | | 0.003*** | | | -0.002*** |
| | | | (0.001) | (0.000) | | | (0.000) | | | (0.001) |
| Number of sick leave days taken | | | 0.018*** | 0.035*** | | | 0.030*** | | | -0.018*** |
| | | | (0.004) | (0.003) | | | (0.002) | | | (0.005) |
| Moved schools 2004-2008 | | | 0.371*** | 0.228** | | | 0.275*** | | | 0.121 |
| | | | (0.124) | (0.096) | | | (0.080) | | | (0.168) |
| ***School characteristics:*** | | | | | | | | | | |
| School location: Urban | 0.071 | 0.012 | -0.206** | 0.004 | 0.036 | -0.098** | -0.077 | 0.099 | -0.339*** | -0.265** |
| | (0.075) | (0.062) | (0.084) | (0.059) | (0.050) | (0.049) | (0.050) | (0.103) | (0.115) | (0.118) |
| School phase: Combined | -0.01 | -0.017 | 0.257** | 0.085 | -0.021 | 0.106* | 0.147** | -0.028 | 0.032 | 0.064 |
| | (0.100) | (0.080) | (0.104) | (0.072) | (0.066) | (0.059) | (0.060) | (0.126) | (0.142) | (0.145) |
| School phase: Secondary | 0.501*** | 0.118** | 0.609*** | 0.205*** | 0.263*** | 0.198*** | 0.333*** | 0.383*** | 0.404*** | 0.415*** |
| | (0.070) | (0.058) | (0.080) | (0.057) | (0.047) | (0.047) | (0.050) | (0.095) | (0.103) | (0.111) |
| Number of teachers per 100 students | 0.036** | 0.018 | 0.064*** | 0.041*** | 0.027** | 0.062*** | 0.057*** | 0.014 | 0.047 | 0.043 |
| | (0.014) | (0.014) | (0.023) | (0.015) | (0.011) | (0.019) | (0.018) | (0.025) | (0.032) | (0.033) |
| Total enrollment in 100s | -0.044*** | -0.015* | -0.014 | -0.022** | -0.025*** | -0.045*** | -0.016* | -0.046*** | -0.080*** | -0.019 |
| | (0.011) | (0.008) | (0.019) | (0.010) | (0.007) | (0.008) | (0.009) | (0.014) | (0.018) | (0.022) |

| Continued…. | Multinomial logit | | | | Stage 1 sequential logit | | | Stage 2 sequential logit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moving vs. staying | Leaving vs. staying | Moving vs. staying | Leaving vs. staying | logit (1 = turnover/transition out of school; 0 = stays in school) | | | logit (1 = move within system; 0 = leave system) | | |
| | 04-'08 | | 08-'12 | | 04-'08 | 08-'12 (1) | 08-'12 (2) | 04-'08 | 08-'12 (1) | 08-'12 (2) |
| Quintile 2 | 0.009 | -0.032 | -0.039 | -0.065 | -0.015 | -0.067 | -0.07 | 0.002 | 0.017 | 0.012 |
| | (0.075) | (0.061) | (0.076) | (0.054) | (0.049) | (0.045) | (0.045) | (0.101) | (0.102) | (0.105) |
| Quintile 3 | 0.157** | -0.028 | 0.04 | -0.215*** | 0.04 | -0.153*** | -0.137*** | 0.11 | 0.072 | 0.095 |
| | (0.079) | (0.064) | (0.081) | (0.059) | (0.052) | (0.048) | (0.049) | (0.105) | (0.112) | (0.115) |
| Quintile 4 | 0.249** | 0.001 | 0.213* | -0.14 | 0.096 | -0.009 | -0.021 | 0.208 | 0.196 | 0.211 |
| | (0.111) | (0.091) | (0.119) | (0.085) | (0.074) | (0.071) | (0.072) | (0.150) | (0.167) | (0.174) |
| Quintile 5 | 0.14 | -0.134 | 0.287* | -0.162 | -0.032 | 0.023 | 0.004 | 0.028 | 0.366 | 0.405* |
| | (0.154) | (0.123) | (0.162) | (0.118) | (0.101) | (0.098) | (0.100) | (0.201) | (0.233) | (0.240) |
| Independent Homeland | -0.289*** | -0.230*** | -0.379*** | -0.241*** | -0.275*** | -0.326*** | -0.291*** | -0.192 | -0.280* | -0.218 |
| | (0.103) | (0.085) | (0.116) | (0.076) | (0.069) | (0.065) | (0.066) | (0.138) | (0.153) | (0.158) |
| Non-independent homeland | -0.339*** | 0.125 | -0.286*** | 0.191** | -0.043 | -0.016 | 0.049 | -0.461*** | -0.281** | -0.148 |
| | (0.105) | (0.084) | (0.105) | (0.078) | (0.068) | (0.064) | (0.065) | (0.139) | (0.142) | (0.145) |
| House of Assemblies | -0.938*** | 0.062 | -0.172 | -0.236 | -0.364** | -0.255* | -0.19 | -0.943*** | -0.348 | -0.285 |
| | (0.199) | (0.183) | (0.212) | (0.171) | (0.143) | (0.139) | (0.140) | (0.256) | (0.297) | (0.299) |
| House of Delegates | -0.840* | -0.691* | 0.133 | 0.521* | -0.780** | 0.333 | 0.367 | -0.289 | -0.366 | -0.315 |
| | (0.504) | (0.380) | (0.443) | (0.306) | (0.317) | (0.258) | (0.266) | (0.635) | (0.658) | (0.623) |
| House of Representatives | -0.333* | -0.219 | -0.283 | -0.367* | -0.263* | -0.332** | -0.320** | -0.201 | 0.215 | 0.262 |
| | (0.200) | (0.207) | (0.233) | (0.204) | (0.154) | (0.157) | (0.160) | (0.270) | (0.321) | (0.318) |
| New School | -0.423*** | -0.015 | -0.280** | -0.016 | -0.189** | -0.163** | -0.124 | -0.447*** | -0.181 | -0.179 |
| | (0.121) | (0.109) | (0.117) | (0.098) | (0.085) | (0.080) | (0.080) | (0.166) | (0.166) | (0.165) |
| Former classification unknown | -0.181 | 0.083 | -0.236 | 0.1 | -0.032 | -0.087 | -0.028 | -0.557** | -0.403* | -0.422* |
| | (0.216) | (0.187) | (0.186) | (0.144) | (0.148) | (0.117) | (0.118) | (0.282) | (0.236) | (0.242) |
| Constant | -0.884*** | -2.033*** | 0.558 | -1.953*** | -0.704*** | -1.176*** | 0.114 | 1.502*** | 0.497 | 2.903*** |
| | (0.227) | (0.252) | (0.490) | (0.372) | (0.182) | (0.234) | (0.321) | (0.359) | (0.475) | (0.653) |
| Pseudo R-squared | 0.137 | | 0.231 | | 0.107 | 0.159 | 0.177 | 0.245 | 0.381 | 0.406 |
| Log likelihood | -12 100 | | -12 800 | | -9 813 | -11 100 | -10 800 | -2 276 | -2 205 | -2 091 |
| Number of observations | 20 155 | | 22 035 | | 20 155 | 22 105 | 22 035 | 4 733 | 6 299 | 6 231 |

**Source:** Persal-EMIS matched dataset. **Notes:** Omitted categories are principal is male, principal is aged 45 to 49, principal is black, student composition is non-majority black (<80%), principals with a REQV level of 14, rural schools, primary schools and quintile one schools. Province dummies are included but not shown. Female interactions with age are included but are not shown. Sample sizes vary for the 2008 to 2012 regressions due to missing information on principal characteristics. Standard errors are in parentheses. Statistically signficant at *p<0.10, **p<0.05, ***p<0.01.