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MARTIN GUSTAFSSON AND FIROZ PATEL[1]

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ABSTRACT

A review of a few input-output models indicates the importance of teacher ability, which may be independent of years of training, for improving pupil performance. A historical analysis confirms the substantial pay increases experienced by teachers in the mid-1990s, moderate pay increases in real terms since 1996, and a falling ratio of teacher pay to GDP per capita. Analysis of Labour Force Survey data reveals that in 2007 teachers were paid less than other professionals, even if the comparison is made conditional on a number of non-pay variables. Working hours is not used as a conditioning variable, however, and low pupil performance levels suggest that the average productivity of teachers is not high. In 2007 the age-pay slope for teachers was flatter than that for other professionals. The impact of the 2008 changes to the teacher pay system are considered. These changes initiate a gradual closing of the pay gap between teachers and other professionals, and convert a rather flat age-pay slope for teachers into one that compares favourably to that of other professionals, and to those of teachers in other countries. The fact that the new system links progression up the salary scales to the behavioural input characteristics of teachers is line with good practice elsewhere, but the linking of pupil performance to teacher pay is probably best undertaken collectively at the level of the school. The teaching hours put in by teachers compares favourably to those in other countries, yet the utilisation of teacher time in many schools is not optimal, resulting in class sizes that are unacceptably high.

Keywords: Teacher, School, Wage Differentials, Incentive, South Africa
JEL codes: H52, I28, J31

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1 Introduction and background

In South Africa there are around 380,000 publicly paid educators whose pay is managed through a single pay system, a term we take to describe, mainly, pay scales and promotion rules, but even other conditions of service matters linked to the employment contract such as teacher deployment and working hours. The power to change this pay system rests largely with the national Minister of Education, though historically teacher unions play an important role in determining any changes through negotiations in the Education Labour Relations Council (ELRC). No pay system in the country encompasses as many employees as the educator one. The educator wage bill amounts to around 3.5% of GDP, and about 3.0% of economically active South Africans are educators (here we are counting only publicly employed educators[2]). However, the role that the country's publicly employed educators play in the social and economic development of the country goes well beyond what these figures indicate and, as we shall see below, is often under-estimated.

Here we shall follow the common practice of referring to the 365,000 educators who spend at least some time teaching in classrooms, as 'teachers'. The remaining 15,000 educators are essentially engaged in managing the teachers[3].

As background to the main focus of the paper it is useful to restate where South Africa stands with respect to the quantity of schooling, and its quality. The country has reached a stage at which the quality challenges in the schooling system clearly overshadow the quantity challenges. In the past, enrolment ratios were not high. This explains why the average years of education of South African adults is relatively low – it stands at around 9.0 years, against for instance 10.0 and 10.8 years in the middle income countries Malaysia and Chile[4]. However, at least as far as pre-tertiary enrolment levels are concerned, South Africa is well placed to close this gap with respect to adult education levels – for example, South Africa's secondary level gross enrolment ratio (93.0) and primary to secondary school life expectancy statistic (12.1) are considerably better than those of both Malaysia (76.0 and 10.8) and Chile (91.0 and 11.7) and middle income countries in general[5]. South Africa's tertiary enrolment level, on the other hand, does not compare that well to those of other middle income countries, but as our focus is on educators working at the pre-tertiary level, this important matter will not receive attention in the paper.

Indicators of the quality of education at the pre-tertiary level point very clearly towards serious problems. In both the 2003 TIMSS assessment (Grade 8 mathematics and science, with 21 of 45 countries being developing countries) and the 2006 PIRLS assessment (Grade 5 reading, with 11 of 39 countries being developing countries), South Africa fared worst of all countries (though it should be kept in mind that countries participating in these international benchmarking exercises would tend to be countries that take education rather seriously). In the regional 2000 SACMEQ programme (Grade 6), South Africa came eighth and ninth out of fourteen countries for reading and mathematics respectively[6], this despite the fact that South

[2] Around 550,000 people define themselves as educators of some type in Stats SA household surveys, which translates to 4.5% of workers.
[3] In splitting the total here, we have counted school principals who teach (an estimated 85% of all the 25,000 principals) as teachers, meaning most of the 15,000 managers would be educators not based in schools.
[4] Cohen and Soto (2001).
[5] UNESCO (2007).
[6] Mullis, Martin, Gonzalez and Chrostowski (2004); Mullis, Martin, Kennedy and Foy (2007); Van der Berg (2005).

Africa's per pupil[7] expenditure in schools in purchasing power parity (PPP) terms exceeds that of all the other thirteen countries except Seychelles[8].

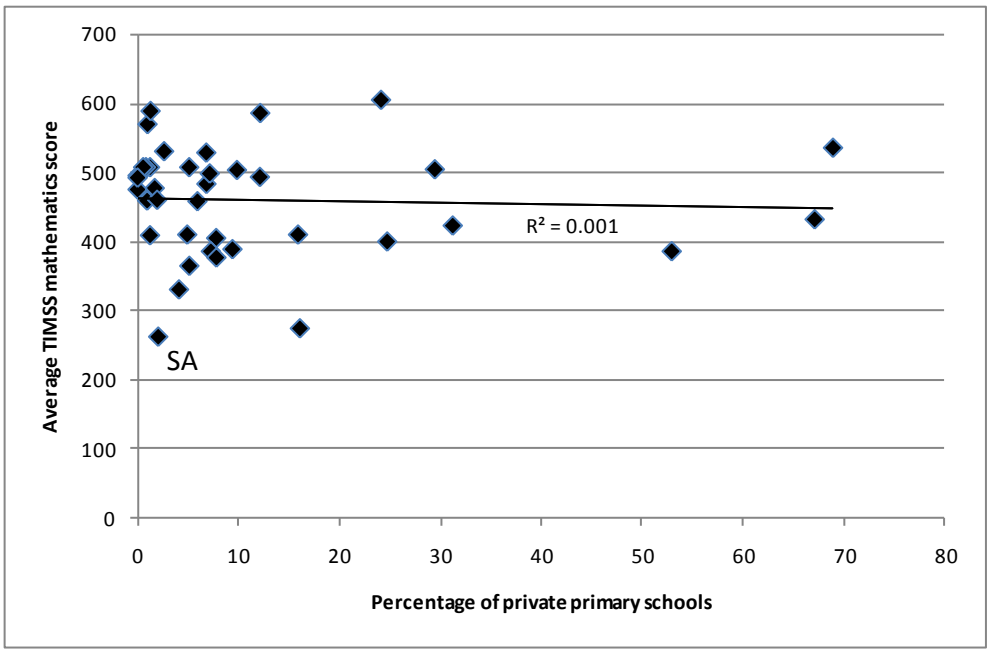
In the last decade, the improved availability of cross-country data on pupil performance of the TIMSS variety has allowed analysts to examine the links between educational quality and economic growth, and their conclusions underline very clearly the importance of quality, and the relatively unimportant role of quantity, a factor that had in earlier models (which lacked data on quality) appeared to be the determining factor. This is not to say quantity is unimportant. Without enrolments in educational institutions, there can be little human capital development. However, any growth-oriented national strategy should focus primarily on what youths are learning, rather than on how many years they spend in school.

A reluctance to focus on educational quality often stems from the assumption that educational quality is difficult to measure, or that improvements take a very long time. Arguably, both assumptions are incorrect. In recent years many examples have emerged of practical ways in which to measure educational quality in a variety of contexts. And with the right education interventions, change need not be slow. To take an example, the Philippines experienced an improvement in its Grade 8 mathematics average score, as measured by rigorous TIMSS standards, of 10% between 1999 and 2003. The opportunities for relatively fast gains are greater when the baseline is low (as is the case in South Africa and the Philippines)[9].

A further background question that often lurks behind the education policy debates is the question of whether South Africa's relatively poor average educational performance is due to the very public nature of schooling in the country. Clearly, the publicness of the schooling system is not something that can be changed easily, yet the question is an important one. Whilst we do not aim to tackle this question in depth, it seems relevant for the rest of the paper to present the rough analysis captured in the next graph. South Africa (SA) undoubtedly has a highly public schooling system, though the country is by no means exceptional in this regard. Many countries with equally public systems perform well, and there is no statistically significant link between the publicness of schooling and pupil performance[10]. Whilst one cannot rule out the possibility that educational quality might be advanced through more private participation in schooling, there is no immediately evident reason to believe that the publicness of schooling in South Africa, including the publicly managed pay system for teachers, is in itself an obstacle to better quality.

[7] The term 'pupil' is used in this paper instead of the conventional South African term 'learner' for the benefit of the non-South African reader.
[8] UNESCO (2007).
[9] Mullis, Martin, Gonzalez and Chrostowski (2004: 44).
[10] If one were to consider private secondary schools, as opposed to private primary schools, in Figure 1, the same picture emerges. Unfortunately there are no internationally standardised statistics on the characteristics of the teacher pay system (for instance whether or not teacher pay is set nationally). Comparing such statistics to average learner performance would have been more directly relevant to this analysis.

Figure 1: Educational quality and degree of private schooling



Source: Mullis, Martin, Gonzalez and Chrostowski (2004); UNESCO: UIS (2007).

In this paper, we try as far as possible to make improving educational quality the point of departure in our discussion of how the teacher pay system works, and how it should evolve. This paper was produced immediately after what can be said to be the most thoroughgoing reform of the teacher pay system since the major changes of the mid-1990s brought about to create a new post-apartheid order. The recent changes are embodied in Resolution 1 of 2008 of the Education Labour Relations Council (ELRC)[11] and bring about what is known as the Occupation Specific Dispensation (OSD). In fact, much of the analysis presented in this paper represents a slight reworking of analysis performed within the Department of Education (DoE) in preparation for Resolution 1 (this is true for the pay analysis using Labour Force Survey data). Moreover, other Department of Education analysis (relating for instance to class size) is summarised below, though not presented in detail for reasons of space. Teacher pay (and related conditions of service matters) in South Africa is a widely discussed topic, but the quantitative and economic analysis of the topic is under-developed. Misunderstandings about key quantitative issues in the discourse are not uncommon. This explains the rather strong focus in the paper on clarifying the essential statistics as well as a few key concepts as they are currently understood in the growing international literature on the topic. Detailed background statistics and some of the methodology have been relegated to the appendix.

2 The teacher factors that matter for educational quality

Numerous attempts have been made, using South African data, to identify statistically significant schooling factors that contribute to educational quality, with a view to influencing policy. It is worth reminding ourselves what the available studies say about the impact of teachers, and teacher pay.

Van der Berg and Burger (2003) arrive at a model with a statistically significant link between pupil performance (at the secondary level) and teacher pay, but attribute this link to years of post-secondary education and training of the teachers (more qualified teachers are paid more). Consistent with the international literature, there is no simple relationship between teacher pay and pupil performance. The link between years of post-secondary training and

[11] ELRC (2008).

performance, on the other hand, is more robust, though by no means simple or beyond dispute. This matter is an important one as both the pre-2008 system and particularly the 2008 OSD pay system have incentives for the upgrading of one's qualifications. The distribution of years of post-secondary training amongst publicly employed educators gives a sense of the potential magnitude of the incentive effects:

Table 1: Years of post-secondary education and training

Years of post-secondary education and training	*% of all publicly employed educators*
0	2
1	1
2	4
3	33
4	40
5	15
6	5
7	1
	100

Source: National Treasury (2007).

Crouch and Mabogoane (1998) also draw a link between the years of post-secondary training and pupil performance in secondary schooling. Gustafsson (2007), focussing on the Grade 6 level, finds that years of training effects are to a large degree actually the effects of which specific racially-defined apartheid training system teachers come from (only 12% of white teachers have fewer than four years of training, against 44% for African teachers). Generally data on training are simply a proxy for information on the teaching abilities of teachers, so one would expect to see a stronger link between teacher ability as reflected in a test or an evaluation, and pupil performance. The data have not permitted much analysis of this link in South Africa[12]. Union pressure resulted in South Africa's exclusion from the teacher testing element of the 2000 SACMEQ[13] study. Lee, Zuze and Ross (2005) find that where countries did test teachers, the SACMEQ 2000 data reveal a strong link. South Africa did test teachers in the 2007 SACMEQ run, and this obviously provides a valuable opportunity to examine these dynamics in the South African context. Of course it is not so much the finding that teacher ability influences pupil performance that is important for the policy process, but rather the detection of certain patterns within this finding, for instance the relationship between teacher ability and years of training.

Econometric analyses of school data typically find that reducing class sizes is not a feasible strategy for improving educational quality. The effects are simply too small, and the cost very large. Bhorat and Oosthuizen (2006), amongst others, reach this finding using South African data. Below, we argue that despite this finding, there is an argument for paying more attention to class size in South African policy than is currently the case.

Some analysts point to a statistically significant link between pupil performance and certain behaviour traits amongst teachers, for instance arriving late at school[14]. Such findings are obviously important for the design of monitoring systems and teacher incentives.

More qualitative studies of the schooling process have also yielded important findings, for instance that teachers require a curriculum and teaching materials that are sufficiently clear and effective in their design[15].

[12] Crouch and Perry (2002) provides a rare exception.
[13] Southern and Eastern African Consortium for Monitoring Educational Quality.
[14] See Gustafsson (2007).

The mindset that informs the search for the right 'ingredients' in the teaching process is a fairly top-down one. Government and researchers need to identify what works, and ensure that this is implemented. To some extent what is needed is the right mix of top-down strategies and strategies that recognise that the required solutions vary, depending on the schooling context, and the characteristics of individual teachers. With sufficient standardised assessment of pupils, and sufficient accountability and incentives mechanisms in place, it is possible to shift some of the responsibility for finding the right mix of 'ingredients' down to teachers themselves[16].

Here we add one analysis to the current stock of statistical input-output analyses, using the 2004 Systemic Evaluation dataset, which focuses on Grade 6. A summarised version of the results appears in the next table (for complete results see the Appendix). The analysis uses pupil observations from the 80% of pupil-weighted schools with the lowest average test scores. Such sample reduction largely eliminates the problem of mixing schools with very different histories, and different education production dynamics, in one model, which can lead to results that are difficult to interpret. The values in the table represent the increase in pupil performance, along a standardised scale, associated with an increase in the value of the explanatory variable from the 10^{th} to the 90^{th} percentile (within the sub-set of not-so-well-performing schools). The standardised test score scale is calibrated to make the difference between the 10^{th} and 90^{th} percentiles *for all observations, including those from better performing schools*, equal 100. To take an example, greater confidence on the part of a teacher in her pre-service training, equal to the difference between the 10^{th} and 90^{th} percentiles of this pre-service confidence variable in the sub-sample of schools, is associated with an improvement in the pupil's reading score of 2.3 points along the standardised scale.

[15] See for instance Schollar (2005).
[16] See Hoenack (1996: 329).

Table 2: Determinants of pupil performance

Explanatory variable	*Quest.*	*Impact on language*	*Impact on mathematics*
Teacher's years of education	E		0.63
Teacher's professional confidence	E	2.28	
Teacher's participation in in-service training	E	1.05	
Teacher's access to the internet	E	15.10	6.86
Teacher's prioritisation of salary relative to other factors	E	-0.98	-3.77
Teacher's sense of society's appreciation	E	-2.16	-3.53
Teacher's desire to stay in the profession	E	-2.01	
Average class size	P	-2.36	-2.29
Teacher's use of an African language in class	E	-3.41	
Teacher's use of assignments (language)/projects (maths)	E		0.82
Teacher's use of feedback (language)/examinations (maths)	E	-1.29	-1.15
Teacher is female	E	2.95	2.80
School fee charged	P	1.15	1.21
Existence of a library	P	4.27	5.13
Learner/toilet ratio	P	-2.91	
Existence of a computer	P	3.44	4.05
Ability of learners to borrow library books	P		-2.94
Existence of a telephone	P	6.56	
Existence of playground	P		2.81
Learner's travelling time	L	-2.23	
Parent's level of education	H	6.67	5.39
Availability of newspapers in the home	H	4.31	3.40
Learner's socio-economic status	L	7.28	6.03
Frequency of feeding scheme lunches	L	-9.53	-6.81
Learner's nutritional status	L	3.50	1.72
Educator and parent's home language is the same	EH		0.83
Age difference learner to class average	L	-11.17	-7.71
Educator and learner's gender is the same	EL	2.15	1.37

Source: DoE (2007b). Note: Blank cells indicate that there was no statistically significant association between the variable and the pupil test score. The letter symbols indicate the questionnaire that collected the data: E for educator, P for school principal, L for learner/pupil and H for home/parents.

Certain results are noteworthy from the teacher policy perspective (there are obviously results relating to other policy areas that warrant discussion too, but we shall limit ourselves to the teacher policy issues here). Raising the years of education of the teacher from 15 to 16 years (or from 3 to 4 years of post-secondary training) is associated with a statistically significant impact when it comes to mathematics, but this impact (0.63) is relatively small compared to the impact of a number of other improvements. In fact, the model suggests that the teacher's sense of professional confidence is a better predictor of better pupil performance than years of training, implying that targeting additional training towards those educators who feel they need more training could be more effective than targeting those educators with fewer years of training.

The exceptionally large association between a teacher's internet access and pupil performance is worth noting. Of course this could be an indication that teachers who make sure they acquire internet access are the kinds of teachers who produce results (as opposed to an indication that the internet is a cause of better teaching). Nonetheless, it is not impossible that to at least some degree, access to the internet improves a teacher's ability to teach. The Minister of Education has in fact expressed a political commitment to public investments in laptops, with internet access, for professional and personal use by teachers.

According to the model, where teachers prioritise pay (as opposed to other aspects of their working conditions), pupil performance is worse. There is an implication that rewarding good teachers means looking at incentives other than just salaries. Moreover, it is the teachers who are most keen on leaving the profession who perform best. This underlines the importance of identifying what incentives are effective at retaining good teachers, and ensuring that these are in place. The significance of the teacher's gender (and the relationship between the teacher's gender and the learner's gender) is very noteworthy. This is a complex matter, so the

Systemic Evaluation on its own cannot explain the full dynamic. But the data do suggest that there are problems with male teachers (at least at the Grade 6 level).

The class size reduction linked to the improvement in pupil performance of around 2.3 standardised points (for both language and mathematics), is a reduction from 55 to 33 pupils. The impact of this change is comparable to, say, the impact of replacing a teacher who is not professionally confident, with one who is. This model does then indicate that there are benefits flowing from a reduction in class size. Whether this change is feasible will be considered below.

It is also noteworthy that certain variables were found *not* to be statistically significant as explainers of better pupil performance. Teacher age, which to a large degree correlates with years of experience, does not appear to matter. This is in keeping with findings from other schooling systems, and is a matter that receives further attention below. Contact time was also not found to be significantly linked to pupil performance. Three different levels of contact time are reported by the school principal, and all three values appear in a large number of schools, so it is unlikely that the insignificance of this variable is due to inadequate variety in the responses.

3 Historical trends

If one focuses only on the system-wide statistics, and ignores for a moment the major distributional changes that have occurred within the system, then there have been two major shifts over the last twenty years. The one was a steady increase in the number of teachers in the ten years preceding 1998. The other was a sharp increase in the salaries of teachers in the mid-1990s.

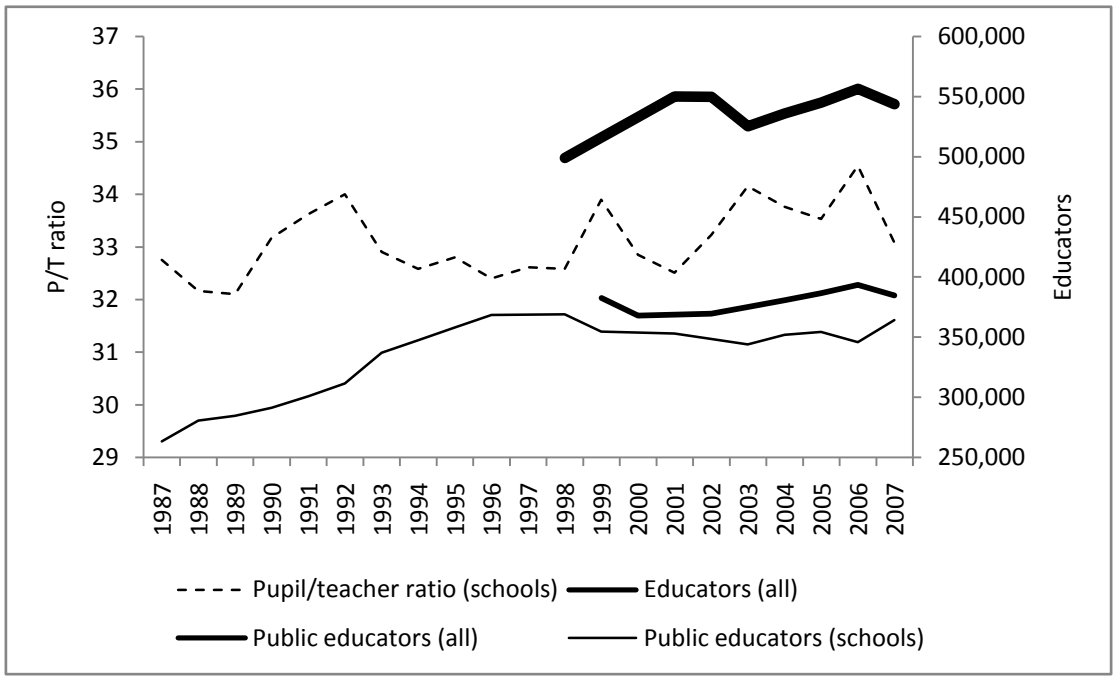
Figure 2 illustrates the first shift. Between 1987 and 1997 the number of publicly employed teachers in schools increased by around 100,000. This increase was a response to enrolment increases – the pupil/teacher (P/T) ratio in schools during this period remained fairly constant at between 32 and 34. From 1998 onwards there was a slight decline in the number of publicly employed teachers, largely as a result of a rationalisation process that saw a large number of publicly employed teachers in middle class schools, which had enjoyed a favourable staffing situation, find private employment within those same *public* schools (this employment practice became permitted in the early 1990s). Today, there are around 25,000 privately employed teachers in public schools. Their presence lowers the pupil/teacher ratio average reported in Figure 2 by about 2.0, and would make the slight increase in the ratio over the twenty years seen in the graph a slight decrease.

The national averages for the P/T ratio hide a substantial redistribution between schools, in favour of historically disadvantaged schools, since 1994. Despite the fact that privately employed teachers give middle class schools a P/T ratio advantage currently, the overall trend over the last decade has been towards lower P/T ratios for historically black schools at the cost of higher P/T ratios for historically white schools (even when privately employed teachers are counted)[17].

The average annual growth in the number of all publicly employed educators (including educators not in schools), and in the number of workers in the country defining themselves as educators of some kind (according to Stats SA household surveys), was around 0.9% in the post-1999 period. This is lower than the annual population growth rate of around 1.3% in this period, and is indicative of problems in attracting a sufficient number of youths into teaching, and an ageing educator workforce affected by HIV/AIDS.

[17] See Gustafsson and Patel (2006) for a discussion of the related shifts in public spending.

Figure 2: Number of educators 1987-2007

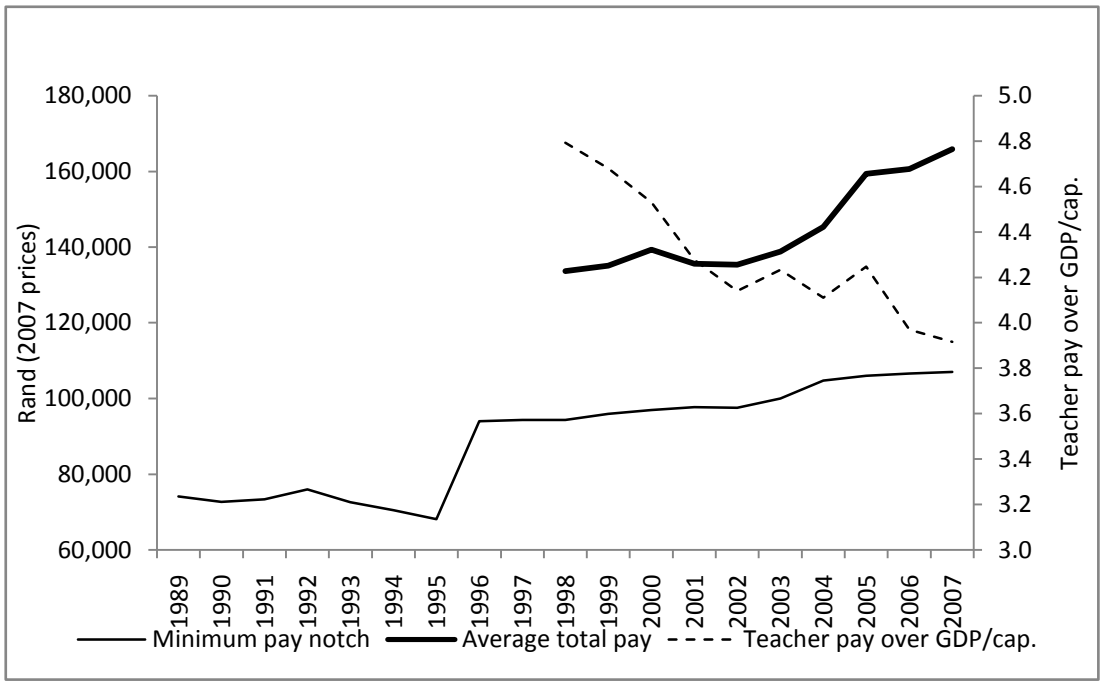


Source: South African Institute of Race Relations (1997); Research Institute for Education Planning (2005); Department of Education (1996); National Treasury (2007); Statistics South Africa (2008); Department of Education (2007a); 1985 to 1997 enrolment data sourced by Luis Crouch. Note: Values used for this and the next graph are provided in the Appendix. The pupil/teacher ratio here is the Public educators (schools) value divided into school enrolments.

The next graph illustrates the second major shift. In the mid-1990s the salaries of most teachers rose dramatically – the real increase in the minimum pay notch for black teachers with four years of post-secondary education was around 25% (it differed by ethnically-defined apartheid education department). This shift was due to a post-apartheid pay equalisation that essentially brought all teachers up to the favourable level enjoyed by the minority of white teachers in the past. Importantly, the rules still specified more pay for more qualified teachers, so the average black teacher still earned somewhat less than his white colleague given that whites had, on average, more years of post-secondary training. The unique historical circumstances of South Africa thus resulted in an abrupt and unusual lifting of the average unit cost of teachers to a substantially higher level. The alternative of lowering the pay of white teachers was regarded as politically untenable, and clearly the unequal apartheid pay scales could not continue. The increase in the unit cost of teachers created important structural constraints for the public education system. In particular, it became much more difficult to lower the P/T ratio. To illustrate, lowering the P/T ratio from the current 33 to 22 (more or less the level in Botswana) would raise annual spending on teacher salaries by R38bn, or by half the amount of public spending currently devoted to the health sector.

Since 1998, average salary spending per educator has increased slightly more than the minimum pay notch. This reflects both an ageing public teacher workforce, and some 'management drift', or an increasing proportion of educators in management positions, including schools-based management positions such as Head of Department positions, which involve substantial teaching time and higher pay.

Figure 3: Teacher pay 1989-2007



Source: National Treasury (2007); National Treasury (2008); ELRC (2008); PSCBC (2004); Department of Education (2007); Pre-1996 pay notch data provided by Department of Education.

Importantly, the ratio of average educator pay to GDP per capita has been declining. This is a trend one would expect in the country's development trajectory[18], based on typical trends elsewhere. It is a trend that is comforting in the sense that it makes improvements such as a lowering of the P/T ratio over the longer term a possibility.

4 The sufficiency of average teacher pay

Given that teacher pay is determined through an administered process, and not through typical market mechanisms, determining the correctness of the teacher pay level becomes an important research task. Even the pay of privately employed educators tends to follow patterns in the public service, making the detection of a market-related wage amongst these educators difficult. Researching what represents a sufficient level of teacher pay is complex, though a relatively good stock of literature on the subject has emerged elsewhere (very little analysis for South Africa has occurred, however). Of course teacher pay is not just an administrative determination of government, but also the outcome of interactions with teacher unions. This does not detract from the need for analysis, however, partly because research can assist in bringing issues related to teacher pay, such as working hours, pupil performance and teacher productivity to the fore within the bargaining process in a more empirical way.

How does one determine the sufficiency of teacher pay? (Here we consider average teacher pay, and in some instances the pay of teachers after fifteen years of service. In the next section we look at how pay should vary by years of experience.) Economists typically calculate a 'conditional wage differential' between teachers and other workers in the national labour market, using household survey data. Differences are typically conditional on years of education, years of experience, working hours and gender. In South Africa clearly race would need to be considered, given both race-based discrimination in the labour market and strong correlations between quality of education received and race given how recently racial discrimination in public schooling ended. Studies focussing on several countries and using a

[18] See Mingat and Tan (1998).

uniform methodology have found that in certain countries teachers are overpaid, whilst in others they are underpaid, on the basis of a conditional comparison of pay within each country[19]. This should not surprise us, as wage negotiation processes, and a government's approach to teacher pay, would tend to be very country-specific.

Conditional differences in earnings can be explained as follows. If gender discrimination results in women earning less in the labour market, and if teaching has a larger proportion of women than, say, other professional occupations (which is usually the case), then lower wages for teachers could partly be the result of gender discrimination, and partly the result of an under-valuation of teachers by society. The conditional wage differential will separate different effects out and will tell us how strong the under-valuation of teachers effect on its own is.

Of course even *un*conditional wage differentials must be understood and analysed, as this is what people perceive, and it is important to check the degree to which perceptions are supported by the data. Lastly, cross-country comparisons of the purchasing power of teachers can be instructive, and have been used in South Africa to argue that teachers are over-paid. However, as we shall see below, comparing teacher pay in different countries in isolation from other factors can be deceptive.

In order to estimate conditional wage differentials between teachers and other occupations in South Africa, we combined four Labour Force Survey (LFS) datasets from 2006 and 2007, and adjusted all pay data to 2007 prices using the official CPIX. The datasets were combined to allow for the estimation of more reliable statistics. Around 67% of workers in the LFS data have exact earnings values, whilst a further 22% have earnings values in bins, and 10% have no earnings data at all (the percentages would be 52%, 38% and 10% if one considered only professionals and associate professionals). It has been demonstrated that workers with earnings data in bins tend to be different from workers with exact earnings data, and hence to improve the reliability of the study we estimated exact earnings values for each worker with a bin response, using an OLS imputation methodology, in line with the advice provided by Posel and Casale (2005). As a result, we obtained a dataset with exact earnings values for 90% of all workers. In the Appendix, we report results using observations from this 90% of workers but also for the 67% who had original exact earnings values, partly to confirm the fact that one obtains different results (we regarded the 90% approach as the best approach). Moreover, in identifying professionals we followed an approach of using just the occupation variable, and a second approach of using the occupation variable plus the constraint that the worker had to have some post-secondary education. We considered the results of the second approach to be preferable, given that the policy discourse nearly always focuses, implicitly if not explicitly, on the difference between the pay of teachers, and the pay of other professionals with post-secondary education.

We begin with the unconditional differences. Table 3 below indicates that in an unconditional comparison, teachers earn less than other professionals, however one defines this. One should keep in mind that the table reflects the situation before the 2008 OSD reform.

[19] Hernani-Limarino (2005).

Table 3: Relative pay differences

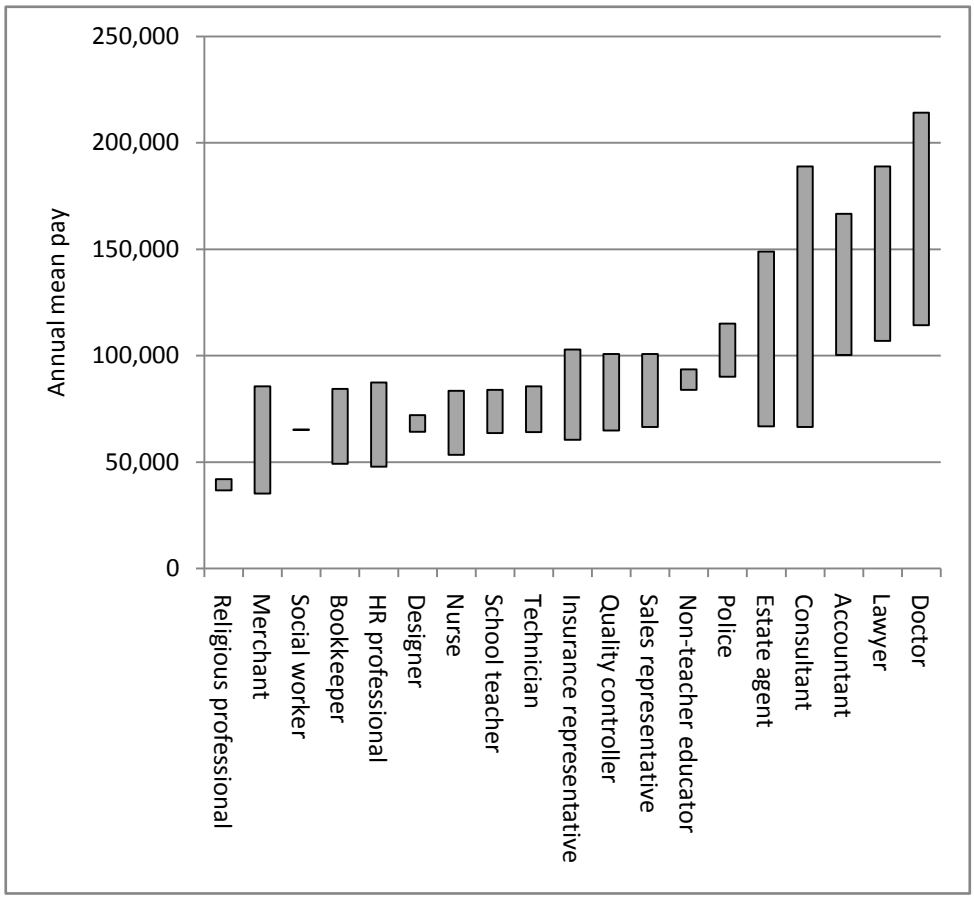
	Unconditional difference ratios	Conditional difference ratios
Teachers	1.00	1.00
Non-teacher educators	1.31	0.87
Educators (both of the above)	1.04	0.95
Professionals*	2.46	1.81
Technicians and associate professionals*	1.75	1.48
Both of the above*	2.10	1.64
All workers*	0.60	0.49

*Source: Stats SA, 2008 (March and September surveys for 2006 and 2007 used). The unconditional values are taken from Table 6 in the Appendix, whilst the conditional values come from Table 7 in the Appendix. What seemed the best estimates from those tables were chosen. Note: * means educators excluded.*

The distinction made in the LFS between professionals and 'technicians and associate professionals' requires some discussion. Of the around 500,000 educators in the LFS data (see Figure 2), some 380,000 to 450,000 (the number depends on whether one uses a post-secondary education requirement) are fairly clearly marked as primary or secondary school teachers. This corresponds fairly well to what one would expect, namely 420,000 teachers, being around 365,000 public employees in schools, 25,000 privately employed teachers in public schools, 20,000 teachers in independent schools and 7,000 mostly public employees in special schools. Around 70% of the teachers in the LFS are classified as 'technicians and associate professionals' (TAP), whilst 30% are professionals. This distinction is difficult to interpret. To some extent it follows years of education and pay, but not very systematically. The situation seems to warrant a comparison against both the professional and TAP categories.

The next graph provides an unconditional comparison of pay across several prominent occupation categories in the LFS (within the professional and TAP super-categories). It is clear that teachers (and even non-teacher educators) find themselves within a lower tier of professionals, with doctors, lawyers, accountants and consultants occupying a higher tier. This pattern is important, because the apparent pay disadvantage of teachers then translates into the question of whether teachers should move into the higher tier of professionals, or are more like lower tier professionals such as social workers and nurses.

Figure 4: Annual pay by occupation



Source: Stats SA (2008) (March and September surveys for 2006 and 2007 used). Note: Bars represents the range from the 25th to the 75th percentile. Observations analysed include those where bins were converted to exact values, and include only those where there was some post-secondary education.

What the previous graph makes clear is that earnings reported in the LFS are under-reported. A comparison with Figure 3 suggests that the under-reporting is as high as 50%. Such under-reporting for earnings is common in LFS-type surveys around the world, partly because respondents do not report gross earnings, but rather earnings after tax, and often after deductions for benefits. (Respondents in the LFS are asked what their gross pay is.)

Turning to a conditional wage comparison, we used years of education, years of experience, gender and race as conditioning variables. We did not use working hours due to the absence of suitable data on this in the LFS and elsewhere. Table 3 summarises the results (details appear in Table 7 in the Appendix). This analysis narrows the pay gap between teachers and other professionals, for instance the difference ratio with respect to professionals (plus TAP) drops from 2.1 to 1.6 (when compared to the unconditional analysis). The coefficients from the detailed results indicate that race is an important factor explaining wage in the South African labour market. As several analysts have argued, to a large degree the importance of race is linked to apartheid-era education experiences. The inconsistency in the results for non-teacher educators probably has little policy significance. These educators constitute a very diverse and small sub-group of educators, and the inconsistencies appear to be a result of the use of the log-lin model.

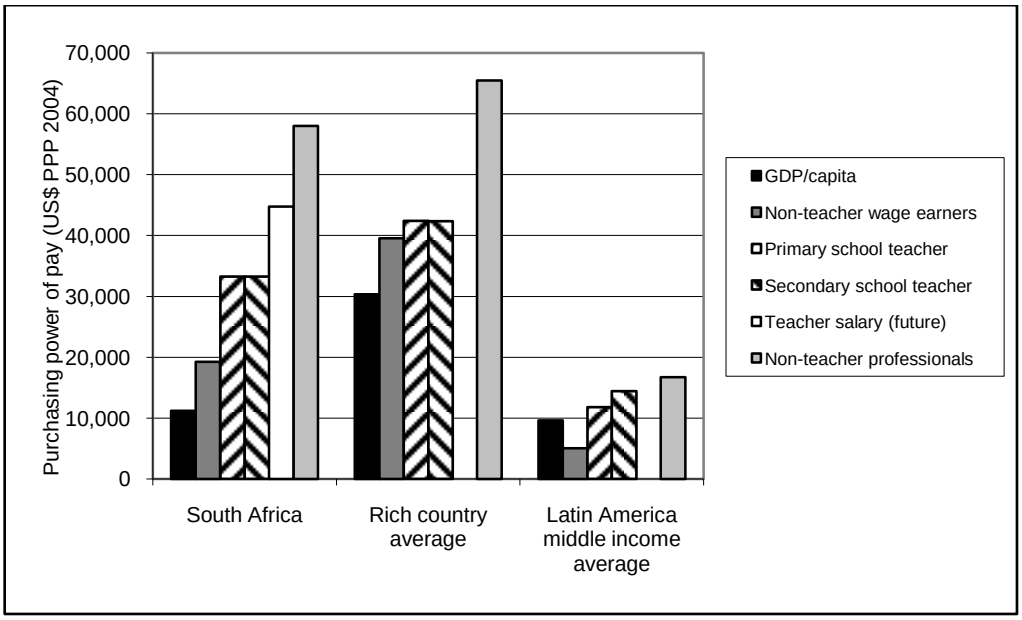
The conditional pay differences suggest that teachers were in fact under-paid in 2007. Though we have not considered working hours, it seems unlikely that this factor would take, for instance, the 1.6 ratio down to a level below 1.0.

One factor that is not typically included in an estimation of conditional wage differentials is outputs, or worker productivity. Given the nature of public schooling, it is possible for productivity to decline to very low levels without major institutional repercussions. Public schools that are unproductive generally do not lose clients and go bankrupt in the way that private schools or a private law firm may. We could not find any model that could compare pay levels across occupations conditional on outputs produced, and one presumes that such a model would be virtually impossible to design. Yet, even if it is in an informal way, school outputs, which we know are low in South Africa, need to be at least a background consideration when teacher pay is discussed. We elaborate on this below.

The 2008 salary agreement provided an immediate increase for teachers in real terms of around 5%, and promises of substantial future increases, in particular for better performing teachers. All teachers who perform at least at a 'satisfactory' level, according to an assessment panel within the school, will receive a 3% salary scale progression every second year over and above the regular inflationary increases. Teachers who are deemed to perform at a 'good' or 'outstanding' level, according to an assessment process that involves moderation by the district office, will receive, in addition, an increase of 3% or 6% every second year. The assessment currently focuses on behavioural input factors such as ability to prepare classes, and conduct pupil assessments, but the 2008 agreement includes an in principle acceptance by unions and the employer that in future years pupil performance should be brought to bear on the assessment of the teacher. Challenges in this regard are discussed in section 6 below. Predicting what a teacher will earn, say, fifteen years into her career, obviously requires an assumption about the teacher's level of performance. This could be 'satisfactory' in one cycle, then 'good' in the next cycle, then 'satisfactory', and so on.

Figure 5 allows us to look at several different unconditional pay comparisons simultaneously. The graph is not a perfect reflection of the various pay levels, partly because sources vary in their reliability and methodology, and because purchasing power parity (PPP) comparisons are inherently prone to inaccuracies. However, the graph provides a sufficient schema for an overall view of various possible comparisons. Pay is gross pay, and as far as possible teacher pay is pay of teachers after 15 years.

Figure 5: Comparisons across countries and occupations



Sources: National Treasury (2007) (for South Africa); Hernani-Limarino (2005: 79); Mizala and Romaguera (2005: 111-112); Gould, Abraham and Bailey (2005: 5-7). Note: Teacher pay estimates represent the average gross salary after fifteen years in service. 'Rich countries' considered are the UK,

the US, Australia, Germany and France. Latin American countries considered are Argentina, Brazil, Uruguay, Chile, Peru and Mexico. The relationship between GDP per capita and pay in the case of Latin America, in particular the fact that GDP per capita appears higher than the average pay of non-teachers, begs questioning. The explanation seems to lie in a particularly prominent under-reporting of income in household surveys, in particular amongst the rich.

The purchasing power of South Africa's primary and secondary school teachers is relatively high. It is not far from the level found in rich countries, and it is well above the Latin America middle income country level. And if one examines the relationship between teacher pay and GDP per capita, then the level in South Africa is well above what is seen in Latin America *and* rich countries. Teacher pay in South Africa is undoubtedly high by international standards if one considers the country's level of development. This has given rise to concerns in the teacher pay debates. However, as the graph shows, all professionals, whether teachers or non-teachers, enjoy an exceptionally high purchasing power in South Africa (relative to the country's level of development), so insofar as this is a problem, it is a problem that relates to all professionals. Despite the large teacher pay increases in the mid-1990s, teacher pay remained below the pay of other professionals. It is not within the scope of this paper to explain why professionals are paid what they are in South Africa, but undoubtedly this is linked to the country's acute skills shortage and high level of structural unemployment.

South Africa is not alone amongst developing countries in having high teacher pay. The Philippines and Malaysia have ratios of teacher pay to GDP per capita of 3.8 and 2.7 respectively[20]. But teacher pay in South Africa is undeniably above the middle income country norm.

What is also illustrated in the above graph is the virtual equality of teacher pay across the primary and secondary school levels in South Africa. Again, this is unusual amongst developing countries, and probably exacerbates the upward pressure on teacher pay as, in a sense, primary school teachers are able to 'free ride' on the need to raise the pay of secondary school teachers, in particular those who have specialised in subjects for which there is a high demand in the labour market. One can speculate that the reason why South Africa has not drawn a strong distinction between primary and secondary school teachers in its policy is that until recently there was such a strong emphasis on racial and ethnic differentiation, that there simply was no room to also draw distinctions according to the level of schooling. If primary school teachers are relatively advantaged by the system, the policy implication is perhaps that this provides the state with additional persuasive power to demand quality improvements at the primary schooling level, where it is known much of the educational quality problem lies.

The future teacher pay level for South Africa in Figure 5 assumes just 'satisfactory' performance for a period of 15 years, and will narrow but not close the unconditional pay gap between teachers and other professionals. The PPP earnings of teachers 15 years into the future will thus be at least as high as those of teachers in rich countries (they could be higher if the teacher's performance exceeds satisfactory). Obviously this comparison is somewhat crude partly because it does not take into account the publicly funded social benefits which, relative to tax paid, would be higher in rich countries. Nonetheless, the level of teacher pay in future years as put forward by the 2008 resolution clearly removes teacher pay as a factor that could inhibit quality improvements, and should clear the way for stronger collaboration between teachers, their unions, the state, and parent communities in tackling poor performance in schools.

5 The relationship between experience and teacher pay

One of the most important design elements of a teacher pay system is the relationship between years of experience and pay. By nature, schooling is an activity requiring many educated

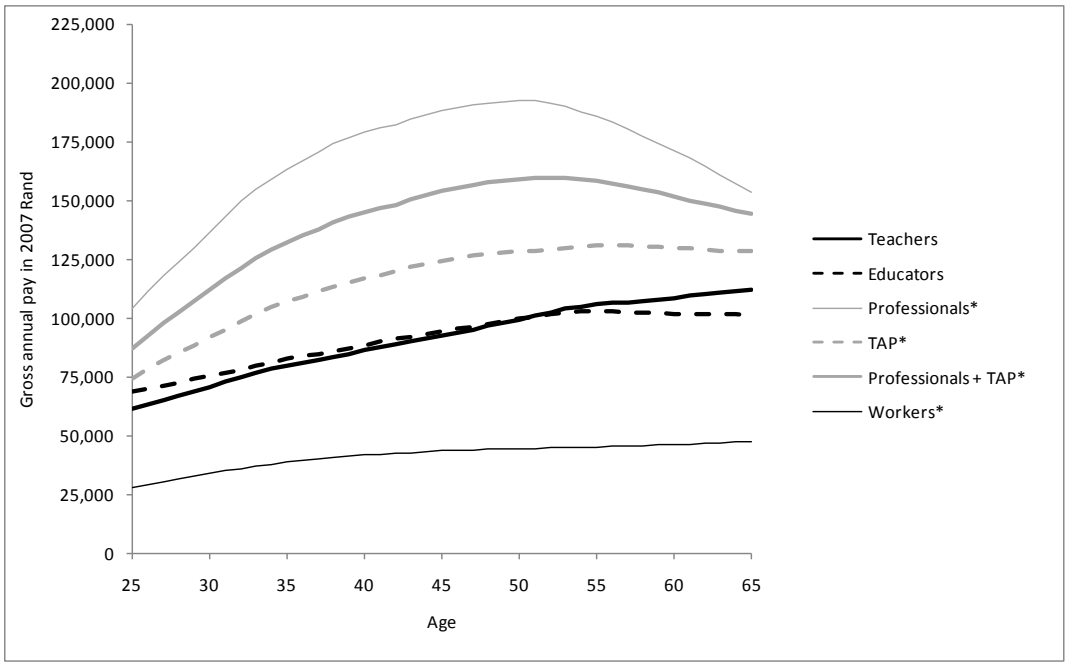
[20] Siniscalco (2002: 39).

workers engaged in the same activity, teaching, their whole working lives. It is inherently difficult to create the promotion opportunities that workers enjoy in many other sectors. Moreover, there is ample evidence that the productivity of teachers, whilst it may increase during the first four or so years, does not increase substantially thereafter. The rationale and opportunities for ongoing salary increases throughout one's career are therefore much weaker in schooling than they are in other sectors. Yet such increases are needed if the schooling system is to retain teachers. How to specify these increases in the pay system is a key policy question. In virtually all countries, the teacher pay system does include experience-linked pay increments, though mostly the age-pay curve for teachers is flatter than that for other professionals[21].

The Labour Force Survey data were used to gauge the age-pay curve for teachers and other professionals. Figure 6 below provides unconditional curves. For teachers, the lifetime salary growth ratio, where we understand this to be career-end pay over career-start pay, is 1.58 (we assumed a career spanning ages 25 to 60). This does not seem to be a particularly flat curve, but as we shall see below, it is likely that the LFS exaggerates the slope of the teacher curve. What is clear from the graph is that other professionals, however we define them, enjoy a steeper curve up to around age 50. Thereafter these non-teachers experience diminishing returns to years of experience, something that is commonly observed in age-pay profiles. Teachers do not experience this same diminishing returns phenomenon, largely because their pay system is designed by government, and not determined by the market. The conditional version of the curves in Figure 6 follow similar patterns to the unconditional curves, though the gaps between the curves are reduced (see Figure 12 in the Appendix). We can therefore conclude on the basis of both the unconditional and conditional age-pay profiles that the pay disadvantage for teachers is greater for older teachers (say those between 40 and 50) than for younger teachers. Crouch (2001), using a conditional comparison of the pay of teachers against the pay of all non-teachers (not just professionals) also finds that older teachers experience the greatest pay disadvantage, though he finds that younger teachers experience a pay *advantage* relative to non-teachers. This could be because Crouch looks at all non-teachers, but it could also be because his analysis uses much earlier data, namely household data from 1999.

[21] Hernani-Limarino (2005).

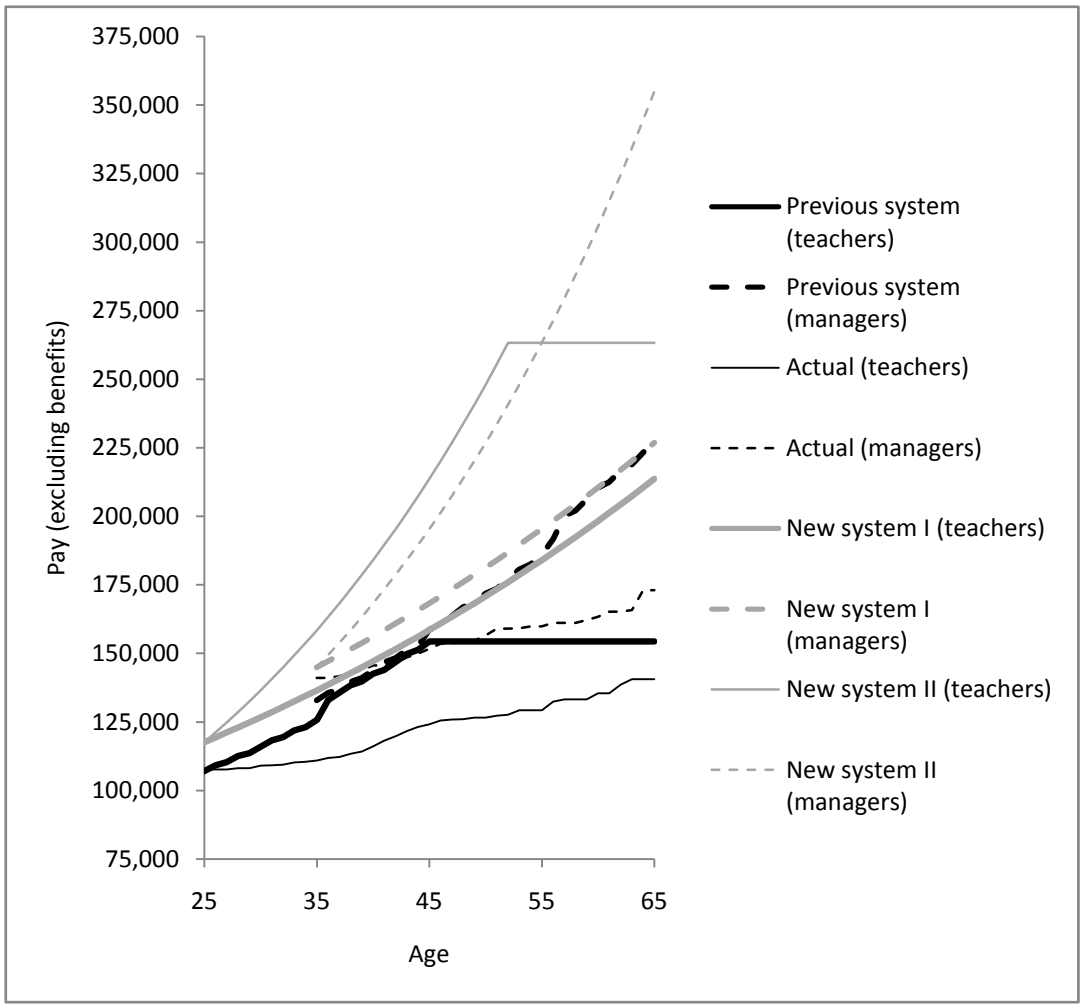
Figure 6: Distribution of income values by age



*Source: Stats SA (2008) (March and September surveys for 2006 and 2007 used for the graph). Note: * means educators excluded. Only observations where workers had some post-secondary education were considered. Curves are derived using the Lowess smoothing method.*

The following graph examines age-pay profiles, but using Persal payroll data and official pay scales from the previous and the new systems. Managers in this graph are Heads of Department, Deputy Principals and Principals, and teachers are all remaining educators with at least four years of post-secondary training (the definition of teachers is thus narrower than what was used above). The payroll data indicate that the lifetime salary growth ratio for teachers is 1.26 (it would be less if teachers with less than four years of training were also counted). For managers the figure obtained from the payroll data is 1.50. It seems as if the slope for teachers of 1.58 using household data is an exaggeration. It is possible that older teachers have a better idea of what their gross salaries are. The payroll data used for the graph below would supply the correct gross salary for all publicly employed educators.

Figure 7: Old and new salary scales



Source: Department of Education (2007); National Treasury (2007); ELRC (2008). Note: The actual curve for teachers excludes the approximately 45% of teachers with less than four years of qualifications. If these teachers are added, the curve drops by around R20,000 in the 25 to 35 age range, and less than this above age 35.

What is noteworthy is that the pre-2008 pay system reflected better returns to years of experience than did the payroll data on actual gross pay. For instance, the official system in 2007 indicated that the lifetime salary growth ratio of a teacher should be 1.44, whilst the payroll data suggested it was only 1.26. This disparity can be explained by the fact that the pre-2008 system had not existed long enough to take full effect. After some years, the 1.44 ratio would have been realised in the payroll data. This highlights an important matter, namely that there is often a difference between the official and the apparent lifetime salary increase, where the apparent increase is what the patterns amongst current wage earners would suggest. What youths considering the possibility of a teaching career should focus on is the official lifetime increase. However, unless this is clearly communicated to them, it is possible that they will base their forecast (and hence their decision on whether to enter the profession) on the apparent increase. Clearly, it is important for the employer to actively signal to youths what the official scales are, in order to maximise the incentive effects of future salary growth, and in order for the profession to attract the best candidates it can. Though pay is by no means the only factor prospective teachers consider, it is inefficient to keep information about future pay benefits from candidates.

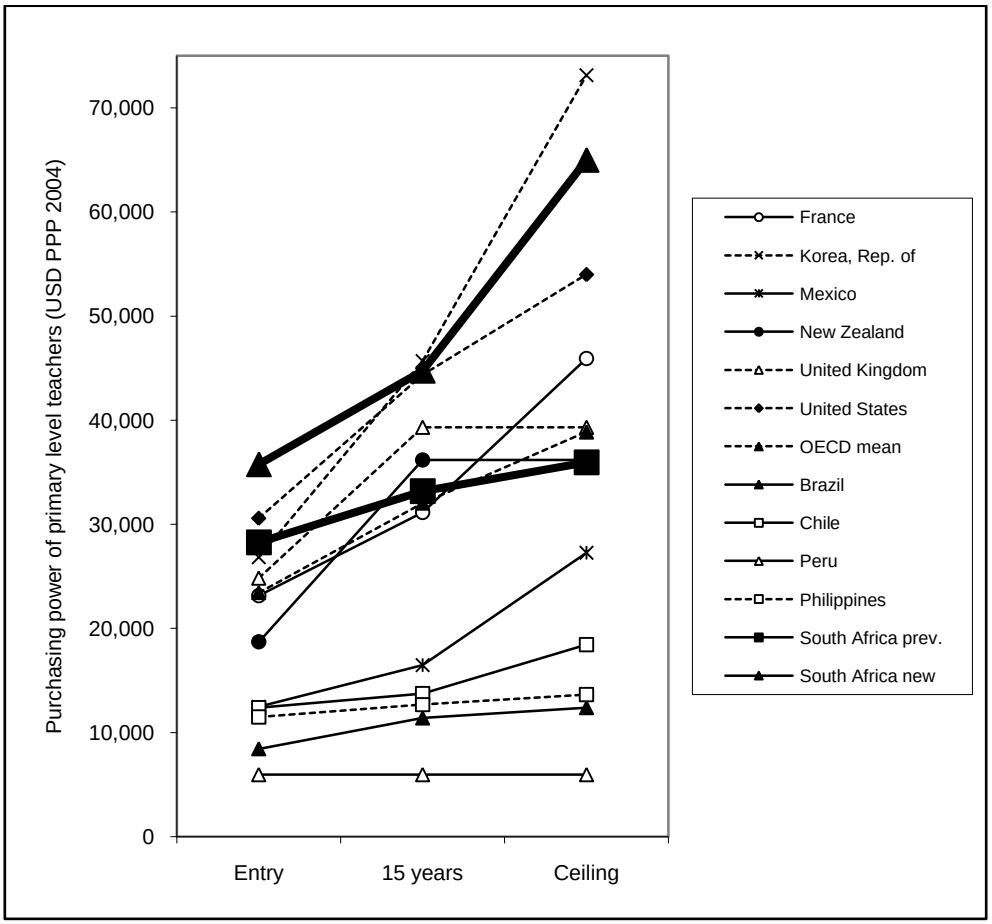
The 2008 pay system contains substantial future benefits for new teachers that should be communicated to youths. (It should be remembered that the actual age-pay profile did not

change much with the introduction of the new system in 2008. The new system is largely about future increases.) The curve 'New system I (teachers)' in Figure 7 illustrates what a teacher who performs at a 'satisfactory' level can expect to earn. If one compares this curve to the teacher curve for the previous system, then it is clear that a mid-career pay plateau in the old system has been replaced by continuous increases to the end of the teacher's career. This improves the official lifetime salary growth ratio from 1.44 to 1.69. However, a teacher who performs above a 'satisfactory' level can expect better increases. For example, a teacher who repeats eight-year cycles of satisfactory-good-good-outstanding performance (there is an assessment every second year) can expect the age-pay curve 'New system II (teachers)', which yields a lifetime salary growth ratio of 2.24, or an age-pay slope that is easily comparable to that of non-teacher professionals.

The 2008 system improves the pay prospects for managers too, but only if they perform above a 'satisfactory' level. A manager following a satisfactory-good-good-outstanding pattern can expect a lifetime salary growth ratio of 2.59.

Figure 8 below indicates how South Africa's previous and new official age-pay curves for teachers compare to those of other countries. The country has in fact moved from having one of the flattest curves, to having one of the steepest curves. These future benefits should be clearly communicated to youths to promote the recruitment of the best possible candidates, and should be used as a basis for demanding substantial educational quality improvements from the entire schooling system. (For teachers already in the schooling system, the new pay system provides performance-linked increases every two years in line with what was explained above. However, teachers already in the system will not be able to attain the same lifetime increases as teachers who enter the system now.)

Figure 8: Cross-country PPP comparison of teacher pay



Source: Mizala and Romaguera (2005); DoE (2007); ELRC (2008); UNDP (2006); US CPI figures at http://www.bls.gov/cpi/.

6 Financial performance incentives for teachers

There has been some discussion above of the financial performance incentives introduced with the 2008 OSD agreement. Here we look at the matter of such incentives in the light of some theory and international practice[22].

Paying teachers more on an individual basis for good performance, either in the form of cash bonuses or (as in South Africa following 2008) through an elevation on the pay scales, is something that has been tried in very few developing countries, and is even rare in developed countries. Promotions into senior teaching positions are common (including in South Africa), but this differs from the OSD-type performance-linked salary progression largely because a promotions system includes an important rationing element. If teachers compete, by out-performing others, for promotion posts, there is a clear sense that the number of such posts is limited. However, in the system introduced in South Africa in 2008, the limitation lies not in the number of promotion posts, but in the definition of, for instance, 'good' and 'outstanding'. Any teacher who fulfils the criteria of, say, a 'good' teacher can expect to move up the pay scales by the specified number of notches. Undoubtedly, in the planning and budgeting process, there must be some background rationing, which will to a large extent manifest itself

[22] Largely we make use of the collection of studies on teacher incentives in Latin America in Vegas (2005).

in the definitions of the performance levels. However, even with this background rationing, a system of performance-linked pay increments introduces less predictability, but also less entitlement, into the pay system. For instance, a school with no 'good' teachers will not see any teachers enjoying the associated salary growth. Certainly in the developing country context, South Africa is breaking new ground with its 2008 policy on teacher performance incentives.

A key policy design question in coming years will be how pupil performance should feature within the teacher incentives policies. The 2008 agreement links progression up the salary scales to input factors such as the teacher's ability to plan her lessons, but it also includes an in principle agreement that somehow pupil performance should influence pay in the future. Though linking pupil performance to pay may seem intuitively sensible, experience across the world suggests that one should proceed with considerable caution. Pupil performance is highly dependent on home background factors, in particular the socio-economic status of the pupil. Hence any teacher incentives attached to pupil performance need to control for home background factors, or one could simply end up rewarding those teachers whose pupils have the most favourable background factors. Even if one rewards teachers for *improvements* in pupil performance (as opposed to absolute levels of performance), the potential for improvement is linked to background factors. Controlling for these factors can be methodologically challenging. Moreover, because schooling is largely a team effort, it is difficult, and potentially divisive, to attribute pupil performance to individual teachers in a school. Lastly, there is evidence that financial incentives for individual teachers linked to pupil performance can make a difference when the incentive is introduced, but that the effect is not lasting[23].

The literature suggests that pay incentives for all teachers within a school, based on improvements in the average pupil results, is certainly implementable without serious problems, and may cause the desired improvements. Amongst developing countries, the most widely written about programme of this type is the SNED programme in Chile. In this programme, the need to control for socio-economic status (SES) is dealt with by dividing schools into groups according to the average SES of pupils, and letting schools compete within their groups.

A key challenge in any educational incentives programme is to study the impact of the incentives on educational outcomes to ensure that spending on the programme is justified, and that the programme is optimally designed. Where an incentive programme spans the entire schooling system (as the OSD one does), it is notoriously difficult to separate out the improvement effects of the programme from the effects of other factors. However, the literature does provide some suggestions on how to proceed. Even more important than programme-specific impact assessments, however, is ongoing monitoring of pupil performance to inform the policy debates and the relationship between the public employer and unions. If there are not substantial improvements in standardised scores collected through programmes such as the Systemic Evaluation in coming years, then one can be highly certain that the OSD is not working as it should.

7 Working hours of teachers

Though we did not use working hours in estimating conditional wage differences above, a short discussion of the teaching time of teachers is presented here, partly with a view to re-examining the rather polemical numbers, and partly with a view to suggesting what research and policy work may be needed.

[23] Glewwe, Ilias and Kremer (2003).

The required working hours of teachers can be regarded as an element of the teacher pay system, in the broad sense of this system used in this paper. What is very clear is that the formal school day is seven hours long, giving a 35 hour 'formal' working week. This is the time educators are required to be at school[24].

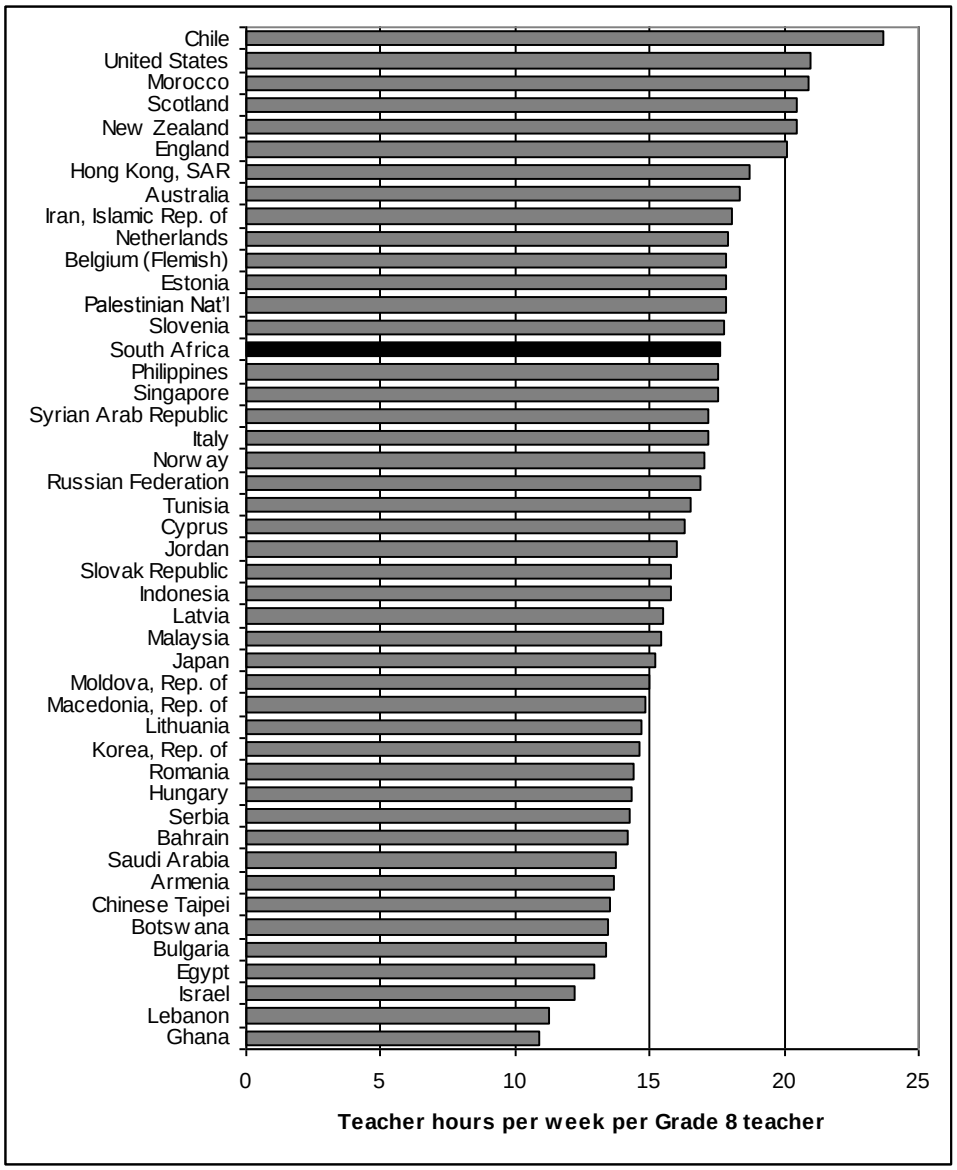
What is less widely accepted is what teaching time of teachers should be. The policy states that in the case of primary school teachers 85% to 92% of the formal school day should go towards teaching. This works out to 30 to 32 hours per week – as we shall see below, this is a relatively ambitious target by international standards. The values are virtually the same for secondary school teachers. Crucially, these 30 to 32 hours exceed the 'learner contact time' specified in the curriculum for all grades – the highest learner contact time is 27.5 hours, at the senior secondary level. This means, for instance, that if you have eight classes in a school, you need just eight teachers. Of course this may not hold true in all situations, for instance in small secondary schools, where the need for subject teaching can result in timetabling problems which would necessitate more than eight teachers for eight classes. But certainly in primary schools, and even in large secondary schools, the one teacher per class criterion should hold in theory.

In practice, however, schools mostly understand the requirement for teaching time to be lower than what the policy specifies. The amount of teaching time that is put in per teacher is partly a function of how the school understands the policy, and how successfully it implements this. A variety of factors such as illness, leave and discipline problems (such as latecoming) can affect implementation. An ELRC study[25] of teacher workload published in 2005 concluded that on average educators spent 3.2 hours per day teaching. This average included the teaching time of managers based in schools. If we take into account only teachers, then this figure becomes 3.6 hours a day, or around 18 hours a week, which is well short of the 30 to 32 hours referred to in the policy.

A cross-country comparison is instructive. The next graph, based on 2003 TIMSS data focussing on teachers who teach Grade 8 mathematics, indicates that the average teaching time in South Africa was 17.6 hours per week. This is not far from the estimate of 18 hours derived from the ELRC report. But what is interesting is that though the ELRC report (commissioned jointly by the employer and unions) describes the gap between required teaching time and actual teaching time as a problem, the TIMSS comparison suggests South Africa is doing fairly well (especially if one compares South Africa to the other developing countries in the graph). Clearly, the conclusion depends on the comparison being made.

[24] ELRC (2003).
[25] ELRC (2005).

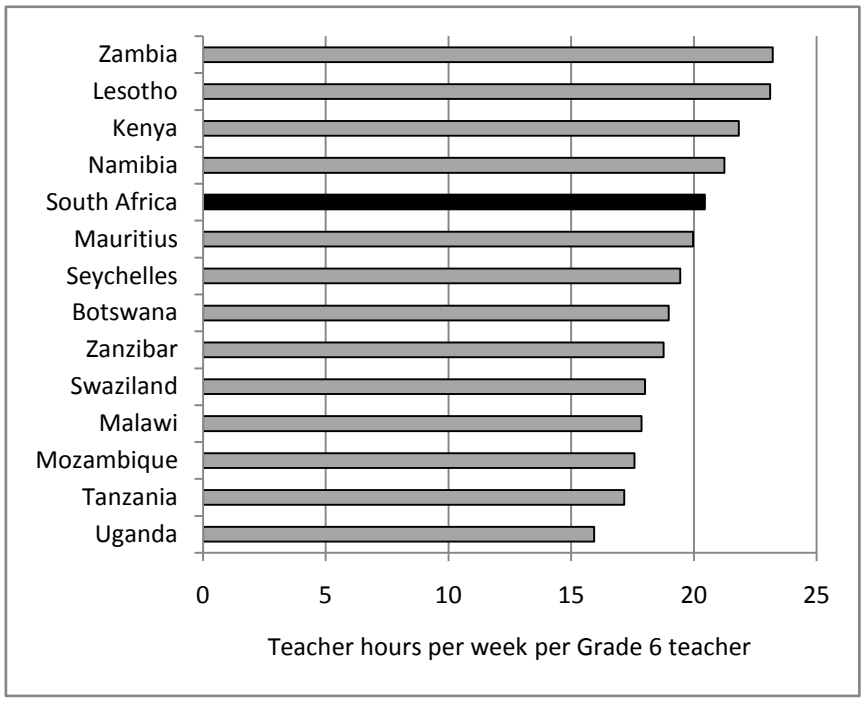
Figure 9: International comparison of teaching hours (Grade 8)



Source: IEA (2004).

SACMEQ data, used for the next graph, provides a similar picture of an above average level of teaching time.

Figure 10: International comparison of teaching hours (Grade 8)



Source: IIEP: SACMEQ (2004).

It seems difficult to conclude that low teaching time is a major contributor to poor pupil performance (South Africa fared worst of all the TIMSS countries in 2003). Production function analyses have not strongly pointed towards a problem with teacher-pupil contact time (in our 2004 Systemic Evaluation model, the contact hours variable was excluded due to low significance – see Table 4). However, it is possible that this matter has not been sufficiently studied. There is much anecdotal, and some empirical evidence, of teacher latecoming being a problem. Teacher responses in the international questionnaires may not be a true reflection of time actually spent teaching.

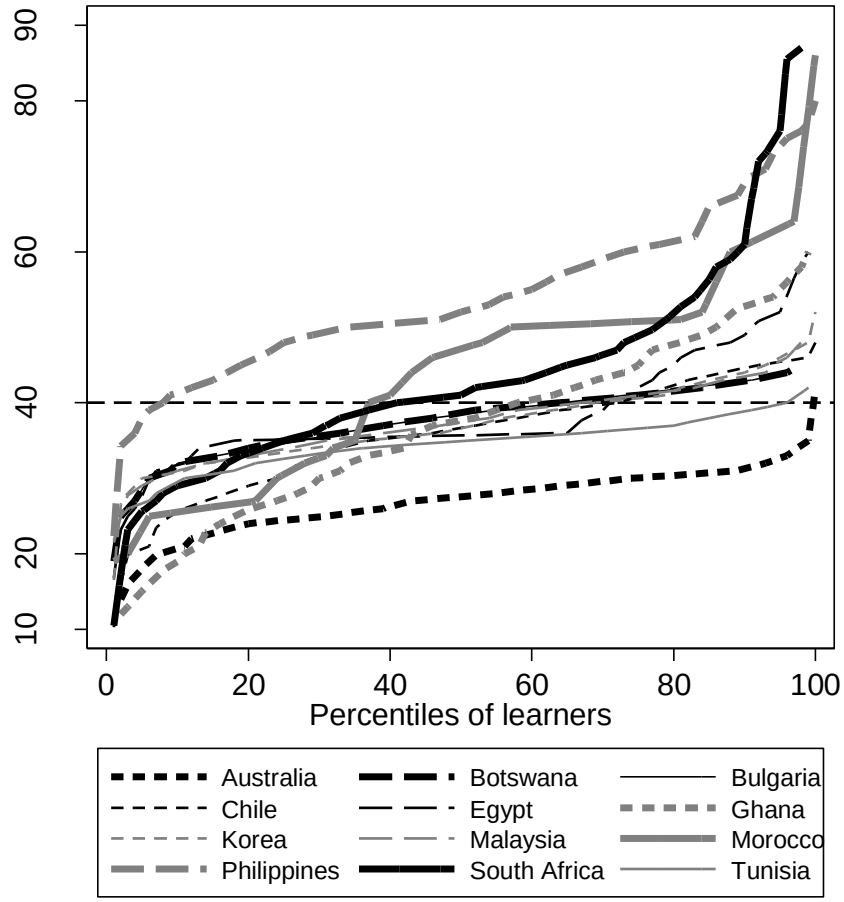
There is clearly a need for some policy work on teaching time. The Department of Education is currently reviewing teaching time requirements as part of the redesigning of the teacher post allocation model. The current policy requirements for teaching time are very ambitious. If fully complied with, they would put South Africa far above any other country in the previous two graphs. Overly demanding policies, it is known, are likely to be ignored. At the same time, the high cost of teachers in South Africa relative to GDP per capita and, linked to this, high pupil/teacher ratios, do make it necessary for above average teaching hours to be demanded from each teacher. The question is what requirement would be reasonable, economically justifiable, and supportive of the curriculum.

8 Class size

Focussed research into the dynamics of class size, in South Africa and elsewhere, is not common, largely because evidence indicates that the benefits accrued from reducing class sizes are, at best, small, and because reducing class sizes is clearly very costly. Yet there is much anecdotal reference to the problem of large classes in South Africa. Cross-country comparisons do suggest there is a problem in South Africa, partly because the average class size is high, but also, importantly (as this is easier to resolve), because there is so much inequality amongst pupils with respect to the class size they experience.

The following graph provides a cross-country comparison for Grade 8 mathematics (using 2003 TIMSS data). The mean class size for South Africa is 44.7 pupils (this is the mean class size experienced by pupils, or the size of the average pupil-weighted class). 16% of pupils experience a class size over 1.25 times the mean, in other words a class size exceeding 55.9. Of the 16 countries represented in the graph (the focus was on representing, in particular, developing countries), three stand out as having exceptionally large classes: South Africa, Morocco and Philippines. The problem in South Africa (and in Morocco) is largely one of the distribution of teachers – in Philippines the problem is more one of a very high average, in other words not enough teachers in classrooms overall. To compare, in Botswana, no pupils were in classes greater than 45.

Figure 11: International comparison of class size



Source: IEA (2004). Note: A horizontal line appears at class size 40, partly because this is commonly regarded in South Africa as the ideal maximum.

Data from national collections reveal similar information. For instance the 2004 Systemic Evaluation indicates that the mean class size experienced by Grade 6 pupils was 43.4, and that 17% of pupils experienced a class size that was 1.25 times the mean (or 54.3).

These statistics raise a number of questions. Firstly, how serious is the problem if our point of departure is improving educational quality? How is this pattern possible in South Africa given

that the allocation of educator posts across schools is determined by a highly equitable model, the so-called 'post provisioning norms'[26]? And how could the problem be rectified?

The production functions discussed in section 2 indicated that reducing class size from around 55 to 33 had a significant positive impact on pupil performance more or less equal to switching from a non-confident teacher to a confident one. There is thus some empirical evidence of an effect, though the change would need to be a large, and potentially very costly one. But common sense should also play a role here. Classrooms are not built to accommodate 50 or 60 pupils, so there are thresholds beyond which serious problems undoubtedly exist. It is possible that the production function analysis, and the input-output data we have, are not able to identify the impact of these thresholds on pupil performance.

We undertook some analysis of Annual Survey of Schools data to explore the causes behind very large classes. These data include variables on classes per grade, privately paid educators, multi-grade teaching and classroom availability, and are thus well suited for this purpose. All pupils divided by all publicly employed educators was found to be 33.6 (this is the statistic reflected in Figure 2 above). The average for this statistic at the school level, where each school is weighted by the number of pupils, was found to be 35.2 (this statistic would also be 33.6 if educators were distributed across schools in a completely equitable manner). A third statistic was calculated for each school, namely pupils divided by 'full-time equivalent' educators, or the number of whole educators available for teaching after the management time of managers had been subtracted (using the official guidelines in this regard). We called this statistic the effective school pupil/teacher (P/T) ratio. The pupil-weighted mean for this statistic was found to be 37.7. But it was inequitably distributed across schools. 13% of pupils were found to experience an effective school P/T ratio of over 1.25 times the mean (47.1) – however, this statistic was not as inequitably distributed as the class size statistic. Inequalities with respect to this effective school P/T ratio are clearly a part of the reason behind large classes. And behind this factor lie some problems with the allocation model (in particular it does not take into account management time), and problems with the filling of posts, in particular in rural areas.

Turning to class sizes experienced by pupils, the average was found to be 47.2 (in other words somewhat higher than what was found in TIMSS and the Systemic Evaluation), with 18% of pupils experiencing over 1.25 times the mean, or 59.0. Class sizes were thus more inequitably distributed than the school P/T ratio, which one would expect given within-school inequalities. A simulation was run to create a scenario where, firstly, all the teaching time available to schools was used (in line with the policy guidelines) and, secondly, schools maximised equity between pupils in the school with respect to class size. The result was a mean class size of 37.8, with around 6% of pupils experiencing a class size exceeding 50 (against 30% in the actual situation). Put differently, the mean class size could be reduced from 47.2 to 37.8 through a different utilisation of the existing teaching time within schools, and the extent of very large classes (exceeding 50) could be substantially reduced. What lies behind this large gap between the actual situation and the simulation? The analysis found rather conclusively that poor time management in schools is a problem. Even if schools with no classroom shortages are considered, the gap between the actual and simulated situations remains more or less unchanged.

The current reviewing of the post provisioning policy in the DoE involves finding an appropriate balance between teaching time requirements, and class sizes. In particular, a key question is in which grades the one teacher one class criterion should be applicable. Moreover, the policy challenge seems to be one of communicating information better. There is no reason why schools (and parents) should not be presented with a simulation of the optimal utilisation of teaching time, and a statement of what the expected maximum class size

[26] DoE (2002).

in the school should be (given the staffing complement, and given the available classrooms). This could provide a useful benchmark. If class sizes higher than the simulated ones exist in the school, this would need to be justified with reference to contingencies such as unfilled posts, or effective management (there may be reasons why even well managed schools would *not* pursue equity in class sizes within the school).

9 Conclusion

The advent of democracy in South Africa brought with it an end to racial discrimination in the pay scales of publicly employed teachers. Black teachers experienced substantial pay increases in 1996 to close the gap between white and black teachers, and the average unit cost of teachers rose sharply. Subsequently, between 1996 and 2007, teacher pay rose moderately in real terms. However, in 2007 teachers were still at a pay disadvantage relative to other professionals, whether one views the difference in unconditional terms, or in conditional terms (using years of experience, years of education, gender and race as conditioning variables). The pay advantage of other professionals, who earned around 1.6 times as much as teachers using the conditional comparison, would probably remain an advantage even if one took into account the favourable working hours of teachers. What is less certain, is how the pay comparison would fare if outputs and productivity were taken into account, given the very low average levels of pupil performance in South Africa as evidenced in a number of international assessment programmes. A methodology for making this kind of comparison appears not to exist. However, any change to the pay system to close the gap between teachers and other professionals would need to come with assurances that increased public spending on each teacher would occur in tandem with quality improvements in the schooling system.

The 2008 OSD changes to the teacher pay system attempt to achieve this by locating most pay improvements in the future, and linking these improvements to evidence of acceptable levels of performance on the part of individual teachers. The teacher performance criteria in the 2008 policy focus on behavioural input factors, such the teacher's ability to prepare good classes. This is a logical approach. In addition, however, the policy envisages linking pay to pupil performance in some way. The literature on teacher incentives suggests that this is probably best achieved through rewarding all teachers in a school as a group, as opposed to individual teachers, and through an approach that takes into account the socio-economic background of pupils.

The 2008 changes substantially alter the age-pay slope for teachers, and make it comparable or better to that of other professionals, depending on the level of performance of the teacher. In an international comparison, South Africa moves from having one of the flattest age-pay slopes, to one of the steepest. This should improve the ability of the education system to recruit good candidates, and to retain good teachers. Importantly, the future age-pay slope is more favourable than the actual age-pay slope that candidates will see if they look at existing teachers. This underlines the importance of communicating future pay benefits to youths considering a teaching career.

The working hours of teachers have been a contentious policy issue. Teachers spend less time teaching than what the policy requires, but this policy is ambitious by international standards and the actual hours of teaching put in by South African teachers compares favourably against those in other countries. There is a need to review and clarify the policy on the working hours of teachers, and perhaps to arrive at requirements that are more realistic. At the same time it seems reasonable to expect South African teachers to put in more hours than teachers elsewhere. This is because teacher pay relative to GDP per capita is high when one considers the country's level of development (the same argument can be made for other professionals), and because there is a problem with excessive class sizes which could be solved through better utilisation of teacher time in certain schools. Currently, the class size experienced by the average pupil is well over 40, and a large proportion of pupils, perhaps 20% to 30%,

experience classes of around 50 pupils or more. Whilst the empirical evidence on the benefits of reducing class sizes is not strong, one cannot ignore basic realities, such as the fact that classrooms were not built to accommodate class sizes of 50 or 60. It should be possible to reduce the percentage of pupils in classes above 50 to around 5% simply by improving the utilisation of the time of teachers currently employed in schools. This should not detract from the importance of filling posts where these are empty (and incentivising teachers to teach in rural areas), or the importance of increasing the overall number of teaching posts in the system over the long run. However, until pay relative to GDP per capita drops further (the current trend is a downward one) it will be economically difficult to depend on growth in the workforce as the primary solution to the problem of excessive class sizes.

References

Bhorat, H. & Oosthuizen, M. (2006). *Determinants of Grade 12 pass rates in the post-apartheid South African schooling system.* Dakar: Sisera. Available from: <http://www.idrc.ca/uploads/user-S/114787836912006_6_DPRU_SAGA_Bhorat_Determinant.pdf> [Accessed October 2006].

Cohen, D. & Soto, M. (2001). *Growth in human capital: Good data, good results.* Paris: OECD. Available from: <http://www.oecd.org/dataoecd/33/12/2669509.pdf> [Accessed June 2007].

Crouch, L. (2001). *Turbulence or orderly change? Teacher supply and demand in the age of AIDS.* Pretoria: RTI. Available from: <http://www.rti.org/pubs/turbulence.pdf> [Accessed October 2005].

Crouch, L. & Mabogoane, T. (1998). *No magic bullets, just tracer bullets: The role of learning resources, social advantage, and education management in improving the performance of South African schools.* Research Triangle Park: Research Triangle Institute. Available from: <http://www.rti.org/ddsp/documents/no_magic.pdf> [Accessed March 2006].

Crouch, L. & Perry, H. (2002). *Determinants of Learning and Learning Change in DDSP Schools' Grade 3 Numeracy and Literacy Assessment Results* (unpublished paper). Pretoria: District Development Support Program.

Department of Education (1997). Schools Register of Needs 1996 (dataset). Pretoria.

Department of Education (2002). *Creation of educator posts in a provincial department and the distribution of such posts to the educational institutions of such a department* (Government Notice 1451). Pretoria. Available from: <http://www.elrc.co.za/ClientFiles/Laws/CREATION%20OF%20EDUCATOR%20POST.doc> [Accessed December 2005].

Department of Education (2007). *Improvements in conditions of service (Government Notice 692).* Pretoria. Available from: <http://www.info.gov.za/documents/notices/2007.htm> [Accessed September 2008]. [Earlier conditions of service notices also consulted.]

Department of Education (2007a). *Education statistics in South Africa 2006*. Pretoria. Available from: <http://www.education.gov.za/EMIS/default.htm> [Accessed September 2008]. [Earlier issues in this series also consulted.]

Department of Education (2007b). Systemic Evaluation 2004 (dataset). Pretoria.

Education Labour Relations Council (2003). *Personnel Administrative Measures*. Pretoria. Available from: <http://www.elrc.org.za> [Accessed September 2008].

Education Labour Relations Council (2005). *Educator workload in South Africa*. Pretoria. Available from: <http://www.hsrcpublishers.ac.za> [Accessed January 2006].

Education Labour Relations Council (2008). *ELRC Resolution 1*. Pretoria. Available from: <http://www.elrc.org.za> [Accessed September 2008]. [Earlier resolutions also consulted.]

Glewwe, P., Ilias, N. & Kremer, M. (2003). *Teacher incentives*. Washington: NBER. Available from: <http://www.jourdan.ens.fr/piketty/fichiers/enseig/ecoineg/articl/Glewweetal2003.pdf> [Accessed July 2007].

Gould, J.C., Abraham, J. & Bailey, B. (2005). *Survey and analysis of teacher salary trends.* Washington: American Federation of Teachers. Available from: <http://www.aft.org/salary/2004/download/2004AFTSalarySurvey.pdf> [Accessed March 2007].

Gustafsson, M. (2007). *Using the hierarchical linear model to understand school production in South Africa.* Stellenbosch: University of Stellenbosch. Available from: <http://akadweb.sun.ac.za/economics/3.Research/2.Working%20Papers.php> [Accessed February 2007].

Gustafsson, M. & Patel, F. (2006). Undoing the apartheid legacy: Pro-poor spending shifts in the South African public school system. *Perspectives in Education*, 24(2): 65-77.

Hernani-Limarino, W. (2005). Are teachers well paid in Latin America and the Caribbean? In Emiliana Vegas (ed.), *Incentives to improve teaching: Lessons from Latin America.* Washington: World Bank: 63-99.
Hoenack, S.A. (1996). The economics of education in developing countries: An assessment of the state of the art. *Economics of Education Review*, 15(4): 327-338.
IEA (2004). TIMSS 2003 (dataset). Chestnut Hill: Boston College. Available from: <http://timss.bc.edu/timss2003.html> [Accessed July 2007].
IIEP: SACMEQ (2004). SACMEQ II (2000 dataset). Harare.
Lee, V.E., Zuze, T.L. & Ross, K.N. (2005). School effectiveness in 14 Sub-Saharan African countries: Links with 6th graders' learning achievement. *Studies in Educational Evaluation*, 31: 207-246.
Mingat, A. & Tan, J.-P. (1998). *The mechanics of progress in education: Evidence from cross-country data.* Washington: World Bank. Available from: <http://www.worldbank.org> [Accessed November 2003].
Mizala, A. & Romaguera, P. (2005). Teachers' salary structures and incentives in Chile. In Emiliana Vegas (ed.), *Incentives to improve teaching: Lessons from Latin America*. Washington: World Bank: 103-150.
Mullis, I.V.S., Martin, M.O., Gonzalez, E.J. & Chrostowski, S.J. (2004). *TIMSS 2003 international mathematics report.* Chestnut Hill: Boston College. Available from: <http://timss.bc.edu> [Accessed August 2005].
National Treasury (2007). Persal unit record download (dataset). Pretoria. [Pre-2007 data also used.]
South Africa: National Treasury (2008). *Budget Review 2008*. Pretoria. Available from: <http://www.treasury.gov.za> [Accessed March 2008].
Posel, D. & Casale, D. (2005). *Who replies in brackets and what are the implications for earnings estimates? An analysis of earnings data from South Africa*. Pretoria: TIPS. Available from: <http://www.tips.org.za/files/774.pdf> [Accessed September 2008].
Public Service Central Bargaining Council (2004). *PSCBC Resolution 2.* Pretoria. Available from: <http://www.pscbc.org.za/> [Accessed September 2008]. [Earlier resolutions also consulsted.]
Research Institute for Education Planning: University of the Orange Free State (2000). *Education and manpower development.* Bloemfontein. [Earlier issues in series also consulted.]
Schollar, E. (2005). *The evaluation of the Learning for Living Project.* Johannesburg: Business Trust. Available from: <http://www.jet.org.za/documents/Schollar.pdf#search=%22%22learning%20for%20living%22%20%22south%20africa%22%22> [Accessed September 2006].
Siniscalco, M.T. (2002). *A statistical profile of the teaching profession*. Paris: UNESCO. Available from: <http://www.ilo.org/public/english/dialogue/sector/papers/education/stat_profile02.pdf> [Accessed November 2007].
South African Institute of Race Relations (1997). *Race relations survey.* Johannesburg. [Earlier issues in series also consulted.]
Statistics South Africa (2008). Labour Force Survey 2007b (dataset). Pretoria. [Earlier data also used.]
UNDP (2006). *Human Development Report 2006: Beyond scarcity: Power, poverty and the global water crisis.* New York Available from: <http://www.undp.org> [Accessed March 2007].
UNESCO: UIS (2008). Education statistics (dataset). Montreal. Available from: <http://www.uis.unesco.org/ev_en.php?URL_ID=3753&URL_DO=DO_TOPIC&URL_SECTION=201> [Accessed June 2008].
Van der Berg, S. & Burger, R. (2003). Education and socio-economic differentials: A study of school performance in the Western Cape. *South African Journal of Economics*, 71(3): 496-522.

<http://www.commerce.uct.ac.za/Research_Units/dpru/WorkingPapers/PDF_Files/wp73.pdf> [Accessed November 2007].

Vegas, E. & Umansky, I. (2005). *Improving learning through effective incentives: What can we learn from education reforms in Latin America?* Washington: World Bank.

Appendix

The first table appearing below provides details behind the summary results presented in Table 2. As explained above, the analysis was performed using only observations from the 80% of pupil-weighted schools with the lowest average test scores. The two models (for language and mathematics) are rather basic in the sense that variables were largely used as they were in the database, without, for instance, an exploration of the effect of interaction terms and non-linear relationships, or the construction of complex indices. This analysis does therefore not exhaust the potential of the 2004 Systemic Evaluation with respect to production function analyses.

The 10^{th} and 90^{th} percentile values are with reference to the reduced 80% sample. See section 2 for an explanation of the impact values.

Table 4: Production functions using 2004 Systemic Evaluation data

Variable[27]		*Language*					*Mathematics*					*Comment*
		Coeff-icients	*t-stat*	*p10*	*p90*	*Impact*	*Coeff-icients*	*t-stat*	*p10*	*p90*	*Impact*	
Teacher's years of education	E						0.1077	3.84	15.000	16.000	**0.63**	
Teacher's professional confidence	E	1.1184	6.59	0.000	1.000	**2.28**						
Teacher's participation in in-service training	E	0.5129	2.78	0.000	1.000	**1.05**						
Teacher's access to the internet	E	7.3994	23.35	0.000	1.000	**15.10**	1.1656	11.30	0.000	1.000	**6.86**	Only 7% of reading teachers and 9% of maths teachers had access to internet.
Teacher's prioritisation of salary relative to other factors	E	-0.4793	-2.65	0.000	1.000	**-0.98**	-0.6405	-9.61	0.000	1.000	**-3.77**	
Teacher's sense of society's appreciation	E	-1.0571	-3.34	0.000	1.000	**-2.16**	-0.6002	-5.01	0.000	1.000	**-3.53**	Only 7% of reading teachers and 6% of maths teachers had a value of zero (no appreciation).
Teacher's desire to stay in the profession	E	-0.9841	-6.11	0.000	1.000	**-2.01**						
Average class size	P	-0.0538	-7.15	33.556	55.000	**-2.36**	-0.0182	-6.37	33.556	55.000	**-2.29**	
Teacher's use of an African language in class	E	-1.6711	-11.18	0.000	1.000	**-3.41**						
Teacher's use of assignments (language)/projects (maths)	E						0.1399	3.45	2.000	3.000	**0.82**	
Teacher's use of feedback (language)/examinations (maths)	E	-0.6337	-5.57	3.000	4.000	**-1.29**	-0.0980	-3.13	2.000	4.000	**-1.15**	Note that using examinations is negatively associated with the maths score.
Teacher is female	E	1.4471	9.50	0.000	1.000	**2.95**	0.4766	8.71	0.000	1.000	**2.80**	
School fee charged	P	0.0043	9.40	13.000	145.000	**1.15**	0.0016	9.34	13.000	145.000	**1.21**	
Existence of a library	P	2.0912	8.88	0.000	1.000	**4.27**	0.8720	9.04	0.000	1.000	**5.13**	
Learner/toilet ratio	P	-0.0145	-9.78	19.873	118.167	**-2.91**						
Existence of a computer	P	1.6861	9.13	0.000	1.000	**3.44**	0.6880	10.93	0.000	1.000	**4.05**	
Ability of learners to borrow library books	P						-0.4993	-6.55	0.000	1.000	**-2.94**	
Existence of a telephone	P	3.2150	17.47	0.000	1.000	**6.56**						
Existence of playground	P						0.1594	6.28	1.000	4.000	**2.81**	
Learner's travelling time	L	-0.0243	-6.41	15.000	60.000	**-2.23**						
Parent's level of education	H	0.2723	15.29	3.000	15.000	**6.67**	0.0763	11.71	3.000	15.000	**5.39**	
Availability of newspapers in the home	H	2.1103	11.29	0.000	1.000	**4.31**	0.5783	8.41	0.000	1.000	**3.40**	
Learner's socio-economic status	L	1.3454	17.45	1.557	4.209	**7.28**	0.3870	13.83	1.557	4.209	**6.03**	
Frequency of feeding scheme lunches	L	-1.5565	-25.29	1.000	4.000	**-9.53**	-0.3858	-17.05	1.000	4.000	**-6.81**	
Learner's nutritional status	L	1.7173	10.03	2.000	3.000	**3.50**	0.2923	4.64	2.000	3.000	**1.72**	

[27] Letter refers to questionnaire used: Educator; Home (parent); Learner; Principal.

Variable[27]		*Language*					*Mathematics*					*Comment*
		Coeff-icients	*t-stat*	*p10*	*p90*	*Impact*	*Coeff-icients*	*t-stat*	*p10*	*p90*	*Impact*	
Educator and parent's home language is the same	EH						0.1403	2.17	0.000	1.000	**0.83**	
Age difference learner to class average	L	-1.7107	-29.94	-1.475	1.725	**-11.17**	-0.4096	-19.57	-1.475	1.725	**-7.71**	
Educator and learner's gender is the same	EL	1.0553	7.27	0.000	1.000	**2.15**	0.2332	4.38	0.000	1.000	**1.37**	
Intercept		18.4135	22.59				5.7001	11.11				
Standard deviation of scores (reduced dataset)						13.4177					4.6064	
R^2 for this model						0.25					0.11	
R^2 if this model is run for entire dataset						0.53					0.45	
N for this model						25897					25780	
Number of teachers in this model						778					773	
Variables excluded from the above due to low significance for both subjects: Average teacher qualification (P); Class size Grade 6 (P); Weekly teaching time Grade 6 (P); Rate of learner attendance (P); Rate of teacher attendance (P); Learner/classroom ratio (P); Existence of a tuckshop (P); Existence of a principal's office (P); Existence of electricity (P); Existence of a copier (P); Existence of sports facilities (P); Principal's teaching load (P); Safety in the school (P); Absence of racial conflict (D); Parent's use of the test language (H); Learners exposure to television (L); Educator and learner's home language is the same; Educator and parent's home language is the same; Learner age (L); Teacher's age (E).												
Source: DoE (2007b).												

The following table provides the values used for Figure 2 and Figure 3 above.

Table 5: Historical values

	Public educators (schools)	*Public educators (all)*	*Educators (all)*	*Learner/ educator ratio (schools)*	*Minimum pay notch (2007 prices)*	*Average total pay (2007 prices)*	*Teacher pay over GDP/cap.*
1987	263,382			32.8			
1988	280,737			32.2			
1989	284,566			32.1	74,067		
1990	291,218			33.2	72,616		
1991	300,716			33.6	73,343		
1992	311,392			34.0	75,952		
1993	336,999			32.9	72,594		
1994	347,452			32.6	70,464		
1995	357,904			32.8	68,077		
1996	368,357			32.4	93,945		
1997	368,599		498,990	32.6	94,276		
1998	368,840	382,511	515,921	32.6	94,352	133,653	4.79
1999	354,463	367,885	532,853	33.9	95,926	135,134	4.68
2000	353,698	368,730	549,784	32.8	96,949	139,312	4.53
2001	352,932	369,575	549,617	32.5	97,683	135,561	4.28
2002	348,409	375,176	525,312	33.2	97,527	135,344	4.14
2003	343,886	380,778	535,953	34.2	100,010	138,790	4.23
2004	351,758	386,379	544,780	33.8	104,753	145,372	4.11
2005	354,330	393,406	556,279	33.5	105,977	159,425	4.25
2006	345,738	384,593	543,637	34.5	106,597	160,631	3.97
2007	363,999	404,263	572,958	33.1	107,007	165,911	3.92

Table 6 below provides the unconditional pay statistics according to occupation, and according to methodology followed. The statistics obtaining using both point and bin values were used for the ratios presented in Table 3 above.

Table 6: Mean salaries of teachers and other occupations

	Only point values used				*Point and bin values used*			
	Mean salary	*N*	*Weighted obs.*	*Salary ratios*	*Mean salary*	*N*	*Weighted obs.*	*Salary ratios*
With no education criterion								
Teachers	82,786	691	286,976	1.00	84,669	1,086	453,265	1.00
Non-teacher educators	67,852	106	53,803	0.82	86,112	171	93,110	1.02
Educators (both of the above)	80,428	797	340,780	0.97	84,915	1,257	546,375	1.00
Professionals*	139,546	268	199,696	1.69	176,635	507	417,686	2.09
Technicians and associate professionals*	80,986	20,246	24,379	0.98	97,515	1,265	794,525	1.15
Both of the above*	98,276	806	1,265	1.19	124,777	1,771	1,212,211	1.47
All workers*	38,825	18,432	8,433,538	0.47	50,963	23,171	11,159,930	0.60
Only with post-secondary education								
Teachers	87,184	576	235,570	1.00	87,858	924	377,034	1.00
Non-teacher educators	96,915	50	32,584	1.11	115,135	96	62,099	1.31
Educators (both of the above)	88,367	626	268,154	1.01	91,715	1,020	439,133	1.04
Professionals*	182,981	155	125,418	2.10	215,830	323	295,705	2.46
Technicians and associate professionals*	131,617	205	152,926	1.51	153,416	380	298,027	1.75
Both of the above*	154,761	360	278,343	1.78	184,501	703	593,731	2.10
All workers*	206,972	1,110	718,497	2.37	194,233	2,037	1,436,667	2.21

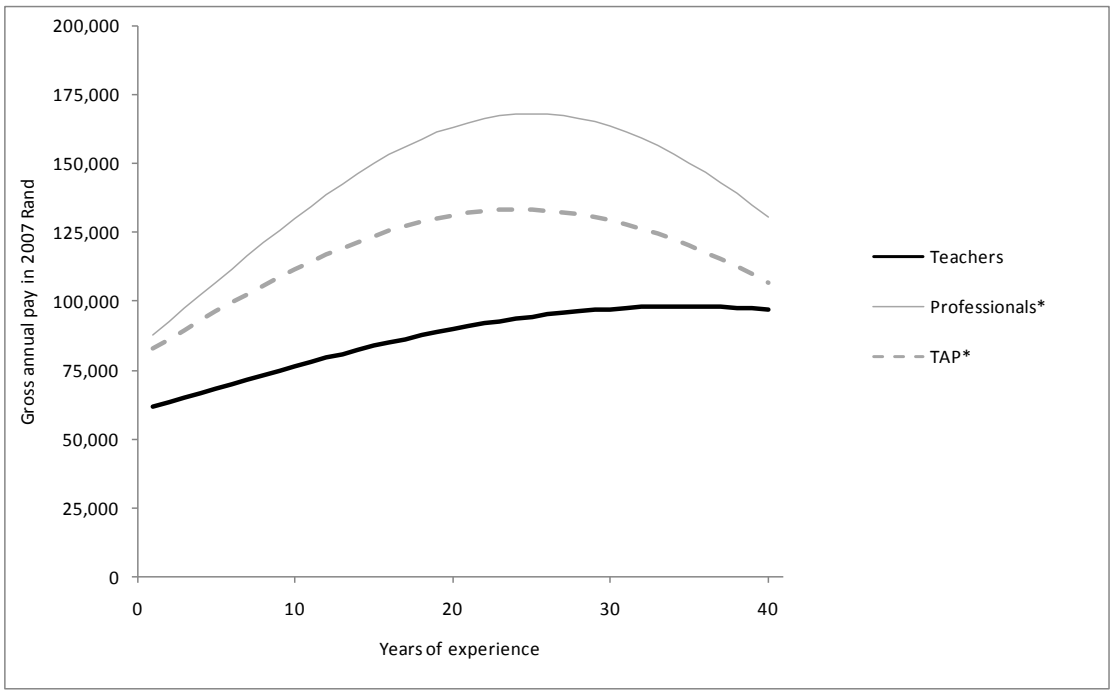
*Source: Stats SA (2008) – datasets 2006a, 2006b, 2007a and 2007b used. Note: * means educators excluded. N and weighted observations are the average across the four datasets. 'Teacher' means occupation codes 2320, 2331, 3310, and 3391. 'Educator' (or sum of Teachers and Non-teacher educators) means occupation codes 2300 to 2399 and 3300 to 3399. All salary values in the four datasets were set at September 2007 levels using Stats SA CPIX indices.*

Table 7: Conditional wage log-lin regression model results

	A Model on all wage earners	B Model on just professionals and TAP	C As for B, but only those with post-secondary education
Years of education	0.10	0.27	0.31
	(119.9)	(23.3)	(10.9)
Years of education (just educators/teachers)++	0.08	-0.13	-0.17
	(9.8)	(-8.2)	(-5.4)
Years of education (just professionals)	0.11	-0.04	-0.11
	(15.7)	(-2.8)	(-3.5)
Years of education (just TAP)	0.07	-0.07	0.04
	(17.9)	(-5.9)	(1.3)
Experience (just educators/teachers)++	0.05	0.04	0.03
	(9.6)	(7.6)	(4.9)
Experience squared (just educators/teachers)++	-0.0009	-0.0007	-0.0004
	(-7.5)	(-5.4)	(-3.0)
Experience (just professionals)	0.05	0.06	0.06
	(12.1)	(14.0)	(12.4)
Experience squared (just professionals)	-0.0012	-0.0012	-0.0011
	(-11.7)	(-11.6)	(-10.3)
Experience (just TAP)	0.04	0.04	0.04
	(12.7)	(13.0)	(9.5)
Experience squared (just TAP)	-0.0006	-0.0005	-0.0009
	(-8.7)	(-7.8)	(-7.7)
Is coloured	0.40	0.26	0.12
	(43.5)	(10.6)	(3.5)
Is Indian	0.68	0.43	0.33
	(44.0)	(13.6)	(8.9)
Is white	1.01	0.46	0.25
	(116.2)	(28.0)	(13.1)
Is male	0.45	0.22	0.20
	(80.0)	(15.8)	(12.0)
Is teacher	-0.87	1.67	2.34
	(-7.2)	(7.6)	(4.8)
Is non-teacher educator	-1.33		
	(-11.0)		
Is non-educator professional	-1.11	0.64	1.74
	(-10.6)	(3.4)	(3.6)
Is non-educator TAP	-0.81	1.00	-0.55
	(-13.9)	(5.8)	(-1.1)
Constant	8.62	6.80	6.42
	(986.0)	(41.4)	(14.7)
N	97285	12056	6880
R^2	0.44	0.44	0.31
Predicted conditional pay (assuming average characteristics)			
Teachers	107,627	91,330	85,707
Non-teacher educators	68,318	69,290	74,434
Educators (both of the above)	93,394	83,350	81,587
Professionals*	129,978	144,172	154,991
Technicians and associate professionals*	95,057	102,331	126,763
Both of the above*	107,089	116,748	140,822
All workers*	52,969		
Pay difference ratios from above			
Teachers	1.00	1.00	1.00
Non-teacher educators	0.63	0.76	0.87
Educators (both of the above)	0.87	0.91	0.95
Professionals*	1.21	1.58	1.81
Technicians and associate professionals*	0.88	1.12	1.48
Both of the above*	1.00	1.28	1.64
All workers*	0.49		

*Source: Stats SA (2008) – datasets 2006a, 2006b, 2007a and 2007b used. Note: The independent variable is the natural log of wage, using both original point values and point values imputed using bin brackets and key characteristics of workers. N here represents the count of observations across all four datasets. * means educators excluded. Variable ++ is educator years of experience in model A, and teacher years of experience in models B and C. Experience is in all instances present age minus estimated age at which the worker completed his studies. Predicted pay uses the average characteristics (e.g. experience and race) found in all observations in model C, i.e. the characteristics of the average professional (or TAP) with a post-secondary education. TAP means technicians and associated professionals. This makes the predicted conditional pay values in each column comparable within a column.*

Figure 12: Distribution of conditional income values by age



*Source: Stats SA, 2008 (March and September surveys for 2006 and 2007 used for the graph). Note: * means educators excluded. Only observations where workers had some post-secondary education were considered. Curves are generated using the coefficients of the log-lin model reported in Table 7.*