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Interrogating a Paradox of Performance in the WCED: A Provincial and Regional Comparison of Student Learning

GABRIELLE WILLS[1], DEBRA SHEPHERD[2] AND JANELI KOTZE[3]

ABSTRACT

The Western Cape, one of South Africa's better performing provinces in terms of educational outcomes, has a relatively well-run education bureaucracy when compared not only within South Africa but also with other middle-income country education systems. Nevertheless, questions have been raised about whether bureaucratic competence has translated into higher levels of student learning in the province. In this paper, we consider how well primary school students perform in the Western Cape when compared with their peers in other systems within and across Southern and Eastern Africa after we control for differences in the socio-economic profiles of students and schooling inputs. Primarily relying on SACMEQ 2007 data, we use both descriptive and multivariate estimation with propensity score matching to explore performance differentials. In particular, we use an internationally calibrated measure of socio-economic status to compare test scores across equally poor students in different systems before drawing naïve conclusions about performance differentials. We find that while the Western Cape is a relatively efficient education system within South Africa, particularly in serving the poorest students, a less-resourced country such as Kenya produces higher levels of grade 6 student achievement across the student socio-economic profile. We also identify that observed differences in resourcing, teacher and other school inputs are typically not able to explain away performance differentials across different systems.

Keywords: Student achievement, Western Cape, Southern and Eastern Africa, comparative education

JEL codes: I20, I21, I24

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I. Introduction

Multi-disciplinary collaboration between educationists and economists has been gaining momentum in recent years in interrogating the sources of dysfunction in basic education service delivery in South Africa. However, in a context where weak institutional functionality and its complex interplay with political processes are increasingly identified as *binding constraints* to realising educational improvements (van der Berg et al., 2016), what has been from absent from this collaboration for too long is the work by specialists in political studies, governance and public administration.

Despite spending more per student than in other states, there are notable performance gaps across South African primary school students relative to their peers in other middle-income or even poorer economic states. The typical response to quality deficits has been a resource based one, for example building more schools, hiring more teachers or mass workbook roll-outs. Yet there is a growing consensus that it is not necessarily the presence of resources that matter but the ability of the system to use these efficiently if we are to see improvements in educational quality (Taylor, 2010; Van der Berg, 2008). It is becoming increasingly clear that one cannot effectively interrogate the topic of 'effective' or 'efficient' service delivery without considering the bureaucratic system through which this takes place and in turn the political processes in which bureaucracies are embedded (Kingdon et al., 2014; Cameron and Levy, 2016; Gustafsson and Taylor, 2016; Levy, 2014; Levy and Walton, 2013). There are currently not enough available, proven solutions to raise learning outcomes that are both contextually and politically sensitive to address considerable deficits in the quality of education service delivery for the majority of students. In recent words of Kashik Basu, economist at the World Bank "we have to overcome the fear of talking about politics, and confront it as part of the challenge of development" (Khemani et al., 2016). This is no place truer than in the area of basic education in South Africa.

In this context, the recent University of Manchester-based and DFID-supported Effective States and Inclusive Development global comparative research programme on governance and politics across various tiers of the basic education system in South Africa (as well as Bangladesh, Rwanda, Uganda and Ghana) provides a useful contribution to the research discourse. In one of the papers that forms part of the wider ESID project, Cameron and Levy (2016) consider whether there may be something to be learnt from one of South Africa's top performing provinces in terms of educational outcomes, namely the Western Cape Education Department (WCED), in understanding how governance informs educational outcomes. Despite the importance of having a well-functioning bureaucracy for school outcomes, evident in contrasting the bureaucratic support given to Western Cape as opposed to Eastern Cape schools in their case study analyses, they encounter a paradoxical reality:

> *"On the one hand, we find that the WCED is (and has long been) a relatively well-run bureaucracy, not only within the South African context, but also…likely so when compared with educational bureaucracies in other middle-income countries…On the other hand, however, we find that notwithstanding the sustained efforts educational outcomes, especially among lower socio-economic segments of the population, remain at levels similar to those of countries and regions with per capita incomes (and public resource availability) orders of magnitude below the Western Cape"* (Cameron and Levy, 2016: 2)

In this respect they posit that there are likely to be limits to the potential of bureaucracy and specifically performance management in raising learning outcomes. Equally given its limits, it is likely better to have a functioning bureaucracy than not as evidenced in the case study research on schools in the Eastern Cape where bureaucratic support for schools is often absent (Shumane and Levy, 2016).

As economists we contribute to this ESID project by interrogating the Western Cape paradox using available cross-national data on schooling in South Africa and particularly the Western Cape versus other Southern or East African countries or regions. This is a complement to the historical narratives and in-depth qualitative approaches taken by other papers in the ESID project series to investigate the macro and micro-governance and political economy determinants of performance over time.

The objective of this paper is to subject this 'paradox' to a more rigorous empirical investigation. We attempt to identify whether a gap really does exist in the performance of Western Cape students relative to their peers in other countries and even other local provinces. We start off with a simple descriptive analysis that investigates how the Western Cape fares regionally. In particular we use SACMEQ 2007 data to identify how the Western Cape performs relative to other systems over the socio-economic profile of students. Unfortunately, the data is outdated at nearly a decade old. Considerable changes may have taken place across provinces and regions which would need to be verified with more recent data that are not yet publicly available, such as TIMSS 2015 and SACMEQ 2013.

Using a methodological innovation by Kotze and Van der Berg (2015), in particular, we attempt to use a more internationally comparable indicator for student socio-economic status (SES) to compare the performance of equally poor students across different systems before drawing naïve conclusions about performance differentials by SES status. We then move to strengthening the descriptive conclusions using a multivariate estimation of learner performance. We consider how the Western Cape performs relative to other systems that on average perform comparatively or better in international tests of literacy and mathematics after we control for differences in i) the socio-economic profiles of students, ii) resourcing differences as reflected in observed differences in school inputs and teachers. We find that typically these factors do little to explain performance differentials.

It is noted, however, that while we endeavour to create as much balance (or comparison) between different system samples using a propensity score matching approach, our cross-sectional analysis cannot control for unobserved differences in students, teachers or school characteristics across provinces and country regions that may inform schooling outcomes. We also highlight some of the methodological challenges of cross-country comparisons in identifying covariate overlap across vastly differently resourced education systems in Southern and East Africa. Nevertheless, we typically find that a plethora of observed variables are not sufficient in explaining performance differentials. It is possible that the strength of institutions (reflected in policy, management, accountability, governance, or political factors) more broadly may account for performance differences between Western Cape students and their peers in other in-country provinces or cross-national regions.

In the next section we consider the empirical evidence base on the strength of education institutions in South Africa and how much the bureaucratic administration matters for school performance. In section III we then descriptively evaluate the comparative performance of the Western Cape. The multivariate estimation in section IV then provides a more robust look at performance differentials between the Western Cape and select regions of interest namely; Kenya, Tanzania, Botswana and Mauritius and two other South African provinces, Gauteng and particularly the Eastern Cape which has been a province of interest in the ESID project.

II. Background

Moving from resources to considerations of institutional strength

In post-Apartheid South Africa considerable strides have been made in improving access to education. Goals of universal primary enrolment have largely been realised and levels of secondary school enrolment compare favourably with other middle-income countries. With redistributive spending to the poorest schools and students, racial inequalities in access to education in particular have been tackled. Despite some evidence of improvement across the national system, for example reflected in improved TIMSS scores between 2002 and 2011, substantial concerns remain about the quality of education provided to millions of youth.

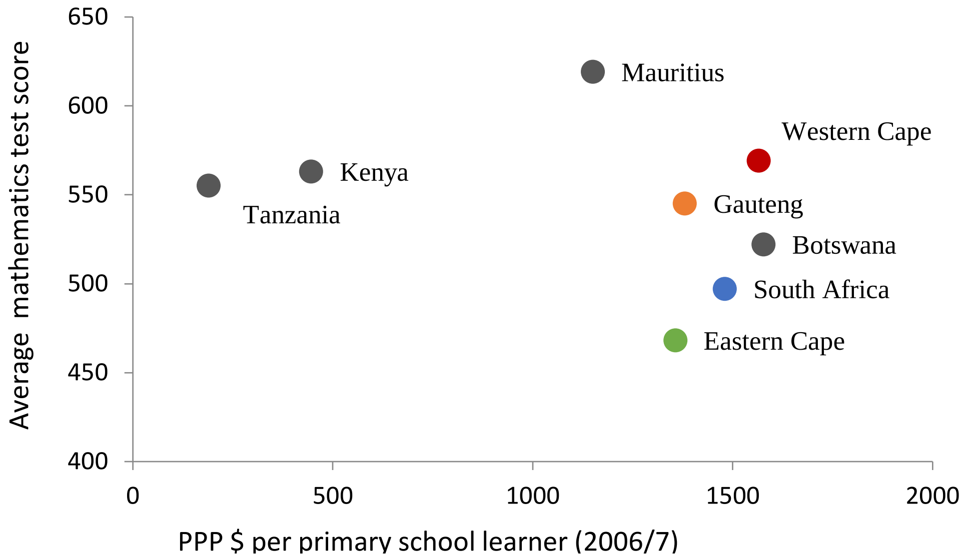
The work of Taylor and Yu (2009) and more recently Kotze and Van der Berg (2015) using the SACMEQ 2007 data confirm that the South African education system is very inefficient. However, pinning down at what point along the service delivery chain this inefficiency is likely located is particularly challenging. Certain countries, Kenya in particular, that are considerably poorer and spend far less per child on education manage to achieve much higher learning outcomes at every level of SES (Kotze and Van der Berg, 2015). We extend this analysis further in an econometric framework while also giving attention to differences *within* South Africa to convert resources into outputs.

As shown by figure 1, cross-country and provincial differences in public expenditure per learner (for countries or regions of interest in this study) do not help in understanding cross-country differences in educational performance; an increase in expenditure per learner does not necessarily lead to increased student performance. Where education spend across different countries has consistently failed to account for differentials in student performance, increasing attribution is being given to the strength of institutions (school, districts and state administrations) in explaining differences in learning across and within country systems (Alvarez, Moreno and Patrinos, 2007; Hanushek and Woesmann, 2007; Pritchett, 2013). This is not to say that resources are not important at all (especially where there are human rights arguments for having access to basic infrastructure including adequate sanitation and electricity). Across the literature in developing countries and in South Africa there are scattered findings of positive resource effects, but "the main message is still not one of broad, resource-based policy initiatives" (Hanushek and Woesmann, 2007: 67). What is more important is getting the institutional structures right. While public provision of schooling may be associated with inefficiencies, public schooling systems can and do differ substantially across countries in terms of their "institutional structure of educational decision-making processes" (Woessmann, 2003: 120).

This is consistent with growing literature more broadly on the importance of institutions for explaining broader issues of inequality, poverty and growth across nations (Acemoglu and Robinson, 2013). However, analysing the impact of reforming institutions is hard because randomly assigning a political or administrative process is seldom possible. To accurately measure the impact of an administration on student learning, one would need to relocate a school and its surrounding community in a weakly functioning province or national education system and then assess the level of improvement when reassigned to a better provincial or national education administration (van der Berg et al., 2016). In South Africa, however, a quasi-experiment created by historical circumstances allowed for the identification of a causal relationship between provincial administrations of education and learning outcomes in schools when provincial boundaries were adjusted between 2005 and 2007. This ensured that no municipality straddled two provinces (Gustafsson and Taylor, 2016). The redrawing of provincial boundaries that affected 7 of 9 provinces in South Africa resulted in the repositioning of 158 secondary schools under new administrations. Provincial boundary changes provided an extremely valuable opportunity to identify how the matriculation results of schools on the switching boundaries were affected by falling under an alternative provincial administration. The causal analysis by Gustafsson and Taylor (2016) identified that students directly benefited when their schools were under more functional provincial systems. The change in matriculation outcomes of province-switching schools moved remarkably consistently with the direction of perceived functionality of different provinces. In particular, schools that shifted from the North West to the Gauteng provincial administration experienced improvements in their matriculation examination outcomes. These findings have served to confirm widespread recognition that there are considerable differences in the functionality of provincial administrations and their sub-level districts in providing the right institutional environment in which schools can succeed (Taylor, 2014). The authors identify that

> *"by 2013, schools moving to better provinces had seen an improvement, over and above that which may have existed in other schools, equivalent to around one year of progress in a rapidly improving country. The conclusion that paying attention to a province's administration is a worthwhile policy priority seems supported"* (Gustafsson and Taylor, 2016: 26).

Figure 1: Average country and region test performance against spending per primary school learner



Source: Spending data for countries retrieved from UNESCO Institute for Statistics. Expenditure data for South African provinces obtained from the Provincial Budgets and Expenditure Review 2005/06 – 2011/12. Average test scores calculated using SACMEQ III (2007). Expenditure only includes public expenditures. Private expenditures may vary notably across countries.

Particularly noteworthy was the improvement in mathematics results (as measured by matriculation marks at the 95th percentile and adjusted for grade 10 to 12 promotion rates) of those schools originally located in the North West being transferred to the administration of one of the top performing provinces in South Africa, Gauteng.

Unfortunately, the Western Cape is one of only two provincial education departments (the other was the Free State) that was not affected by the provincial boundary changes. This natural experiment cannot be exploited to isolate out the bureaucratic or provincial administrative effect on student learning from other factors that drive higher levels of performance in the Western Cape relative to say the Eastern Cape (two provinces that have received particular attention in the ESID project series). In the absence of a social experiment or exogenous policy change, we rather take advantage of a host of available observed differences across school systems as captured in comprehensive SACMEQ surveys of students, teachers and school principals (or otherwise referred to as school heads).

Are there limits to bureaucratic governance for raising learning outcomes?

While Gustafsson and Taylor (2016) provide very convincing evidence on the importance of well-run education bureaucracies for learning outcomes, Cameron and Levy (2016) argue that there may be limits to the potential of bureaucracy for raising learning outcomes as they juxtapose the strength of the WCED's top down-bureaucracy against the position that "sustained, determined efforts to strengthen the operation of the Western Cape's education bureaucracy have not translated into larger, hoped-for gains" (ibid 2016:20).[4] But are these necessarily contradictory views? Taken together, bureaucractic governance and the larger political processes in which these are embedded may matter for learning but there may be limits to how much can be gained through top-down governance of schools.

They identify a number of reasons for why this may be the case including difficulties of overcoming socio-economic disadvantage (which we show that the Western Cape appears to do better than all other provinces at the low end of the SES spectrum), the persistant impacts of policy disruptions in education in post-Apartheid South Africa, weaknesses in teacher content knowledge and pedagogical skills and that performance management processes may only translate into sustained gains after a longer period. Hoadley et al. (2016) also identify that there are schools in the Western Cape that are subject to 'capture' by groups and individuals who do not have the best interests of children at heart. Yet a key argument emerging in the ESID papers on governance in the Western Cape is that strengthening the educational hierarcy (vertical governance and hierarchy) has not been complemented by a parallel focus on strengthening peer-to-peer governance (horizontal governance). They establish that more consideration needs to be given to the centrality of school-level governance dynamics, particularly the role of school governing bodies (SGBs), where its is suggested that supportive bottom-up governance enables some schools to achieve higher levels of performance even in the midst of weak bureaucratic support (Shumane and Levy, 2016).

This reasoning aligns with the work of Andrews, Pritchett and Woolcock (2013) who posit that vertical governance and increased pressures for compliance may provide schools with an appearance of capability but they remain functionally weak. Imposing top-down 'best practice' upon systems may actually crowd out alternative ideas and initiatives at a school level that may emerge from local

[4] The work by Lassibille (2016) in Madagascar also suggests that strengthening bureaucratic support without consideration for school-level interventions is not effective in changing the behaviour of school managers. Lassibille estimates the impact of a gambit of school improvement interventions (providing operational tools, report cards and related instructional manuals; holding meetings between school staff and the community to develop a school improvement plan; training sessions with various actors to stimulate motivation) at the district, sub-district and principal level on 7 school management (monitoring and support related) tasks that Malagasy educators deemed essential for school performance. The interventions changed principal behaviour only when targeting the entire chain of service delivery, with schools benefiting directly from school-level interventions and indirectly through the interventions at the sub-district and district levels. Positive impacts on principal management behaviour, however, were not beneficial when they cascaded down only through the district and sub-district offices.

agents. Cameron and Levy's (2016) proposal for complementary horizontal governance may provide a platform for what Andrews et al (2013) describe as "positive deviance", experimentation, learning by doing, grass-roots level problem solving and engagement. It also complements Elmore's argument that external accountability and broader bureaucratic and policy initiatives to strengthen schools are not sufficient for improvement. External accountability must be preceded with internal accountability, referring to the internal capacity of the school organization to hold its agents accountable to each other. It is internal accountability that determines the schools' response to the external environment and bureaucratic requirements (Elmore, 2002).

In qualifying this position, however, more empirical evidence is necessary, in addition to case-study work. It is conceivable that in realising eductionally signficant gains in school improvement, there are likely to be limits to *both* vertical and horizontal governance and management relations if these do not directly impact on what takes place in the instructional core, what City et al (2009) identify as "composed of the teacher and the student in the presence of content…a focus on the instructional core grounds school improvement in the actual interactions between teachers, students, and content in the classroom…" Meta-analyses of a plethora of randomized control trials in primary schools in developing countries find considerably smaller effects for strengthening school-based governance, management and bureaucratic support than efforts to impact directly on what happens in the instructional core through adddressing class sizes, learning material shortages and teacher capacity constraints (McEwan, 2015). As noted by Elmore (2000) in his insightful dialogue on "Building a New Structure for School Leadership":

> *"The closer policy gets to the instructional core – how teachers and students interact around content - the more policy-makers lose their comparative advantage of knowledge and skill, and the more they become dependent on the knowledge and skill of practitioners to mould and shape the instructional core"* (ibid, 2000: 26).

While his argument is directed at the limits of bureacratic processes and policy, it is also likely to be equally applicable to school-based management concerns. Unless local managers and governers in a school have a comparative advantage in understanding what is required for improvement at the classroom level and in facilitating these changes, it is not clear that strengthening horizontal governance through SGBs is the 'silver bullet' for change. Other developing country studies also cast doubt on the ability of parent associations or "school committees" (akin to the South African SGB) to contribute to school progress and learning where capacity levels of parents are low. In The Gambia, for example, Blimpo, Evans and Lahire (2015) identify that the impacts on learning of a management intervention that provided a grant and comprehensive school-management training program to principals, teachers and parent representatives was strongly mediated by the baseline local capacity of the region as measured by adult literacy or the share of the School Management Commitee who have no formal education. They found no evidence that a comprehensive intervention of this kind can help improve learning outcomes, except when baseline capacity is sufficienty high. They reason that "other inputs that enter the educational production function such as teacher quality and content knowledge might be low and thus constitute binding constraints that prevent other policies from functioning well" (Blimpo, Evans and Lahire, 2015: 4). Nevertheless, this quantitative literature often does not speak to how governance dimensions are likely to be just as much about power as about levels of capacity (Levy, 2014).

A further challenge to improving the complementarity of horizontal governance at a national level, is the opposing trajectory of recent national policy debates to limit SGB powers and effectively revert to more centralised governance arrangements as a way of limiting the predatory influence of some SGBs on the school system (Makhubele, 2015; DBE, 2016; ELRC, 2014: 22). Of course, bureaucracies can also be predatory (with substantial variation from province to province), so there is need for careful reflection as to whether, in some contexts, the proposed solution would indeed reduce the overall risks of predation.

Teacher content knowledge as a binding constraint to educational improvement in South Africa

With the exception of being directly involved in appointing SGB paid teachers (an inaccessible option for the majority of no-fee paying schools), it is also not clear how South African SGBs actively alter a binding constraint to educational improvement: the 'stock' of quality teachers in a school. Positive peer-to-peer governance is implied as being important for stimulating aspects of teacher quality *other* than content knowledge such as motivation, engagement and team work (Shumane and Levy, 2016). But motivation, while important, is unlikely to overcome teacher content knowledge gaps as suggested by Taylor, Draper and Sithole (2013) who introduced the simple concept in the NEEDU 2012 report of distinguishing between teachers who "won't" or alternatively "can't" teach. Venkat and Spaull (2015) show that the vast majority (79%) of South African grade 6 mathematics teachers were classified as having content knowledge levels below grade 6 using SACMEQ 2007 data. That is to say that they could not achieve 60% correct or more on the grade 6/7 mathematics items in the test. But there are notable differences in the content knowledge of teachers across South Africa. For example, across the 42 item test (corrected for guessing) they identify that grade 6 Western Cape teachers who wrote the SACMEQ 2007 teacher test (64% of the Western Cape teacher sample) got 63% of the items correct on average compared with 39% of items correct on average among Eastern Cape teachers (Venkat and Spaull, 2015). Within South Africa, teacher content knowledge appears to be highest among Western Cape teachers as seen in Table 1.

Nevertheless, even where teachers have better levels of teacher content knowledge across South Africa, overall these skills are not translated into the levels of student learning that we would hope to see. Other SACMEQ countries achieve higher levels of student learning with similar levels of teacher content knowledge. This is illustrated in Figure 2 which presents a local polynomial smoothed line for student mathematics test scores against teacher mathematics test scores for selected regions sampled in SACMEQ 2007 (see next section for more information on this dataset). At roughly 1 to 2 standard deviations above the mean teacher mathematics score, higher levels of student performance are observed in Kenyan regions or Gaborone (in Botswana), than in the Western Cape or Gauteng. The quality of teachers in the Eastern Cape is obviously a concern but equally their ability to convert teacher content knowledge into student performance in mathematics as suggested by a flat student-teacher test profile.

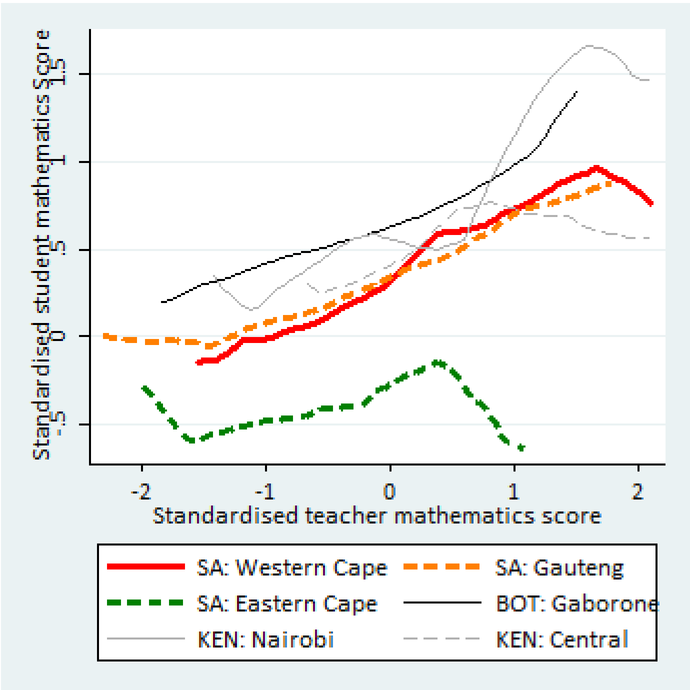
As indicated in the 2013 DBE sector report, "What this suggests is that whilst improving teacher knowledge must be a priority, it is also important to focus on better ways of making use of the existing levels of teacher knowledge, through for instance more effective school management" (DBE, 2013: 24). The multivariate estimation results presented later confirm that even when discounting for differences in teacher content knowledge and qualifications, significant differences exist across countries in terms of student performance. It is most likely the case that teacher content knowledge interacts with other important aspects of the schooling environment to produce the desired learning impacts.

Table 1: Teacher content knowledge. Percentage correct on 42 item test (corrected for guessing) using SACMEQ 2007.

	Proportion who wrote the test (%)	Mean (%)	Std. error (%)
Eastern Cape	82	39	2.7
Free State	93	50	3.5
Gauteng	70	52	4.4
KwaZulu-Natal	85	46	3.2
Limpopo	93	44	3.2
Mpumalanga	83	32	2.9
Northern Cape	84	53	3.7
North West	80	47	4.1
Western Cape	64	63	3.4

Source: Venkat and Spaull (2015) using SACMEQ 2007.

Figure 2: Student mathematics and teacher mathematics scores for selected SACMEQ 2007 country regions



Source: SACMEQ 2007, own graphs. **Notes**: Kernel-weighted local polynomial regression. To ease the comparison, student mathematics scores and teacher mathematics Rasch scaled scores are standardised to a mean of 0 and standard deviation of 1. Outliers with teacher test scores over 2.5 standard deviations are excluded. BOT = Botswana. KEN = Kenya. SA = South Africa.

III. The Western Cape performance differential. A descriptive analysis

Method and Data

In the sections that follow we provide more specificity on whether there is a student performance differential between the Western Cape and i) other provinces in South Africa, ii) other countries and iii) within country regions.

It is important to note that different conclusions will be reached about the comparative performance of a country/region versus others depending on *what* educational outcome is compared, *how* it is measured and *who* is considered among a sub-population of students in making a comparison. Although we consider findings from other reports on provincial performance using a number of different school survey datasets as well as the matriculation examination, the dominant findings of this paper rely on using the third SACMEQ dataset due its cross-sectional nature.

Data

The Southern African Consortium for Monitoring Educational Quality (SACMEQ) is a group of education ministries, policy-makers and researchers which in conjunction with UNESCO's International Institute for Educational Planning (IIEP) has administered four cross-national surveys of grade 6 learning across fifteen SACMEQ ministries of education since its inception. The most recent SACMEQ IV survey of 2013 has not yet been released in the public domain. We therefore rely on older SACMEQ III data collected during the last quarter of 2007 from 61,396 pupils, 8,026 teachers and 2,779 schools. Across each sample, the data was explicitly stratified by region by separating each sampling frame into separate regional lists of schools prior to undertaking the sampling. This means that data is representative of grade 6 students not only at the country level but regional/provincial level.

Students were tested in three subject areas - literacy, mathematics and health - although we only use the first two performance measures in this paper. Rasch scaling was used to generate the literacy and mathematics scores where different test levels can be used to ascertain mathematics and literacy competencies providing a concrete analysis of what pupils and teachers actually can do (Hungi et al., 2010).

We consider four key outcome measures from SACMEQ for the descriptive analysis:

- A literacy score - a Rasch scaling measure taking into account the difficulty of each test item in the reading test (set to have a mean of 500 and standard deviation of 100).
- The percentage of grade 6 students who can achieve a competency level of 4 (derived from the literacy score scale) reflecting that they can read for meaning. They have surpassed a basic reading level and "can read on or read back in order to link and interpret information located in various parts of the text" (Hungi et al., 2010: 6).
- A mathematics score - a Rasch scaling measure taking into account the difficulty of each test item in the mathematics test (set to have mean of 500 and standard deviation of 100).
- The percentage of grade 6 students who can achieve a competency level of 4 on the mathematics test reflecting that they have reached a "beginning level of numeracy". What this means is that students have surpassed a level of basic numeracy and now "translate verbal or

graphic information into simple arithmetic problems." They can use multiple different arithmetic operations on whole numbers, fractions and/or decimals (Hungi et al., 2010: 8).

Descriptive Method

At a purely descriptive level comparing raw averages without taking into account often high levels of variation about the average as reflected in confidence intervals can lead to very misleading comparisons across countries or regions. Averages themselves may also mask very different levels of performance along the student socio-economic profile especially in countries or regions with high levels of inequality.

Certain countries or provinces cannot be compared fairly without accounting for large differences in home background factors or differential access to resources. For example, if students in the Western Cape are wealthier than students in another context or the schools they are attending are more resourced, one must discount for this advantage. Higher learning outcomes may be the result of students' home background including parent's education and support for learning, prior access to early childhood development or resources in the home which enable a child's development. This is particularly the case in South Africa where the relationship between socio-economic status of students, and particularly the school, is extremely strong and convex by international standards. In 2009, Stephen Taylor and Derek Yu conducted a comprehensive analysis of the relationship between socio-economic status and educational achievement in South Africa relative to other international contexts by using a number of different international tests of student achievement.[5] Their work highlighted how a considerable amount of the variance in reading and mathematics scores among South African students can be attributed to a students' SES and particularly the SES of their school. Furthermore, the strength of this relationship is considerably stronger when compared to other international contexts; in fact, all other countries that participated in PIRLS 2006 (Taylor and Yu, 2009: 23; Taylor, 2010).[6]

In both the descriptive and multivariate analyses, effectively discounting for advantage requires constructing a comparable measure of student socio-economic status (SES) across countries or regions. The choice of SES scale can, however, significantly influence the performance rankings of countries over the socio-economic profile (Kotze and Van der Berg, 2015).

Most commonly, socio-economic status of students is captured by deriving an index of asset ownership using questions in surveys on the possession of assets in a household such as a fridge, television, bicycle or car. Constructing the asset index involves attributing unique weights to each of the various possessions based on the amount of common information they provide. One of the criticisms of using asset-based indices of SES for a combined sample of countries is that this method assumes that the same possessions will carry the same weights in different countries, regardless of the different contexts. While this assumption may be plausible for countries of a similar economic development level, it will not be accurate for countries with greatly varying economic structures (Filmer and Pritchett, 2001; Harttgen and Vollmer, 2011). For instance, ownership of a radio in Malawi is associated with a completely different percentile in the income distribution than the ownership of a radio in Finland. To have the most accurate SES measure *within* a country, country

[5] They used PIRLS 2006, SACMEQ 2000; TIMSS 1995; TIMSS 1999; TIMSS 2003.

[6] As an example Taylor and Yu (2009:23) note that the "South Africa a student with a given SES has more than twice the chance of achieving a reading score approximately equal to the reading score predicted by the SES gradient, than would be the case in the USA."

specific weights need to be derived to attach country or region level weights to possessions. But this comes at the cost of the comparability of the SES measure across the countries.

In order to circumvent this trade-off, Kotze and Van der Berg (2015) propose a method which constructs a wealth indicator which takes into account both the accuracy and the comparability of the commonly used asset index.[7] The distribution of an asset index constructed using a country specific weighted index is linked to the national income distribution in order to simulate household income for each wealth percentile. The traditional asset-based index is transformed into an indicator measured in log of per capita consumption. The result is therefore a single, internationally comparable measure of student SES which can be applied to every international evaluation for which an asset index can be derived. This new wealth indicator enables the comparison of equally poor students under different education systems. For example, the level of literacy of a child living under $1.25 per day or $2 a day in the Western Cape can be compared to the level of literacy of a child who is equally poor in the Eastern Cape or in Kenya. To further increase the accuracy of a comparable SES measure, the social gradients are adjusted to account for out of school children. Some countries may perform better than others if only the strongest of candidates are enrolled in the school system. Effective access to education must account for both enrolment patterns and what they learn in school (Taylor and Spaull, 2015). We calculate the percentage of 11 to 15 year olds who are currently not in school at each percentile and make the assumption that these students would have performed at the same level as the lowest performing 5th percentile, had they written the SACMEQ tests. For more detailed information on the construction method the reader is referred to the appendix and Kotze and Van der Berg (2015).

Unfortunately, due to challenges in accessing household income data for certain countries, this internationally comparable SES scale measured in log per capita consumption terms could be constructed for some but not all of the countries participating in SACMEQ. Where not available we revert to a country specific weighted SES asset index.

Of course, beyond conditioning on student SES there are a number of other significant differences in student groups, the schools in which they learn, their teachers and other factors that influence the learning environment. We give more attention to these factors in the multivariate estimation section.

Results: Provincial comparisons of student performance within South Africa

The Western Cape is a top performing province but not consistently the best performing province in terms of student achievement

We start off comparing student performance across provinces within South Africa which can be tackled rigorously given the availability of a number of within country datasets in addition to international tests of numeracy or literacy. The Western Cape can certainly be commended for the relatively good student achievement outcomes it produces within the South African context. But it is important to qualify that while the Western Cape is *a* best performing provincial department with respect to observed educational outcomes in South Africa, it is not consistently *the* best performer. Depending on what educational outcome is considered, the grade level and the position at which performance is measured along the student socio-economic profile, Gauteng or other provinces at times fare better.

[7] A method similar to this was devised by Harttgen & Vollmer (2011) in order to link asset indices in the DHS data to a national income distribution. Their method, however, is not suitable for our purposes as it is unable to account for children of a specific age group.

Gustafsson in the 2013 “Report on Progress in the Schooling Sector Against Key Indicators” (see DBE, 2013) compares student achievement across nine provinces using different grade and subject test results from the Annual National Assessments (2011-2012), SACMEQ III maths performance, TIMSS 2011 and different measures of grade 12 performance in the matric examinations. In total he identifies 14 different measures. His analysis suggests that the Western Cape performs best across 8 of the 14 measures, not all 14 measures. One relative area for improvement in the Western Cape is actually converting learning into National Senior Certificate (NSC) or matriculation outcomes – the NSC is the critical document that provides students with added advantage in accessing further tuition and earnings potential in the labour market (DBE, 2013). Although the proportion of those who actually sit the matriculation examination and pass is high in the Western Cape, other provinces such as the Free State or KwaZulu-Natal are more effective at producing larger proportions of their provincial population of youths with a NSC. Using General Household Survey data for the periods 2012-2014, it is Gauteng that has the highest percentage of youths aged 20-28 with a completed grade 12.[8] Furthermore, the Western Cape, though a relatively good performer at the Grade 12 level, could probably perform a lot better here if one considers that it emerges as a top performing province in the earlier grades (DBE, 2013: 3).

Furthermore, the levels of improvement in student achievement that are evident in other provinces are not necessarily observed in the Western Cape, possibly as results are coming off a higher base level. In examining growth rates in the number of high-level mathematics and physical science passes in the matriculation examination between 2008 and 2015, the Western Cape shows some of the lowest rates of growth in the percentage of students achieving 60% or more in mathematics or physical science.

Table 2: TIMSS 2002 and 2011 performance

	TIMSS 2002		TIMSS 2011		
	Average math. score	Sample size	Average math. Score	Sample size	Probability > F
Eastern Cape	250	508	316	966	0.001
Free State	291	405	359	821	0
Gauteng	303	333	389	1579	0
KwaZulu-Natal	278	775	337	2083	0
Limpopo	244	628	322	1139	0
Mpumalanga	287	469	344	1581	0.001
Northern Cape	341	341	366	882	0.263
North West	280	435	350	895	0
Western Cape	414	367	404	1103	0.737
South Africa	285	4261	348	11049	0

Source: Reddy, Prinsloo, Arends and Visser (2012). **Notes:** Provincial statistics and the 2002 national statistic all exclude independent schools. Only the 2011 national statistic includes independent schools. A difference-in-means test was run for each province, and for the country. The result was that for 7 provinces, specifically those with values close to zero in the final column, differences are indeed statistically significant except in the Northern Cape and Western Cape.

Another interesting aspect is the change in provincial performance of grade 9 students’ mathematics across TIMSS 2002 and 2011 (Reddy et al., 2012). Average performance for the Western Cape exceeded other provinces in both years but there was no discernible improvement in results across the

[8] Part of this Gauteng advantage in the NSC could relate to in-migration of educated youth into the province in search of job opportunities (Gauteng has increasingly become a hub of economic activity in South Africa).

two years, again possibly because results are coming off a larger base. Statistically significant improvements were observed in all other provinces except the Northern Cape as seen in Table 2. This provides some suggestion that other provinces are potentially catching up to the Western Cape in terms of student achievement although more recent data such as the soon to be released 2013 SACMEQ IV and 2015 TIMSS results are necessary to verify this.

Western Cape grade 6 students perform better at lower ends of the SES distribution than students in any other province

We now consider how Western Cape grade 6 students fare relatively to their peers in other South African provinces but across the socio-economic student profile. A key conclusion from Figure 3 is that when comparing the performance of the poorest grade 6 students across provinces, they perform notably better in the Western Cape than in any other province regardless of what SES scale is used. The performance of students who are living on $1.25 or $2 dollars a day, as transformed onto the log of per capita consumption scale and reflected by the two vertical red lines, is better in the Western Cape when considering both mathematics and literacy scores. This suggests that the bureaucratic efficiency of the Western Cape Education Department does not just benefit the wealthy, it benefits the poorest of students in their system. Figure A1 which also provides confidence intervals around mathematics and literacy scores for the Western Cape, Gauteng and Eastern Cape confirms that the higher performance of the Western Cape is statistically significant among poorest students. This is also confirmed later in the econometric results, where the Western Cape outperforms Gauteng province (and the Eastern Cape) among schools in the poorest school quartile.

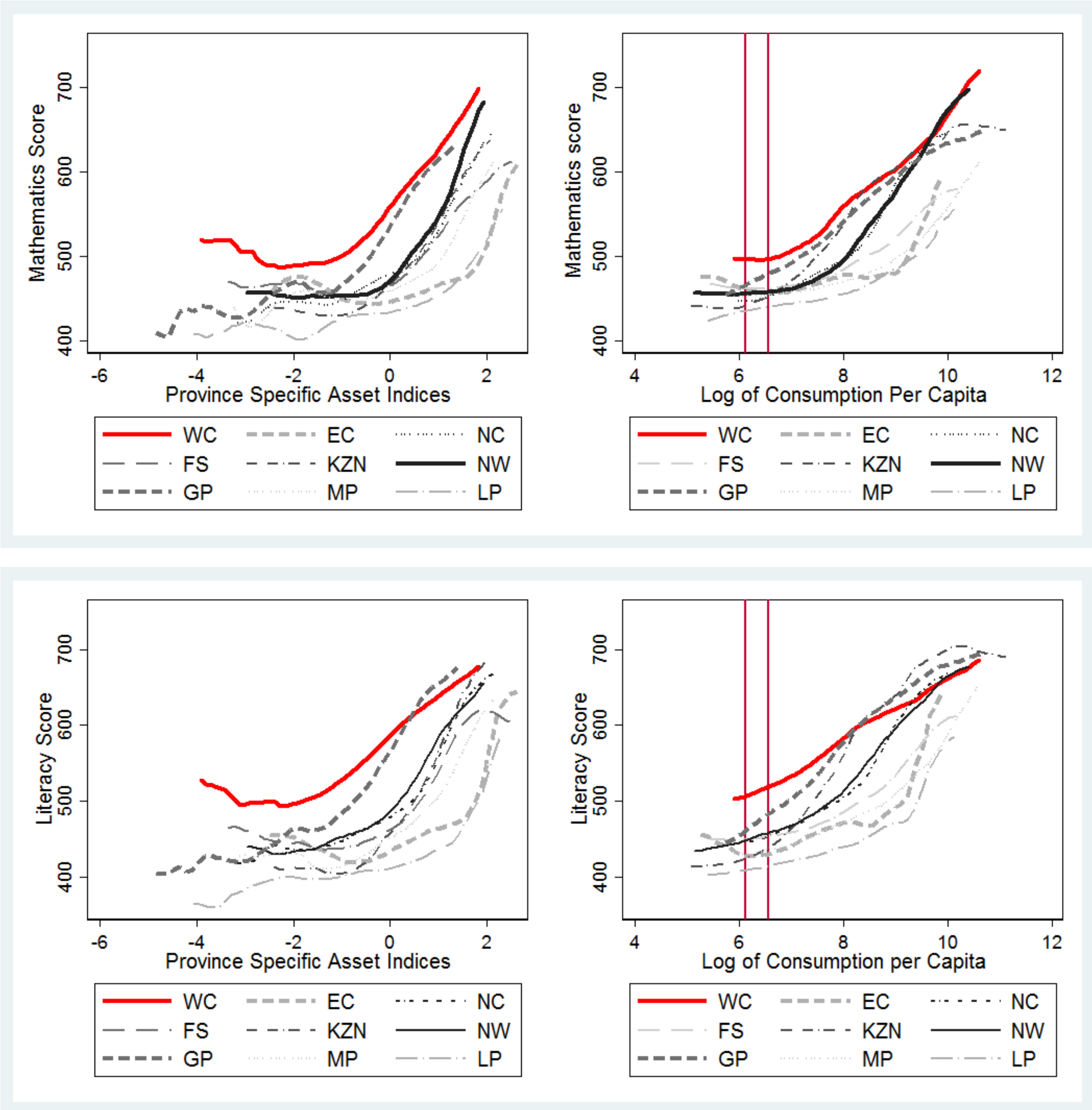
It is important to note that the choice of SES measure used does influence the extent of the performance differential between the Western Cape and other provinces. The performance differential declines when the log of consumption per capita is used rather than the less comparable province specific weighted SES asset index (in the first panel of Figure 3). In particular, the performance differential narrows between students in the Western Cape and Gauteng and notably KwaZulu-Natal with indications of possibly higher literacy scores achieved in Gauteng and KwaZulu-Natal at higher ends of the student SES distribution. The performance differential between Western Cape and Eastern Cape students also narrows when the more comparable SES measure is used. However, Eastern Cape students consistently fare very poorly with worse performance only observed among students from Limpopo.

Results: Cross country comparisons of student performance

Each of the four graphs in Figure 4 shows the average performance of South Africa and its nine provinces relative to other countries participating in SACMEQ III (excluding Seychelles due to small sample size) using four performance measures.

With respect to literacy scores, there are no other countries which on average achieve statistically significantly higher literacy scores than students in the Western Cape. It is important to note as well that Western Cape students do not outperform their counterparts in Gauteng using average performance measures. But there are considerable differences in the average performance of students in the Western Cape (and Gauteng) relative to South Africa. Whereas 87% of grade 6 learners could read for meaning in the Western Cape, only 52% of South African grade 6's on average could read for meaning. This was as low as 36% in the Eastern Cape.

Figure 3: Mathematics and literacy scores for grade 6 students by student SES, provincial comparisons using two measures of student SES



Source: SACMEQ III and NIDS household dataset. **Notes**: In the first vertical panel, province specific SES measures are used where possessions are weighted at the province level. In the second vertical panel the province specific weighted SES index has been calibrated to the consumption distribution of households with children of similar age (11 to 15 years) to the grade 6 cohort. In the second panel, the socio-economic profile is also adjusted for slight variations in the enrolment rate of 11 to 15-year-old children. Children who are not in school are given the learner performance level of a grade 6 student in the bottom 5% of the performance distribution. The red vertical lines reflect the point at which a student lives at the poverty line as reflected by $1.25 per day or $2 per day.

There are also only three within country regions of the 116 regions that outperform the Western Cape in reading achievement; namely Nairobi in Kenya, South Highlands in Tanzania and Manzini in Swaziland as reflected in Figure 6. When looking at mathematics achievement, statistically significantly higher average numeracy scores are observed among Mauritian grade 6 students compared with Western Cape students and only 4 within country regions in Mauritius (see Figure 5) outperform the Western Cape with respect to average mathematics achievement. It must also be recognised that the differences in mathematics scores and the percentage of grade 6 learners who are achieving at a beginning level of numeracy are not statistically significantly different across Gauteng and the Western Cape.

Confidence intervals are, however, wide for regional averages due to smaller sample sizes which makes it difficult to detect real differences in averages. Notable differences in performance, however, emerge in the multivariate analysis and in interrogating performance across the student SES distribution.

Western Cape performance along the socio-economic learner profile – a within and cross-country comparison

In Figure 7, which contrasts the student SES performance profiles for the Western Cape and Gauteng against two top performing countries in SACMEQ, Kenya and Tanzania, even higher levels of sensitivity to the SES measure are observed when considering the shape and position of each profile.

Whereas it appears that Kenya and Tanzania are underperforming relative to the Western Cape and Gauteng provinces using a context specific weighted SES asset index, the picture is very different when the SES asset index distributions are appropriately anchored to the log of consumption per capita scale. This reiterates the findings of Kotze and Van der Berg (2015). After the calibration, students in Tanzania and especially those in Kenya outperform Western Cape students at all levels of SES including at the $1.25 and $2 dollar a day poverty lines represented by the red vertical lines (see Figure A2 for confidence intervals). If we limit Kenyan students to those in wealthier within-country regions this difference in favour of Kenya will likely be augmented.

Unfortunately, household data could not be accessed for other top-performing countries in SACMEQ III such as Mauritius, Botswana and Swaziland to calibrate their SES asset indices to the log of consumption per capita scale.[9] We give closer attention to the comparison between the Western Cape and these three other countries in addition to Tanzania and Kenya in the multivariate analysis that follows.

[9] Both Mauritius and particularly Botswana charge notable amounts for their datasets collected by their central statistics offices. This unfortunately limits economic research more broadly on these two countries. Providing open-access data through portholes such as the International Household Survey Network (IHSN, www.ihsn.org/) is highly recommended as a way of engaging the interest of the international research community and aspiring academics to conduct research on these nations which would be valuable research for these countries. An additional barrier to using a number of datasets collected by Central Statistics in Mauritius is that by law they require a representative to collect the data in person.

Figure 4: Literacy and mathematics results in SACMEQ III 2007, all participating countries and nine South African provinces

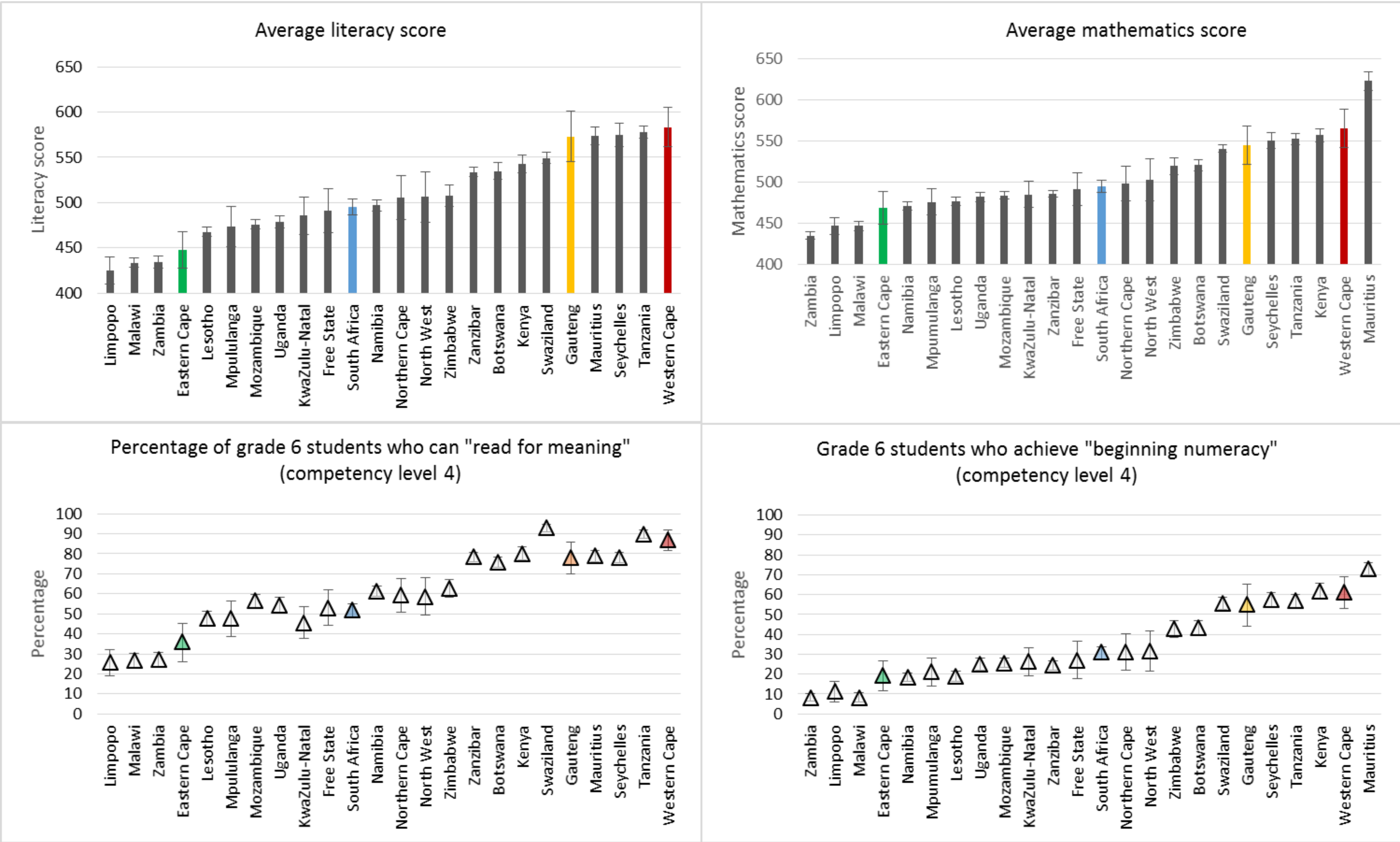


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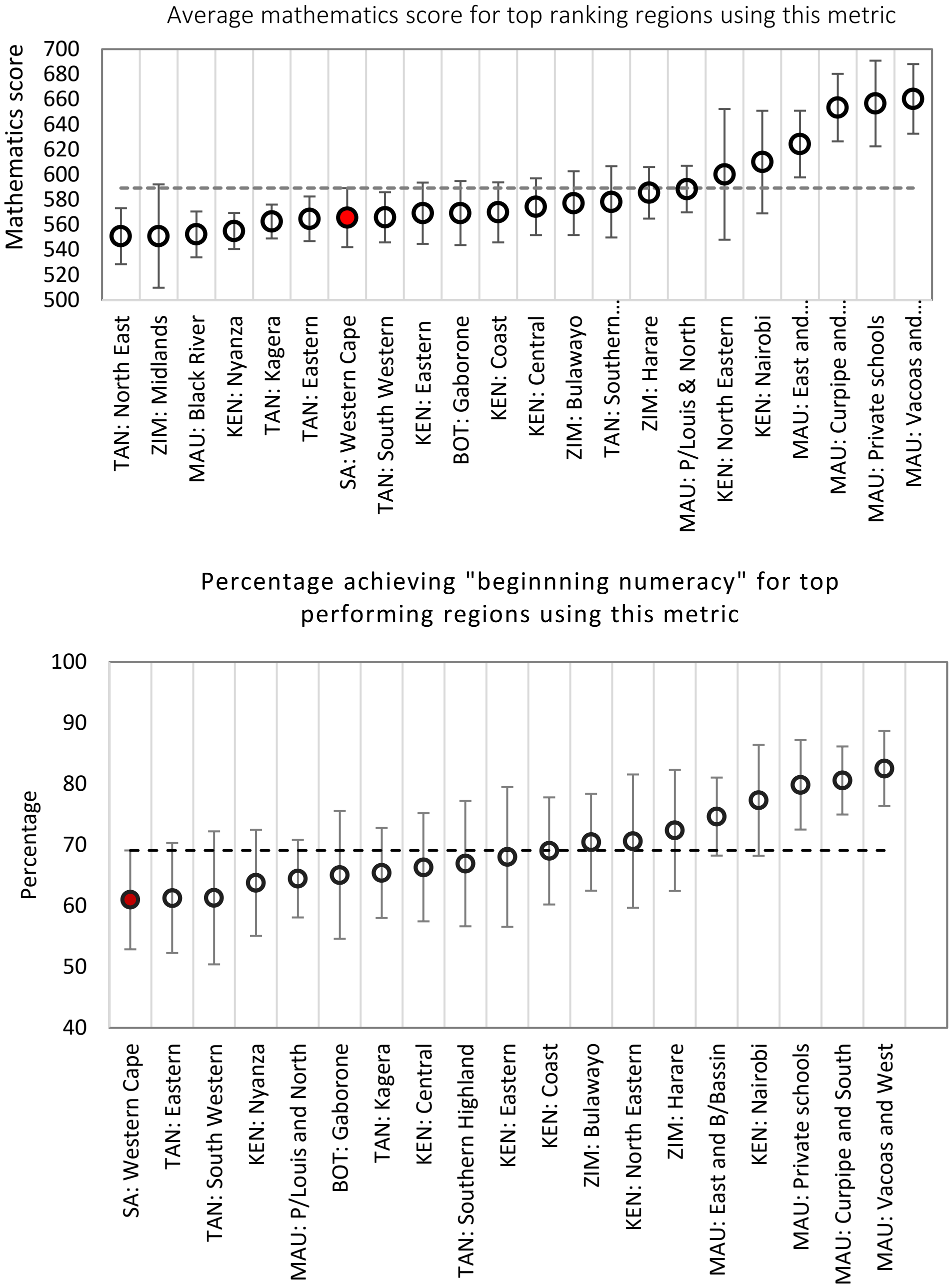
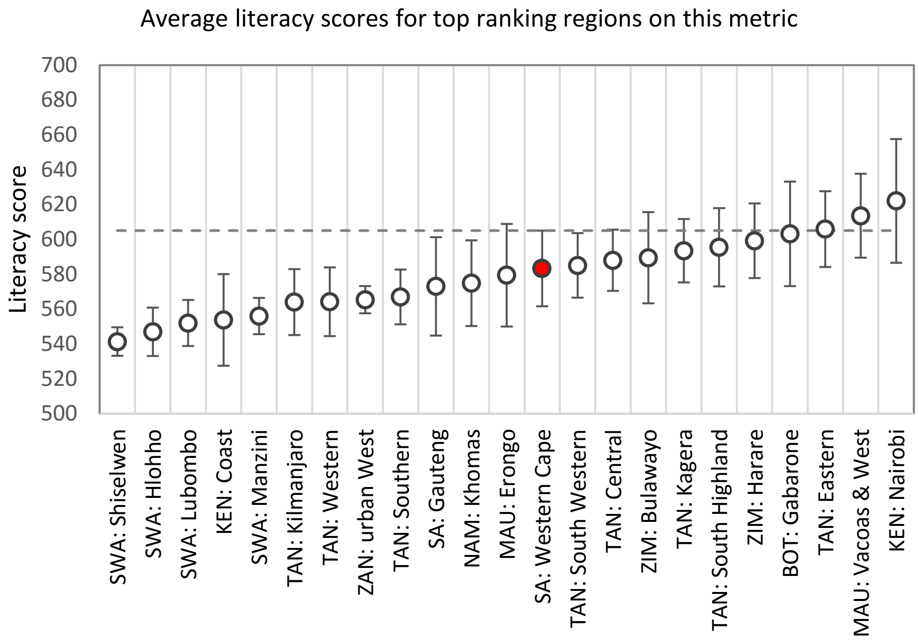
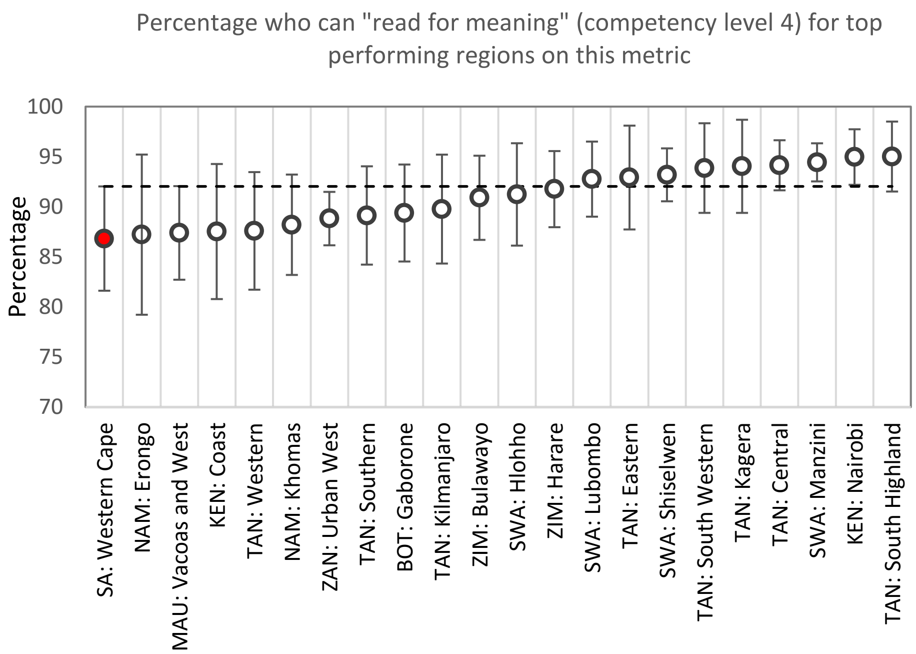
Figure 5: Mathematics achievement among grade 6 students for top performing within-country regions, SACMEQ III 2007



Source: SACMEQ III, 2007. **Notes**: Estimates account for survey sample weights. Dashed line reflects upper limit of 95% confidence interval for the Western Cape. Bars about the mean reflect the 95% confidence interval. Average performance is only different from the Western Cape where the entire confidence interval lies below or above the dashed line.

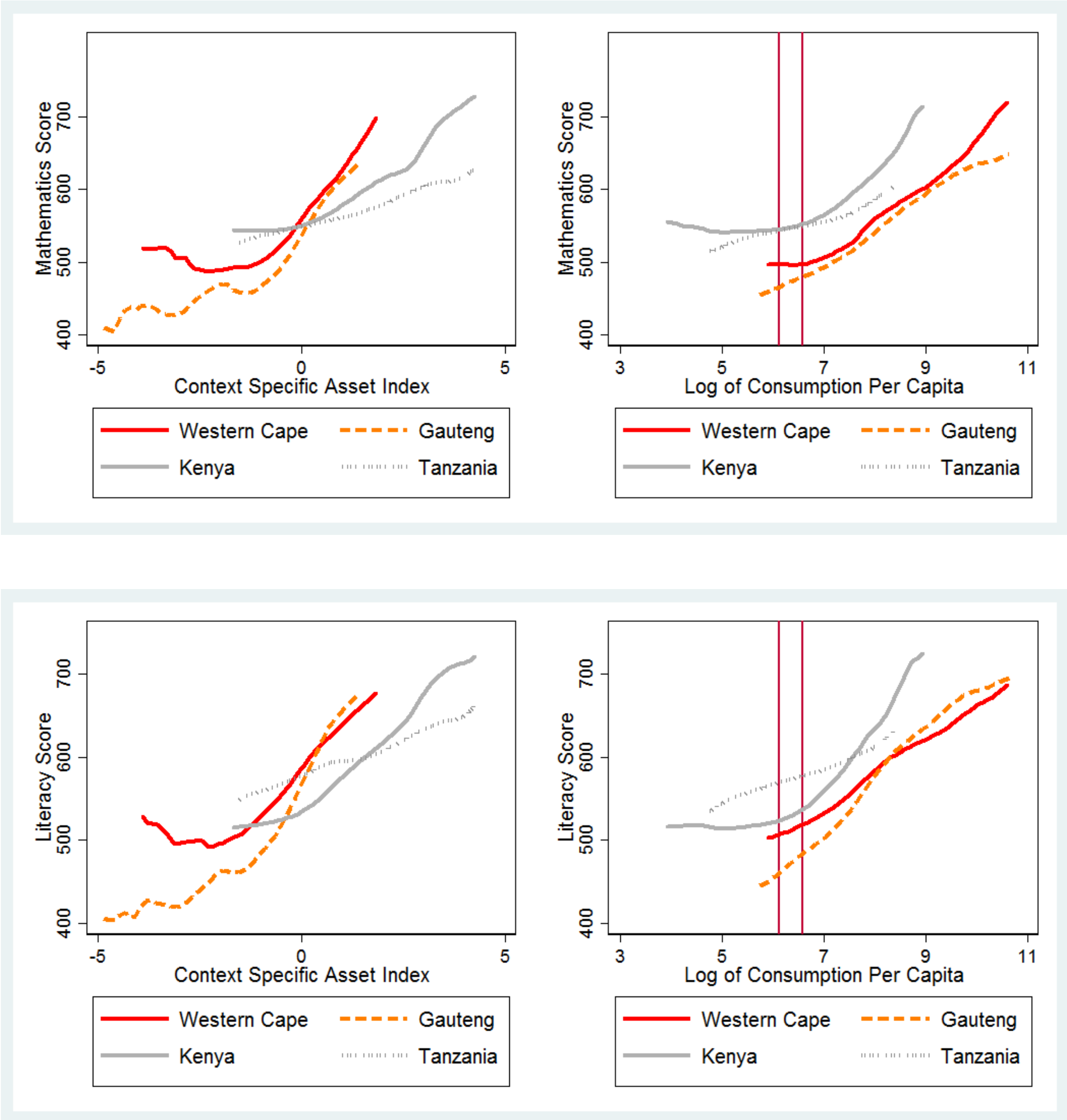
Figure 6: Literacy achievement among grade 6 students for top performing within country regions, SACMEQ III 2007





Source: SACMEQ III, 2007**. Notes:** Estimates account for survey sample weights. Dashed line reflects upper limit of 95% confidence interval for the Western Cape. Bars about the mean reflect the 95% confidence interval about each mean. Average performance is only different from the Western Cape where the entire confidence interval lies below or above the dashed line.

Figure 7: Mathematics and literacy scores for grade 6 students by student socio-economic status, cross national comparisons using two measures for student SES



Source: SACMEQ III and household datasets. **Notes**: In the first vertical panel, province or country specific SES measures are used where possessions are weighted separately for each province or country. In the second vertical panel the province specific weighted SES index has been calibrated to the consumption distribution of households with children of similar age (11 to 15 years) to the grade 6 cohort. In the second panel, the socio-economic profile is also adjusted for slight variations in the enrolment rate. Children who are not in school are given the learner performance level of a grade 6 student in the bottom 5% of the performance distribution. The red vertical lines reflect the point at which a student lives at the poverty line as reflected by $1.25 per day or $2 per day.

IV. Multivariate estimation

Method and data descriptives

In identifying whether certain systems are more efficient than others in producing learning outcomes, one must take into account that not only are children brought up in very different home circumstances (captured to some extent in differences in SES) but the context in which administrations operate is likely to be very different. In addition to diverse student populations, there may be considerable resourcing disparities across the educational systems of poorer and wealthier countries (and regions) in terms of classroom resources, infrastructure and buildings, teacher qualifications and content knowledge to name but a few. Parental support may also differ across systems. In the multivariate estimation that follows we are able to more rigorously control for these differences before using the coefficients on region or country indicators to make fair comparisons of student performance.

Tables 3 to 5 describe the differences in the characteristics of Western Cape students against those in Kenya, Mauritius, Botswana and Tanzania. In addition, we contrast Western Cape students to those in Gauteng and Eastern Cape (benchmarks for better and poorer performing in-country regions in South Africa). Table 3 describes student-level information for the countries/regions of interest. Data is included on student's sex and age, as well as indicators for living situation, parental education, absenteeism, access to books and computers, attendance of preschool, exposure to the test language (English), number of children in the home, travel time to school, access to daytime meals, assistance with homework at home, and grade repetition. Apart from the distribution of girls and boys, it is clear that the home background of students is vastly different across country and regional contexts. Whilst students from Mauritius and the Gauteng and Western Cape provinces of South Africa come from highly educated, resource rich homes with relatively fewer household members, the opposite is true for Kenya, Tanzania and the Eastern Cape.

With regards to teacher and classroom resources (Table 4) similar and, in some cases more dramatic, differences across countries are evident. Whilst Kenya has comparable teacher performance to the Western Cape with respect to teacher content knowledge in literacy and mathematics, their teachers are markedly younger, less experienced and less educated. Tanzanian children are taught by even younger, less educated and less experienced teachers. Despite this and the fact that Tanzanian and Kenyan classrooms are fuller (with corresponding higher pupil-teacher ratios) and have access to fewer textbooks than in the Western Cape, their student performance is competitive to that of the Western Cape, and significantly higher than the South African average.

We also consider some observed factors that may provide crude proxies for the quality of governance and management in the school including data on teacher absenteeism, problems of teachers skipping class and district support (indicated by whether school inspection has taken place). Additionally, the impact of the political environment on the school as proxied by strike days lost is considered as a control variable. In 2007 South African teachers participated in one of the largest public sector strikes in post-Apartheid South Africa (while hardly any strike activity occurred in other SACMEQ countries that year) but is suggested as having very significant impacts on student learning (Wills, 2016). Teacher strike absenteeism was twice as prevalent in the Eastern Cape as in the Western Cape and Gauteng. Finally, we consider indicators that capture parental involvement in the school along various dimensions such as assisting the school with infrastructural needs, providing financial contributions to teacher/staff salaries or supporting school extra-curricular activities.

We discount for these observed differences across systems using a regression framework and propensity matching approach. Consider the following education production function:

$$\boldsymbol{Y_{is} = WC + \beta' H_{is} + \alpha SES_{is} + \gamma' R_{is} + \delta' I_s + \varepsilon_{is}}$$

where $\mathrm{Y_{is}}$ is the test score of student i in school s, $\mathrm{H_{is}}$ is a vector of student and home background factors, SES is a continuous measure of socio-economic wealth (either context specific SES or log per capita consumption), R_{is} is a vector of classroom and teacher resources, and $\mathrm{I_s}$ is a vector of school/institutional factors. WC is a Western Cape fixed effect that takes a value of 1 if the student is taught in a Western Cape school, and 0 otherwise. It is this variable that is of primary interest to this paper, measuring the difference in expected performance between Western Cape students and another country or regions' student group once controlling for all contextual poverty, home background and school resourcing variables.

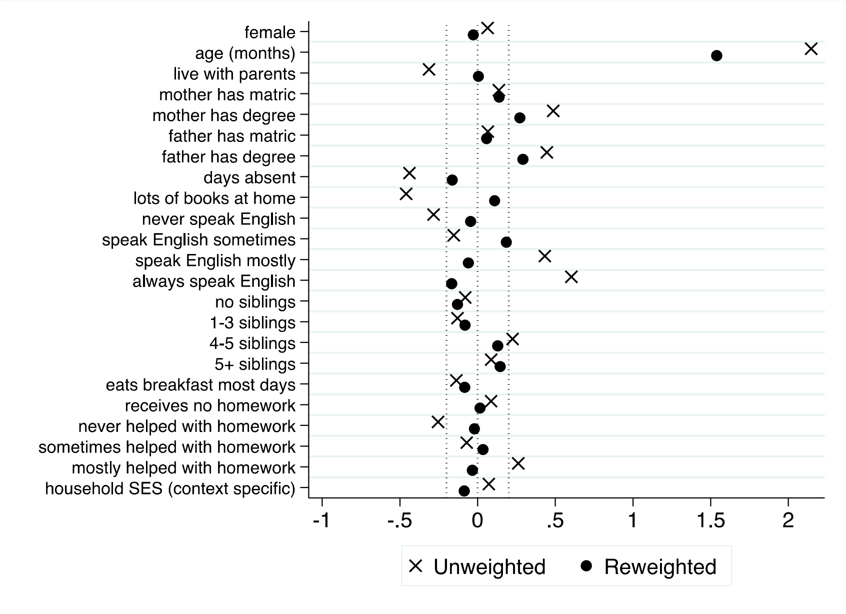
As was seen from Table 3, there are significant differences in the country and regional student samples when comparisons are being made to the Western Cape. This has implications for estimation. A lack of common support in covariate controls will result in bias in the estimated WC effect given extrapolation over the supports of H, SES, R and I where no comparable observation exists. For this reason, propensity score weights are computed and utilised in weighted least squares regression to ensure that the estimated WC coefficient is computed using the most suitably comparable groups of students across two country/regional settings. The weights used here are one of a class of balancing weights and their associated estimand (Li, Morgan and Zaslavsky, 2014). Specifically, students in the Western Cape are assigned propensity score weights equal to $\mathbf{1 - e(x)}$ and learners in the comparison country/region are assigned weights equal to $\mathbf{e(x)}$, where $\mathbf{e(x)}$ is the propensity score of being a grade 6 student in the Western Cape estimated from a probit model where student and home background characteristics are regressed onto the WC dummy. This weighting places greater emphasis on units with propensity scores close to 0.5 where overlap between the two student groups is greater.

In the spirit of doubly-robust estimation, the final model controls for the propensity weights as well the same student and home background variables used in estimating the propensity score on which the weights are computed. This regression-adjustment mops up any imbalances that may remain between groups (Hill & Reiter, 2006; Ho, Imai, King & Stuart, 2007; Stuart, 2010), increases the precision and efficiency of the estimation and reduces bias (Abadie & Imbens, 2011; Kang & Schafer, 2007; Rubin & Thomas, 2000).

However, while this approach gets us further it is also illustrative of some of the challenges of trying to engage in cross-country comparisons of student performance. Figures 8 to 13 illustrate to what extent the propensity reweighting approach is able to enhance balance across two samples of students. Standardised differences in means are computed before and after reweighting is applied, with a value of between -0.2 and 0.2 being indicative of good balance. In the case of Western Cape comparisons to Botswana, Mauritius, Gauteng and Eastern Cape, the standardised difference in means in student and home background factors are brought closer to zero after reweighting is applied (see figures 9 to 12 below). In the case of Kenya, the reweighting creates some improvement in sample balance, although this depends on limiting Kenyan regions in consideration to Kenya Central and Nairobi (see figure 13).

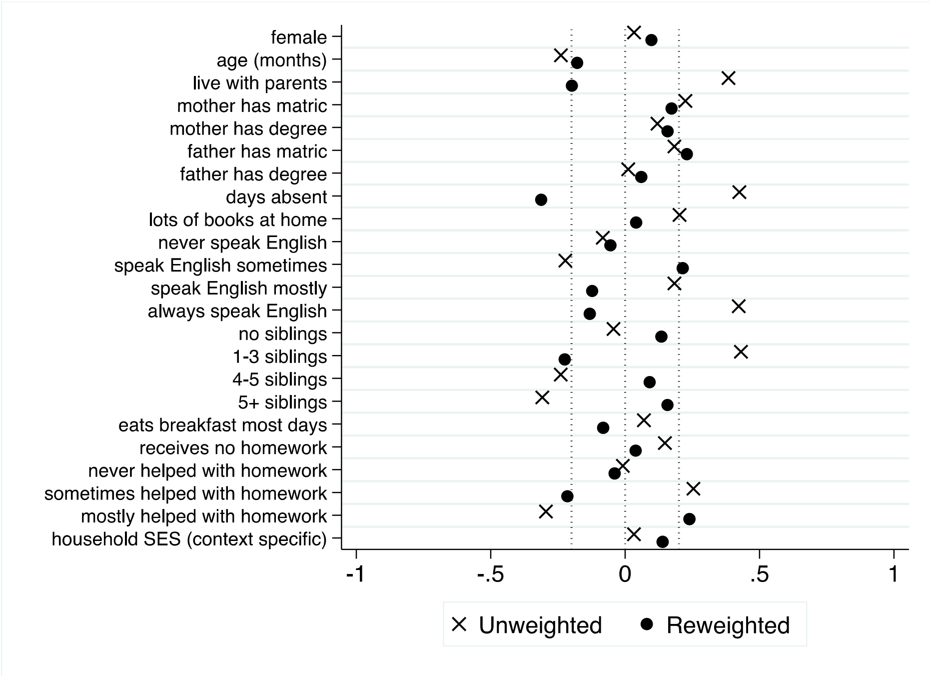
Whilst it is possible to achieve suitable covariate support between selected Kenyan regions and the Western Cape, the same is not true of Tanzania. Figure A3 of the appendix displays the standardised differences in means between the Western Cape on the one hand, and Kenya and Tanzania on the other. There is substantially limited common support between the Western Cape and Tanzanian samples even more so than that between the Western Cape and all Kenyan regions. With such limited common support, there is little that can be done to reliably protect the regression analysis from strong biases. Propensity score weights are not applied in the comparison with Tanzania. For this reason, the results of the comparative analysis between Tanzania and the Western Cape will be interpreted with extreme caution. Specifically, with limited covariate overlap between the Western Cape and Tanzanian samples, the coefficient on the WC dummy will be biased towards a limited group of students, most likely a more affluent subset, and therefore cannot be interpreted as indicative of an average difference in expected performance between the two country/region contexts. Similar issues exist with the teacher samples from Tanzania and Kenya when compared to the Western Cape (see Table 4); for example, whilst at least a quarter and two-thirds of teachers in Tanzania and Kenya are younger than 30 and possess less than a post-secondary qualification (excluding teacher training), respectively, these proportions are less than 10 percent in the Western Cape. This presents challenges for the identification strategy, specifically, we cannot control effectively for performance differentials between these countries and the Western Cape due to differences in teacher backgrounds.

Figure 8: Standardised differences in mean student and home background factors between the Western Cape and Mauritius before and after propensity reweighting



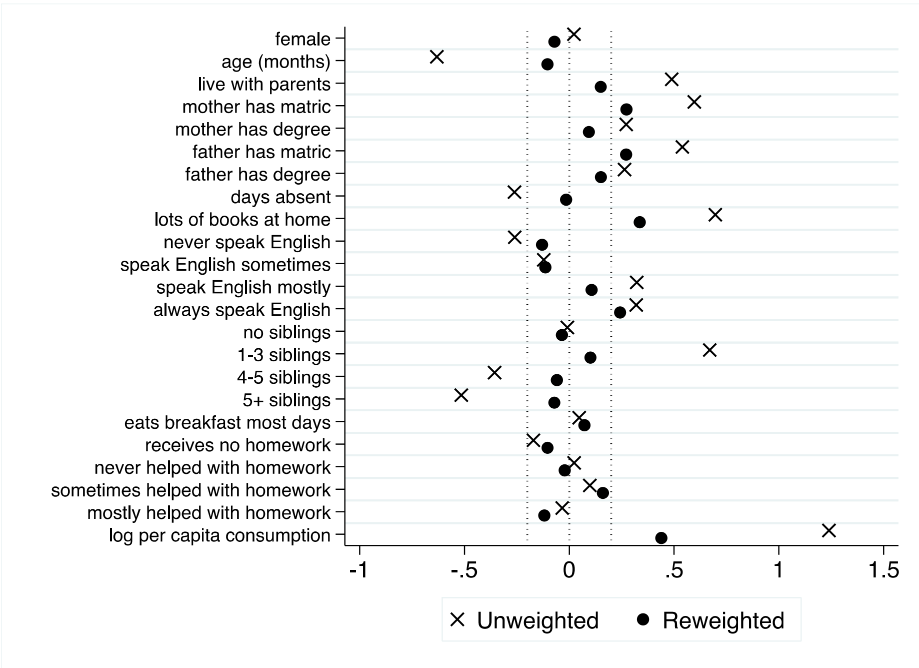
Notes: The propensity score weights include controls for student gender, age, living arrangements, books at home, exposure to English (test language), number of children in the home, eating breakfast, assistance with homework and context specific socio-economic status. Mean difference is calculated as Western Cape mean less Mauritian mean.

Figure 9: Standardised differences in mean student and home background factors between the Western Cape and Botswana before and after propensity reweighting



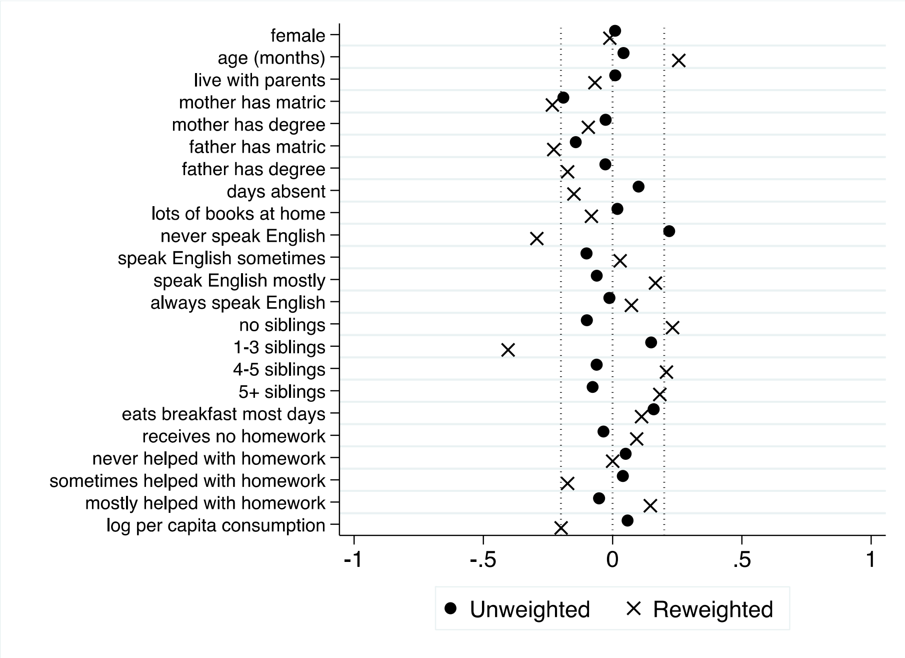
Notes: The propensity score weights include controls for student gender, age, living arrangements, books at home, exposure to English (test language), number of children in the home, eating breakfast, assistance with homework and context specific socio-economic status. Mean difference is calculated as Western Cape mean less Botswanan mean.

Figure 10: Standardised differences in mean student and home background factors between the Western Cape and Eastern Cape before and after propensity reweighting



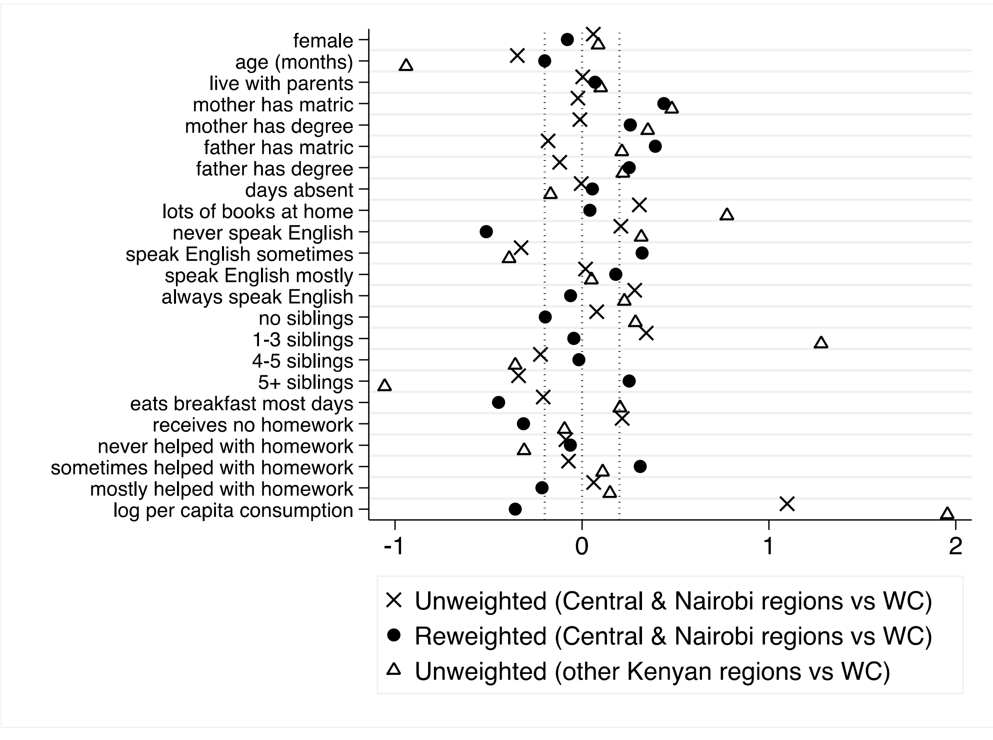
Notes: The propensity score weights include controls for student gender, age, living arrangements, books at home, exposure to English (test language), number of children in the home, breakfast, assistance with homework and log per capita consumption. Mean difference is calculated as Western Cape mean less Eastern Cape mean.

Figure 11: Standardised differences in mean student and home background factors between the Western Cape and Gauteng before and after propensity reweighting



Notes: the propensity score weights include controls for student gender, age, living arrangements, books at home, exposure to English (test language), number of children in the home, eating breakfast, assistance with homework and log per capita consumption. Mean difference is calculated as Western Cape mean less Gauteng mean.

Figure 12: Standardised differences in mean student and home background factors between the Western Cape and Kenya (and Nairobi and Central) regions before and after propensity reweighting



Notes: The propensity score weights include controls for student gender, age, living arrangements, books at home, exposure to English (test language), number of children in the home, eating breakfast, assistance with homework and log per capita consumption. Mean difference is calculated as Western Cape mean less Kenyan means.

Table 3: Home background characteristics across SACMEQ countries and SA regions

Variable	**Western Cape**	**Kenya**		**Tanzania**		**Botswana**		**Mauritius**		**Gauteng**		**Eastern Cape**	
Female	0.522	0.482	**	0.507		0.505		0.489	*	0.517		0.510	
Age (in months)	150.6	165.5	***	174.2	***	153.5	***	136.5	***	150.2		159.7	***
Live with parents	0.831	0.799	**	0.828		0.729	***	0.941	***	0.827		0.617	***
Mother has senior secondary education	0.189	0.294	***	0.074	***	0.112	***	0.153	***	0.198		0.198	***
Mother has tertiary education	0.276	0.050	***	0.010	***	0.217	***	0.124	***	0.361	***	0.044	***
Father has senior secondary education	0.168	0.393	***	0.150	***	0.097	***	0.158		0.190		0.213	***
Father has tertiary education	0.289	0.080	***	0.029	***	0.244	***	0.154	***	0.337	***	0.049	***
Learner has used a computer	0.920	0.126	***	0.018	***	0.361	***	0.985	***	0.832	***	0.179	***
Days absent from school in last month	0.916	1.216	***	1.992	***	0.269	***	1.810	***	0.745	**	1.711	***
Lots of books present in the home	0.509	0.216	***	0.031	***	0.390	***	0.722	***	0.500		0.198	***
Attended preschool for a year or less	0.333	0.502	***	0.487	***	0.169	***	0.080	***	0.245	***	0.419	***
Attended preschool for 2+ years	0.493	0.422	***	0.132	***	0.238	***	0.899	***	0.598	***	0.300	***
Speaks English at home sometimes	0.584	0.750	***	0.269	***	0.689	***	0.663	***	0.633	**	0.643	***
Speaks English at home most of the time	0.128	0.112		0.138		0.077	***	0.031	***	0.149		0.041	***
Speaks English at home all the time	0.115	0.051	***	0.517	***	0.028	***	0.011	***	0.119		0.034	***
1-3 siblings	0.754	0.297	***	0.362	***	0.545	***	0.813	***	0.687	***	0.441	***
4-5 siblings	0.127	0.261	***	0.268	***	0.223	***	0.063	***	0.148		0.268	***
More than 5 siblings	0.042	0.414	***	0.282	***	0.142	***	0.026	***	0.059	*	0.212	***
Have meal at school	0.772	0.213	***	0.000	***	0.918	***	0.724	***	0.646	***	0.747	
Eats breakfast often	0.843	0.785	***	1.000	***	0.817	*	0.887		0.781	***	0.826	
Never receive help with homework	0.052	0.133	***	0.225	***	0.054		0.133	***	0.041		0.047	
Sometimes receive help with homework	0.651	0.615	**	0.306	***	0.525	***	0.685	**	0.631		0.603	**
Mostly receive help with homework	0.267	0.213	***	0.232	**	0.409	***	0.167	***	0.290		0.282	

Table 3 continued: Home background characteristics across SACMEQ countries and SA regions

Variable	**Western Cape**	**Kenya**		**Tanzania**		**Botswana**		**Mauritius**		**Gauteng**		**Eastern Cape**	
<u>Traveling distance to school:</u>													
0.5-1km	0.168	0.184		0.204	**	0.206	***	0.198	**	0.154		0.143	
1-1.5km	0.090	0.166	***	0.126	***	0.130	***	0.113	**	0.096		0.105	
1.5-2km	0.068	0.086	*	0.078		0.076		0.067		0.062		0.081	
2-2.5km	0.026	0.083	***	0.071	***	0.060	***	0.051	***	0.051		0.057	***
2.5-3km	0.039	0.044		0.039		0.042		0.039		0.050	***	0.049	
3-3.5km	0.030	0.037		0.035		0.027		0.027		0.030		0.030	
3.5-4km	0.031	0.021	*	0.023		0.020	**	0.019	**	0.023		0.040	
4-4.5km	0.020	0.021		0.033	**	0.017		0.020		0.022		0.034	*
4.5-5km	0.039	0.021	***	0.029		0.028	*	0.026	**	0.052		0.057	*
>5km	0.142	0.057	***	0.047	***	0.091		0.084		0.234		0.114	*
Repeated once	0.182	0.338	***	0.179		0.258	***	0.197		0.158		0.280	***
Repeated twice	0.028	0.091	***	0.027		0.039		0.017	**	0.019		0.053	***
Repeated 3+ times	0.032	0.025		0.003	***	0.015	***	0.009	***	0.009	***	0.081	***

Source: SACMEQ 2007. **Notes**: Western Cape mean is statistically significantly different from other country/province mean at the ***1% level of significance, **5% level of significance or *10% level of significance.

Table 4: Teacher and classroom characteristics across countries/regions

Variable	Western Cape	Kenya		Tanzania		Botswana		Mauritius		Gauteng		Eastern Cape	
Mathematics teacher and classroom characteristics:													
Math teacher test score	852.76	898.26	***	825.02	***	780.98	***	-		790.58	***	726.69	***
Textbook availability:													
Only for teacher	0.178	0.023	***	0.109	***	0.036	***	0.025	***	0.216	**	0.154	
Shared between 2+	0.041	0.559	***	0.664	***	0.118	***	0.038		0.072	***	0.173	***
Shared between 2	0.266	0.223	***	0.092	***	0.212	***	0.036	***	0.282		0.185	***
Textbook per learner	0.471	0.184	***	0.031	***	0.621	***	0.881	***	0.336	***	0.340	***
Teacher age:													
Younger than 30 years	0.031	0.188	***	0.302	***	0.144	***	0.065	***	0.055	***	0.000	***
30-40 years old	0.426	0.360	***	0.338	***	0.472	**	0.331	***	0.347	***	0.394	
40-50 years old	0.385	0.291	***	0.187	***	0.323	***	0.272	***	0.373		0.407	
Older than 50 years	0.131	0.161	***	0.160	***	0.061	***	0.332	***	0.225	***	0.118	
Teacher qualifications:													
Less than secondary education	0.174	0.041	***	0.039	***	0.254	***	0.015	***	0.157		0.281	***
Senior secondary education	0.013	0.633	***	0.899	***	0.334	***	0.316	***	0.042	***	0.107	***
Post-secondary education	0.171	0.286	***	0.050	***	0.184		0.585	***	0.211	**	0.058	***
Degree or higher	0.615	0.039	***	0.000	***	0.228	***	0.083	***	0.590		0.474	***
Teaching experience:													
0-5 years of experience	0.069	0.241	***	0.454	***	0.193	***	0.063		0.119	***	0.160	***
6-10 years of experience	0.109	0.176	***	0.106		0.203	***	0.132	*	0.119		0.065	***
11-20 years of experience	0.595	0.363	***	0.145	***	0.451	***	0.343	***	0.514	***	0.475	***
20+ years of experience	0.200	0.220	**	0.282	***	0.153	***	0.462	***	0.249	***	0.220	

Table 4 continued: Teacher and classroom characteristics across countries/regions

Variable	Western Cape	Kenya		Tanzania		Botswana		Mauritius		Gauteng		Eastern Cape	
<u>Weekly teaching time:</u>													
10-14 hours per week	0.047	0.077	***	0.271	***	0.116	***	0.025	***	0.101	***	0.071	**
15-19 hours per week	0.190	0.314	***	0.316	***	0.101	***	0.151	***	0.075	***	0.095	***
20-25 hours per week	0.563	0.575		0.183	***	0.593	*	0.638	***	0.558		0.319	***
25+ hours per week	0.152	0.010	***	0.092	***	0.016	***	0.099	***	0.193	**	0.221	***
<u>Class assessments:</u>													
1 test per term	0.074	0.004	***	0.006	***	0.005	***	0.167	***	0.045	***	0.022	***
2-3 tests per term	0.486	0.403	***	0.144	***	0.429	***	0.423	***	0.487		0.536	**
2-3 tests per month	0.303	0.352	***	0.471	***	0.364	***	0.244	***	0.248	***	0.234	***
Weekly tests	0.110	0.239	***	0.367	***	0.195	***	0.166	***	0.220	***	0.128	
<u>*Literacy teacher and classroom characteristics*</u>													
Literacy teacher test score	813.27	791.02	***	722.18	***	770.10	***	-		776.49	***	717.85	***
<u>Textbook availability:</u>													
Only for teacher	0.046	0.018	***	0.106	***	0.025	***	0.025	***	0.073	**	0.082	***
Shared between 2+	0.053	0.540	***	0.652	***	0.117	***	0.044		0.118	***	0.167	***
Shared between 2	0.179	0.225	***	0.099	***	0.212	**	0.035	***	0.336	***	0.255	***
Textbook per learner	0.688	0.208	***	0.034	***	0.639	***	0.866	***	0.437	***	0.432	***
<u>Teacher age:</u>													
Younger than 30 years	0.039	0.257	***	0.311	***	0.139	***	0.065	***	0.095	***	0.000	***
30-40 years old	0.372	0.340	*	0.271	***	0.501	***	0.333	**	0.330	*	0.314	***
40-50 years old	0.336	0.311		0.254	***	0.308	*	0.271	***	0.338		0.417	***
Older than 50 years	0.227	0.091	***	0.165	***	0.053	***	0.331	***	0.236		0.189	**

Table 4 continued: Teacher and classroom characteristics across countries/regions

Variable	**Western Cape**	**Kenya**		**Tanzania**		**Botswana**		**Mauritius**		**Gauteng**		**Eastern Cape**	
<u>Teacher qualifications:</u>													
Less than secondary education	0.172	0.018	***	0.095	***	0.260	***	0.015	***	0.274	***	0.256	***
Senior secondary education	0.039	0.651	***	0.877	***	0.326	***	0.316	***	0.090	***	0.104	***
Post-secondary education	0.160	0.276	***	0.027	***	0.190	***	0.585	***	0.119	***	0.140	
Degree or higher	0.603	0.055	***	0.000	***	0.224	**	0.084	***	0.518	***	0.420	***
<u>Teaching experience:</u>													
0-5 years of experience	0.089	0.327	***	0.435	***	0.214	***	0.064	***	0.189	***	0.110	
6-10 years of experience	0.140	0.124		0.096	***	0.191	***	0.132		0.090	***	0.022	***
11-20 years of experience	0.417	0.369	***	0.124	***	0.446		0.343	***	0.325	***	0.562	***
20+ years of experience	0.327	0.181	**	0.345		0.150	***	0.461	***	0.398	***	0.226	***
<u>Weekly teaching time:</u>													
10-14 hours per week	0.023	0.091	***	0.266	***	0.112	***	0.025		0.087	***	0.095	***
15-19 hours per week	0.180	0.322	***	0.316	***	0.103	***	0.152	**	0.202		0.186	
20-25 hours per week	0.518	0.555	**	0.194	***	0.606	***	0.637	***	0.502		0.157	***
25+ hours per week	0.211	0.005	***	0.084	***	0.007	***	0.099	***	0.094	***	0.268	***
<u>Class assessments:</u>													
1 test per term	0.138	0.012	***	0.016	***	0.005	***	0.167	**	0.246	***	0.022	***
2-3 tests per term	0.524	0.466	***	0.175	***	0.418	***	0.424	***	0.432	***	0.473	**
2-3 tests per month	0.251	0.264		0.504	***	0.370	***	0.243		0.140	***	0.280	
Weekly tests	0.061	0.257	***	0.302	***	0.200	***	0.166	***	0.181	***	0.143	***
<u>*Other classroom characteristics:*</u>													
Average class size	38	44	***	53	***	29	***	34	***	41	***	44	***
School pupil-teacher ratio	33.8	43.8	***	59.7	***	28.1	***	22	***	32.3	***	36.3	***

Table 5: Comparison of "governance" and parent/community involvement across SACMEQ countries and SA regions

Variable	Western Cape	Kenya		Tanzania		Botswana		Mauritius		Gauteng		Eastern Cape	
Teacher absenteeism:													
Sometimes a problem	0.368	0.598	***	0.554	***	0.547	***	0.497	***	0.553	***	0.651	***
Often a problem	0.107	0.087	*	0.092		0.081	**	0.047	***	0.045	***	0.124	
Teachers skipping class:													
Sometimes a problem	0.104	0.515	***	0.375	***	0.252	***	0.100		0.318	***	0.253	***
Often a problem	0.026	0.107	***	0.085	***	0.043	**	0.002	***	0.025		0.120	***
District support:													
School has never been fully inspected	0.115	0.059	***	0.015	***	0.039	***	0.414	***	0.254	***	0.272	***
Number of times school has been visited by an inspector in the past 2 years	3.323	5.581	***	1.938	***	1.364	***	26.016	***	3.169		3.146	
Parental involvement													
Parents/community assist with building facilities	0.128	0.548	***	0.900	***	0.185	***	0.107	*	0.214	***	0.565	***
Parents/community assist with maintaining facilities	0.175	0.421	***	0.650	***	0.144	**	0.317	***	0.473	***	0.646	***
Parents/community purchase furniture and equipment	0.173	0.380	***	0.547	***	0.120	***	0.413	***	0.357	***	0.432	***
Parents/community purchase textbooks	0.229	0.110	***	0.155	***	0.114	***	0.230		0.356	***	0.172	***
Parents/community purchase stationery	0.419	0.094	***	0.185	***	0.218	***	0.352	***	0.516	***	0.253	***
Parents/community contribute to exam fees	0.000	0.831	***	0.097	***	0.057	***	0.088	***	0.114	***	0.157	***
Parents/community contribute to teacher salaries	0.476	0.496		0.044	***	0.025	***	0.007	***	0.632	***	0.079	***
Parents/community contribute to staff salaries	0.356	0.148	***	0.254	***	0.056	***	0.007	***	0.517	***	0.265	***
Parents/community assist with extra-curricular	0.711	0.569	***	0.364	***	0.943	***	0.860	***	0.749	*	0.846	***
Parents/community assist with teaching	0.370	0.125	***	0.301	***	0.291	***	0.032	***	0.225	***	0.268	***
Parents/community assist with school meals	0.316	0.263	***	0.278	**	0.146	***	0.134	***	0.308		0.249	***
Strike action (Political economy disruptions)													
Days lost to strike action (math teachers)	5.11									5.83	**	13.74	***
Days lost to strike action (reading teachers)	5.06									6.46	***	13.90	***

Econometric Results

The Western Cape effect and expected mathematics and literacy performance

Tables 6 and 7 present the estimated Western Cape effect in comparison to other South African regions and SACMEQ countries using mathematics and literacy outcomes in grade 6. We begin with a simple model that controls for a Western Cape fixed effect only (column 1), from which we expand the specification to include socio-economic, home background, classroom and school factors. This process aims to separate that part of the performance gap that might be explained by resourcing and home background factors from the part that may be linked to institutional factors. The nature of the reweighted regression analysis requires that only regions or countries that are sufficiently comparable to the Western Cape in terms of, at a minimum, student socio-economic and home background factors be considered; for this reason, only the Nairobi and Central regions of Kenya are selected for comparison. Tanzania is included in the analysis, but no reweighting based on propensity scores is applied as this did not substantively improve common support and these results are treated with more caution.

From column 1 of Table 6 before controlling for relevant schooling inputs, students in the Western Cape perform on average significantly better on the mathematics test than students from Botswana and the Eastern Cape, whilst underperforming relative to students in the selected Kenyan regions and Mauritius. This is consistent with the earlier descriptive results. No significant difference is observed for students from the Western Cape and their counterparts in Gauteng and Tanzania. Once we control for home background and socio-economic status of students, the Western Cape effect is positive and significantly different from zero in comparison to Botswana, the Eastern Cape *and* Gauteng but in Kenya and Mauritius[10] the opposite effect continues to hold. Importantly, the further inclusion of teacher test scores (column 3) does not have any significant effect on the size and significance of the Western Cape coefficient in all country/region comparisons except with Tanzania. For the most part, differences in mathematics teacher subject content knowledge do not play a role in explaining test score differences across these regions/countries and the Western Cape. The same is true for the inclusion of teacher (age, qualification and experience) and classroom (teaching time, homework, assessment, and textbook availability) factors. These are important findings. Even when one takes into account these observed differences in the instructional core – the place where the student and teacher interact around content – the Western Cape effect remains in the initial direction.

We do qualify, however, that the model comparing the Western Cape to the two Kenyan regions does not effectively control for teacher characteristics (for reasons of lack of common support discussed earlier); therefore, it is possible that part of the negative (positive) Western Cape (Kenya) effect is accounted for by teacher unobservables. Cautions related to lack of common support are again reiterated when comparing the result for the Western Cape versus Tanzania. The positive Western Cape effect relative to Tanzania in mathematics contradicts the relative positions of each socio-economic learning profile in figure 7.

In regression 5 we consider whether the observed Western Cape effect is the result of differences in, for example, proxies for governance or differences in accountability across systems? If we proxy for differences in governance using indicators such as teacher absenteeism and school inspection

[10] The advantage to Mauritius is also augmented by the reality that its grade 6 students are on average nearly a year younger than grade 6 students in the Western Cape. Due to overlap problems we couldn't adequately control for age differences. The bias however generated would underestimate the Mauritian advantage over the Western Cape.

observables, adding this to the regression also does not have any effect on the size and significance of the Western Cape coefficient.

The broad effects of controlling for teacher test scores, teacher characteristics and governance indicators on the Western Cape coefficient in Table 7 is largely similar in estimating literacy scores. The Western Cape effect remains largely unchanged from regression 2 to 4. However, the direction of the effects differs at times when literacy rather than mathematics is the outcome variable. In literacy, Western Cape students *outperform* rather underperform relative to their peers in Mauritius but underperform relative to Kenya (although this difference becomes insignificant from regression 7 onwards). Initially no significant differences are observed in literacy performance when compared to students in Tanzania and Gauteng. But in regressions 6 to 8 a notable *advantage* to Tanzania over the Western Cape in literacy scores emerge. Part of these differences may reflect differential exposure to English in these countries which may not be fully captured by indicators for frequency of speaking English at home. In particular, the Western Cape learning advantage relative to the Eastern Cape in literacy is more pronounced than in mathematics. Consistent with the mathematics results, the Western Cape effect in literacy is positive and significant in comparisons to Botswana.

The most interesting changes in the Western Cape coefficient in estimations of both literacy and mathematics occur once we control for parent and community involvement in regressions 6 to 8. The significance of the Western Cape disadvantage (negative WC effect) in mathematics relative to Mauritius disappears while it strengthens the Western Cape advantage (positive WC effect) relative to Botswana. In comparisons to the Eastern Cape, including controls for parent involvement in the provision of school facilities and learning materials, financial contributions to salaries and assistance in teaching, extracurricular activities and school meals typically *increases* the Western Cape effect by almost a factor of 2 in both mathematics and literacy.

The Western Cape effect increases in regression 6 relative to the Eastern Cape when controlling for parent contributions to buildings. This is due to the negative correlation between parent contributions to buildings and the WC dummy which in turn is positively correlated to student performance. From Table 5 it is evident that whilst significant parent contributions in the Eastern Cape are largely related to the building and maintenance of school facilities as well as the purchase of equipment and furniture, parent contributions in the Western Cape (and Gauteng) are linked to financial provisions for learning materials and staff salaries. This pattern emerges where the need for parent contributions to physical improvements in schools in the Eastern Cape is likely attributed to historical infrastructural backlogs in these more disadvantaged (typically non-fee paying) schools, while parents of students in wealthier Western Cape schools are able to use their contributions (through fees) towards hiring additional School Governing Body paid teachers (in addition to state paid teacher allocations). Although parent contributions to teacher salaries are more prevalent in Western Cape schools it appears to have a stronger positive correlation to performance in the Eastern Cape (controlling for parent contributions to buildings). The inclusion of this in the regression model is therefore not able to "explain away" the positive WC effect. The WC effect would only become smaller if it was correlated to higher performance after accounting for contributions to facilities/buildings.[11]

[11] As an interesting aside, a one-way analysis of variance (ANOVA) is used to determine whether or not expected parental involvement in a region differs significantly according to measures of school governance, such as teacher absenteeism. Only in the case of Kenya and the Gauteng and Western Cape provinces of South Africa is teacher absenteeism found to be significantly negatively related to parent involvement; that is, higher

Though on the surface, the change in coefficient magnitude suggests that higher overall parental involvement in the Eastern Cape can overcome as much as half of the learning gap, there is a need for caution prior to drawing such a far-reaching implication. Unpacking why the coefficient changes and what this implies about the pathways through which parental and community involvement impacts on learning is complex. The nature and type of parental involvement, how they relate to learning and are correlated to socio-economic status of students and schools differs significantly across the systems considered.[12] Parental involvement and its interactions with different factors in explaining learning outcomes is in itself an area for further research requiring more detailed data to further decompose these factors.

As mentioned earlier in this paper, the expected performance differential between the Western Cape on the one hand and Mauritius and Botswana on the other is, for reasons related to data availability, potentially biased by the fact that the context specific measure of SES is used to reflect the relative wealth of students instead of log per capita consumption. Whilst we cannot know how large this bias is, we can deduce the probable direction of the bias if we compare estimates of the Western Cape effect from country/region comparisons for which we have both the context-specific SES and log per capita consumption. In the case of Tanzania and the Eastern Cape, the Western Cape effect becomes more positive when log per capita consumption is replaced with context-specific SES, and less negative in the case of Kenya. This is expected given that the distribution of per capita consumption of the Western Cape lies further to the right of that observed in these three regions. In the case of Gauteng, no change in the Western Cape effect is estimated.[1] It will therefore be the case that should the per capita consumption distributions of Mauritius and Botswana lie to the right of the Western Cape, the Western Cape effect estimates presented in Tables 7 and 8 will become more negative in the case of Mauritius and less positive in the case of Botswana (and vice versa should the per capita consumption of the Western Cape be lower than Mauritius and Botswana).

Performance by school SES quartile

As a final set of regressions, we assess the descriptive suggestions that the size of the Western Cape effect varies over the student socio-economic profile. In Table 8 the Western Cape effect is estimated for sub-samples of students attending schools that are in a similar point in the country specific distribution of school (average) log per capita consumption. This is achieved through interacting the WC dummy with indicators of relative school wealth captured by wealth quartiles; that is, schools within a given country/region are assigned to a country/region specific school wealth quartile using the average per capita log consumption of the students sampled in each school. All models control for propensity reweighting, home background factors, teacher and classroom factors, governance and

levels of parent involvement are related to lower teacher absenteeism problems. Parent involvement is estimated to be significantly and negatively related to teaching days lost due to strike activity in Gauteng only. These findings suggest that parent involvement and governance appear to play different roles in different regions, and the estimated Western Cape effect reported in Tables 6 and 7 may therefore be masked by non-linear relationships between school governance and performance.

[12] Consider for example the unusual non-linearity in the relationship between parental involvement (reflected in a composite index of parent contribution indicators) and student performance in the Eastern Cape as seen in the Appendix, Figure A4 which is contrasted against a more linear relationship in Gauteng and the Western Cape. Or consider the difference in the strength of the relationship between parental involvement and student SES in different regions/systems in Table A1.

parent/community indicators.[13] The WC effect is normalised relative to students taught in schools falling within the first school wealth quartile in the country/region being compared to the Western Cape.

In contrast to Figure 7 no significant literacy performance advantage is observed for Kenya compared with the Western Cape at all quartiles. However, students attending the wealthiest schools in Kenya perform significantly better than students attending the wealthiest schools in the Western Cape with regards to mathematics. Panel B of the table identifies the average student log per capita consumption by the school log per capita consumption quartile. Clearly the Western Cape and Gauteng are wealthier while the Eastern Cape is very similar to the "wealthier" regions of Kenya. In fact, the wealthiest 25% of schools in the Eastern Cape and Kenya (Central and Nairobi) are far more comparable to Western Cape schools in quartile 2. This just reinforces how much better schools are performing in Kenya relative to Western Cape considering differences in the relative wealth of students.

When comparing Gauteng to the Western Cape, students in wealthier Gauteng schools perform similarly to their Western Cape counterparts; the primary differences occur at the bottom and middle of the distribution where Western Cape students perform significantly better in mathematics and literacy. This is consistent with Figure 7 although this finding holds even after controlling for "governance" indicators, parent involvement and teacher strike indicators. In literacy, the same finding holds for comparisons of the Eastern and Western Cape, except the difference is significant even at the top end of the distribution, and the size of the difference is much larger ranging from 0.6 to 1 standard deviations. The gap in mathematics performance comparing Western Cape and Eastern Cape schools is significant and large for quartiles 2 to 4 but not quartile 1. The reason for this is that quartile 1 students are still relatively wealthier in the Western Cape. If we use absolute wealth quartiles the significant advantage to the Western Cape in the poorest quartile 1 schools remerges.

Despite limitations in the analysis in controlling for certain school inputs, there are clearly substantial performance differences across systems (including in those systems which are not subject to common support estimation challenges) that cannot be explained even using the plethora of observed controls. If classroom factors, teacher content knowledge differences, crude governance factors and parental involvement indicators don't account for the difference, one is left wondering what does? It is evident that quantitative indicators cannot capture the full range of determinants of outcomes, including 'soft' governance determinants for which useable quantitative measures are not available. The best we can do in explaining variation in learning performance is an R-squared of 60% in the Western Cape-Gauteng comparisons with as little as 20-30% explained in the Tanzanian comparison. It may be argued that we have not fully accounted for resourcing differences across systems, for example at the level of the bureaucracy, but we have likely adequately accounted for school resourcing differences through *inter alia* student SES measures, pupil to teacher ratios and parent contributions to facilities and salaries. With the available data it is not possible to pin-down further which of the many possible unobserved features of the school environment, teacher labour market, accountability structures and broader cultural and political factors may account for remaining performance differentials.

[13] As with the analysis of Tables 6 and 7, in the case of Kenya, only textbooks, class size and assessment are used as regression controls because all the other teacher/classroom variables have very little overlap with Western Cape or are homogenous in Kenya.

Table 6: Reweighted multivariate regression of SACMEQ III grade 6 mathematics scores

	1	2	3	4	5	6	7	8	9
Comparison country/region:					*Coefficient on Western Cape Dummy*				
Kenya (Nairobi & Central)	-0.605***	-0.375***	-0.344***	-0.373**	-0.376**	-0.434**	-0.355*	-0.359*	
	(0.16)	(0.18)	(0.17)	(0.17)	(0.16)	(0.16)	(0.19)	(0.19)	
R-squared	0.085	0.398	0.412	0.453	0.462	0.471	0.473	0.484	
Botswana [a]	0.320***	0.282***	0.222***	0.254***	0.289***	0.413***	0.337***	0.421***	
	(0.14)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	
R-squared	0.024	0.454	0.458	0.493	0.499	0.511	0.514	0.517	
Mauritius [a, c]	-0.604***	-0.259***		-0.232**	-0.300**	-0.251	-0.211	-0.236	
	(0.15)	(0.09)		(0.11)	(0.15)	(0.17)	(0.17)	(0.18)	
R-squared	0.052	0.399		0.424	0.436	0.450	0.454	0.454	
Tanzania [b]	0.136	0.297	0.436**	0.469**	0.461*	0.432**	0.526***	0.464**	
	(0.13)	(0.21)	(0.21)	(0.22)	(0.24)	(0.20)	(0.20)	(0.20)	
R-squared	0.003	0.193	0.209	0.234	0.241	0.252	0.255	0.261	
Eastern Cape	0.438***	0.490***	0.430***	0.488***	0.492***	0.890***	1.023***	0.861***	0.759***
	(0.18)	(0.13)	(0.13)	(0.11)	(0.11)	(0.16)	(0.19)	(0.19)	(0.20)
R-squared	0.043	0.284	0.291	0.384	0.409	0.457	0.478	0.491	0.493
Gauteng	0.257	0.320***	0.278***	0.296***	0.354***	0.408***	0.454***	0.402***	0.405***
	(0.19)	(0.08)	(0.08)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)
R-squared	0.013	0.500	0.507	0.555	0.562	0.590	0.591	0.595	0.595
Other controls:									
Home background	X	X	X	X	X	X	X	X	X
Socio-economic status		X	X	X	X	X	X	X	X
Teacher test scores			X	X	X	X	X	X	X
Teacher/classroom characteristics				X	X	X	X	X	X
"Governance" indicators					X	X	X	X	X
Parents contribute to school building and teaching materials						X	X	X	X

Parents contribute to salaries							X	X	X
Parents contribute to extra-curricular and teaching activities								X	X
Teacher days lost to strike activity									X
Observations:									
Western Cape	900	900	900	876	876	876	876	876	876
Kenya	920	920	920	899	899	899	899	899	
Botswana	3 868	3 868	3 868	3 868	3 868	3 868	3 868	3 868	
Mauritius	3 524	3 524	3 524	3 524	3 524	3 524	3 524	3 524	
Tanzania	4 193	4 193	4 193	4 170	4 170	4 170	4 170	4 170	
Eastern Cape	1 066	1 066	1 066	981	981	981	981	981	981
Gauteng	1 020	1 020	1 020	1 020	1 020	1 020	1 020	1 020	1 020

***Notes**: Teacher and classroom characteristics include: teacher education, teacher age, teacher experience, weekly teaching time (hours), textbook availability, class size, pupil-teacher ratio (PTR), frequency and discussion of homework and frequency of classroom assessment. Due to lack of overlap in teacher characteristics between the Western Cape and Tanzania or Kenya, only textbook availability, class size and frequency of assessment are controlled for. Standard errors clustered at the school level are shown in parentheses. *** significance at 1% level ** significance at 5% level * significance at 10% level.*

[a] *In the case of Botswana and Mauritius, socio-economic status is measured using the context specific asset index. In all other analyses, log per capita consumption is used.*

[b] *Due to the lack of overlap in learner home background, balance reweighting is not utilized for the comparison with Tanzania.*

[c] *No teacher test scores are available for Mauritius.*

[d] *This estimate includes all Kenyan regions, therefore no balance reweighting is applied.*

[e] *Test scores are missing for approximately 20 percent of the South African grade 6 mathematics teachers sampled. A dummy variable equal to 1 for a missing test score and 0 otherwise is included in the analysis as not to exclude students taught by these teachers from the sample. Students taught by mathematics teachers with missing test scores had significantly higher mathematics test scores, therefore excluding these students from the analysis is likely to bias the estimated coefficients.*

Table 7: Reweighted multivariate regression of SACMEQ III grade 6 literacy scores

	1	2	3	4	5	6	7	8	9
Comparison country/region:					*Coefficient on Western Cape Dummy*				
Kenya (Nairobi & Central)	-0.424**	-0.269**	-0.208*	-0.261*	-0.133	-0.277*	-0.238	-0.244	
	(0.17)	(0.12)	(0.11)	(0.14)	(0.14)	(0.15)	(0.18)	(0.18)	
R-squared	0.040	0.346	0.370	0.422	0.454	0.466	0.467	0.472	
Botswana [a]	0.282***	0.255***	0.190***	0.229***	0.265***	0.401***	0.395***	0.393***	
	(0.13)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)	
R-squared	0.018	0.455	0.460	0.496	0.501	0.508	0.508	0.510	
Mauritius [a, c]	0.092	0.376***		0.345***	0.299***	0.380***	0.397***	0.427***	
	(0.12)	(0.07)		(0.10)	(0.11)	(0.13)	(0.14)	(0.15)	
	0.002	0.390		0.414	0.424	0.437	0.441	0.442	
Tanzania [b]	0.054	-0.064	-0.142	-0.226	-0.231	-0.411**	-0.370*	-0.417**	
	(0.11)	(0.13)	(0.15)	(0.16)	(0.17)	(0.18)	(0.20)	(0.20)	
R-squared	0.000	0.167	0.180	0.206	0.210	0.222	0.222	0.228	
Eastern Cape	0.662***	0.704***	0.593**	0.619***	0.631***	1.175***	1.153***	1.215***	1.038***
	(0.19)	(0.12)	(0.13)	(0.11)	(0.16)	(0.20)	(0.18)	(0.18)	(0.20)
R-squared	0.093	0.376	0.398	0.444	0.465	0.514	0.532	0.539	0.542
Gauteng	0.136	0.180**	0.137*	0.101	0.045	0.043	0.086	0.080	0.072
	(0.18)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)
R-squared	0.004	0.505	0.513	0.559	0.568	0.582	0.586	0.587	0.590
Other controls:									
Home background		X	X	X	X	X	X	X	X
Socio-economic status		X	X	X	X	X	X	X	X
Teacher test scores [e]			X	X	X	X	X	X	X
Teacher/classroom characteristics				X	X	X	X	X	X
“Governance” indicators					X	X	X	X	X
Parents contribute to school building and teaching materials						X	X	X	X

Parents contribute to salaries							X	X	X
Parents contribute to extra-curricular and teaching activities								X	X
Teacher days lost to strike activity									X
Observations:									
Western Cape	907	907	907	883	883	883	883	883	883
Kenya	922	922	922	901	901	901	901	901	
Botswana	3 868	3 868	3 868	3 868	3 868	3 868	3 868	3 868	
Mauritius	3 524	3 524	3 524	3 524	3 524	3 524	3 524	3 524	
Tanzania	4 194	4 194	4 194	4 171	4 171	4 171	4 171	4 171	
Eastern Cape	1 068	1 068	1 068	982	982	982	982	982	982
Gauteng	1 020	1 020	1 020	1 020	1 020	1 020	1 020	1 020	1 020

Notes*: Teacher and classroom characteristics include: teacher education, teacher age, teacher experience, weekly teaching time (hours), textbook availability, class size, pupil-teacher ratio (PTR), frequency and discussion of homework and frequency of classroom assessment. Due to lack of overlap in teacher characteristics between Western Cape and Tanzania and Kenya, only textbook availability, frequency of assessment and class size are controlled for. Standard errors clustered at the school level are shown in parentheses. *** significance at 1% level ** significance at 5% level * significance at 10% level.*

[a] *In the case of Botswana and Mauritius, socio-economic status is measured using the context specific asset index. In all other analyses, log per capita consumption is used.*

[b] *Due to the lack of overlap in learner home background, balance reweighting is not utilized for the comparison with Tanzania.*

[c] *No teacher test scores are available for Mauritius.*

[d] *This estimate includes all Kenyan regions, therefore no balance reweighting is applied.*

[e] *Test scores are missing for approximately 17 percent of the South African grade 6 literacy teachers sampled. A dummy variable equal to 1 for a missing test score and 0 otherwise is included in the analysis as not to exclude students taught by these teachers from the sample. Students taught by literacy teachers with missing test scores had significantly higher test scores, therefore excluding these students from the analysis is likely to bias the estimated coefficients.*

Table 8: "Western Cape" effect when comparing students attending schools with similar relative values of school socio-economic status

PANEL A	Western Cape	Kenya	Diff.		Western Cape	Gauteng	Diff.		Western Cape	Eastern Cape	Diff.	
					Literacy test scores							
Quartile 1	-0.405	0.000	-0.405		0.326	0.000	0.326	**	0.628	0.000	0.628	***
Quartile 2	-0.285	0.126	-0.411		0.616	0.334	0.282	*	1.001	0.364	0.637	**
Quartile 3	-0.083	0.136	-0.219		0.580	0.520	0.060		0.810	0.035	0.775	***
Quartile 4	0.043	0.387	-0.344		0.620	0.736	-0.116		0.909	0.478	0.431	
R-squared		0.460				0.614				0.593		
					Mathematics test scores							
Quartile 1	-0.606	0.000	-0.606	*	0.312	0.000	0.312	**	-0.415	0.000	-0.415	
Quartile 2	-0.228	0.063	-0.291		0.661	0.319	0.342	**	0.713	-0.670	1.383	***
Quartile 3	-0.175	0.178	-0.353		0.792	0.278	0.314	***	0.658	-0.621	1.279	***
Quartile 4	-0.087	0.633	-0.710	**	0.963	0.838	0.125		1.231	0.333	0.898	**
R-squared		0.471				0.584				0.551		

PANEL B	Average student log per capita consumption by school log per capita consumption quartile			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Kenya (Central and Nairobi)	6.398	6.752	7.149	7.933
Eastern Cape	6.217	6.643	7.035	7.606
Gauteng	6.995	7.513	8.544	9.297
Western Cape	7.187	7.734	8.384	9.292

***Source**: SACMEQ 2007. **Notes**: Regression models control for home background and student characteristics, teacher and classroom characteristics, governance indicators and parent/community involvement indices (see the notes to tables 6 and 7 for further information). Due to lack of overlap in teacher characteristics between the Western Cape and Kenya, only textbook availability, frequency of assessment and class size are controlled for at the teacher/classroom level. Standard errors clustered at the school level are shown in parentheses. Statistically significant at *** 1% level ** significance at 5% level * significance at 10% level.*

V. Conclusion/Discussion

The key research objective of this paper was to explore the performance of the Western Cape Education Department relative to other education systems within South Africa and regionally in Southern and Eastern Africa.

Two key conclusions emerged from the descriptive analysis of student learning across South African provinces. First, the Western Cape is *a* top performing province but not consistently the best performing province in terms of student achievement when a number of different performance indicators are considered. One relative area for improvement in the Western Cape is actually converting learning into National Senior Certificate (NSC) or matriculation outcomes. Second, Western Cape grade 6 students perform better at lower ends of the socio-economic distribution than students in other provinces using SACMEQ data. This is confirmed in multivariate comparisons of performance relative to Gauteng at different wealth quartiles. This suggests that the benefits of a functional Western Cape Education Department (WCED) extends to the poorest of students in their system. However, in making this observation the methodological choice of SES measure notably affects the extent of the performance differential between the Western Cape and other provinces. In cross-country comparisons even higher levels of sensitivity to the SES measure were observed when considering the shape and position of each student performance profile by SES. WCED bureaucratic efficiency and their approach to managing the school terrain provides some hope that improving the quality of education institutions can make a difference for the poorest of South Africans and thereby tackling inherent inequalities in learning in the system. It is important to qualify however, that this 2007 SACMEQ data is now nearly a decade old. Considerable changes may have taken place across provinces which would need to be verified with more recent data such as TIMSS 2015 and SACMEQ 2013 as they become available.

Despite the success of the WCED in providing quality education within the South African context, when considering their performance relative to other Southern and East African systems, especially Kenya (and its Central and Nairobi regions) and to a lesser extent Mauritius, there is indeed a puzzling result of lower mathematics performance relative to these regions. Importantly, teacher content knowledge as measured by teacher scores on the SACMEQ mathematics test did not account for performance gaps in favour of Kenya. Although one can’t rule out that other pedagogical skills, unobserved abilities and motivations of teachers that may be important for learning are not captured by teacher test scores. In estimations on matched regional samples, in addition to including teacher test scores, controlling for other differences in the teacher labour markets of these countries (where possible) and classroom conditions did not notably impact on the size and significance of the Western Cape coefficient. In other words, for the most part the Western Cape effect remains in its initial direction against each comparative country/region even after accounting for observed similarities in the instructional core.

Nevertheless, an interesting insight from the analysis is that the Western Cape effect was very sensitive to the inclusion of controls for parent involvement in schools and their contributions to the school institution. For example, the significant Mauritian advantage to the Western Cape in mathematics falls away after controlling for parental involvement indicators while the Western Cape advantage to the Eastern Cape almost doubles in both mathematics and literacy after inclusions for parental involvement. This occurs even after accounting for school resourcing (including pupil-teacher ratios), student home background and teacher factors. With non-linearity in the relationship between parental involvement and student performance in some contexts, and very different relationships between parental involvement and student or school wealth, we cannot disentangle the different pathways by which parent involvement affects learning. But this does potentially point to interesting dynamics between horizontal governance in schools and learning that is worthy of more exploration.

It is worth noting that the exercise of investigating this Western Cape paradox has highlighted an important methodological challenge in exploring performance differentials cross-nationally. Before we have even considered unobserved differences, the *observed* characteristics of education systems are often so diverse that this places limits on empirical comparisons of learning. In cross-national comparisons (even of regions/country in geographic proximities), caution is required in interpreting results where little covariate overlap is present (in this context comparing the Western Cape to Tanzania was particularly problematic).

Despite methodological limitations, descriptive and multivariate analysis confirm that even one of the best performing education systems in South Africa is not able to make the most efficient use of its resourcing levels despite considerable efforts. One is inclined then to attribute the performance gaps to differences in administrative institutions including higher levels of accountability. But this plays out in different ways than observed in our data. Consistent with broader themes in the ESID project series around how vertical and horizontal (peer-to-peer) governance interact in generating learning outcomes, we considered whether certain crude proxies for governance and parental involvement might account for performance differentials. When we controlled for these proxies, teacher absenteeism and school inspection variables, this did not alter the size and significance of the Western Cape effect. More research is required to understand what it is that drives higher levels of performance beyond observed differences across schools. What are the subtle aspects of governance, package of interventions, cultural and political factors that explain the puzzle? Studies by Carnoy, Chilisa and Chisholm (2012), Gustafsson and Taylor (2016) or Hoadley and Galant (2015) amongst others start to provide more specificity on these unobserved factors that may be important in the South African context. So, too, do the complementary school-level case studies undertaken as part of the ESID research project (Hoadley et al., 2016; Shumane and Levy, 2016). Nevertheless, there is scope for larger cross-national and multi-disciplinary investigations of the possible reasons underlying performance differentials across education systems.

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Appendix:

Kotze and Van der Berg (2015) method for constructing an internationally comparable measure of student socio-economic status

An asset index is a unidimensional composite indicator of a set of assets which reflects the underlying wealth of a household. Suppose a set of N variables, a_{ij} to a_{Nj} represents the ownership of N assets by each household j, then the asset index can be represented as a function of a set of underlying variables a_{ij}.

$$A_i = f(a_{ij}) = f(a_{1j}, \ldots, a_{Nj}) \qquad (1)$$

The asset index for each household can then be expressed as a linear combination of the set of assets a_{ij}, where v_{ij} are the weights assigned to the underlying variables a_{ij}.

$$A_j = (v_{1j}a_{1j} + v_{2j}a_{2j} + \cdots + v_{Nj}a_{Nj}) \qquad (2)$$

These weights are calculated based on the variance and covariance of the variables a_{ij}, using methods such as factor analysis, principal component analysis of multiple correspondence analysis. Regardless of the method used, however, the construction of an asset index involves attributing unique weights to each of the various possessions (a_{ij}) based on the amount of common information the asset contributes in relation to the latent variable (in this case wealth).

When constructing an asset index across various countries, the same process is followed given the common information across all countries. Equation (2) is therefore adjusted and A_{jc} is the asset index for household *j* in country *c* and averaged as follows:

$$A_{jc} = (v_{1jc}a_{1jc} + v_{2jc}a_{2jc} + \cdots + v_{Njc}a_{Njc}) \qquad (3)$$

$$\mathbf{A} = \mathbf{v}\ \mathbf{a} \qquad (4)$$

From equation 3 it is evident that the weights v_{ijc} will only vary by country if an asset index is constructed for each country individually. If an asset index is constructed for a combined sample of countries, the implicit assumption is that the same possessions will carry the same weights in different countries, regardless of the different contexts. While this assumption may be plausible for countries of a similar economic development level, it will not be accurate for countries with greatly varying **economic structures (Filmer and Pritchett, 2001; Harttgen and Vollmer, 2011). For instance, ownership of a radio in Malawi is associated with a completely different percentile in the income distribution than the ownership of a radio in Finland. In constructing two separate indices for urban and rural Kenya, Chuma & Molyneux (2009) demonstrate the large variation in wealth rankings when comparing a generic asset index with a context specific index. Clearly, the value of an asset-based measure is compromised when using it in cross-country analysis.

Therefore, to have the most accurate SES measure within a country, country specific weights need to be derived. This, however, comes at the cost of the comparability of the SES measure across the countries. In order to circumvent this trade-off, this paper proposes a method with which to construct a wealth indicator which takes into account both the accuracy and the comparability of the commonly used asset index.[14] To improve the accuracy of the measure of SES, this method uses asset indices that have been constructed using country specific weights. To overcome the problem of

[14] A method similar to this was devised by Harttgen & Vollmer (2011) in order to link asset indices in the DHS data to a national income distribution. Their method, however, is not suitable for our purposes as it is unable to account for children of a specific age group.

comparability, the method links the asset index distribution to the national income distribution in order to simulate household income for each wealth percentile. Income per capita, denoted in the international dollar then serves as a common yardstick with which to compare the country specific asset indices.

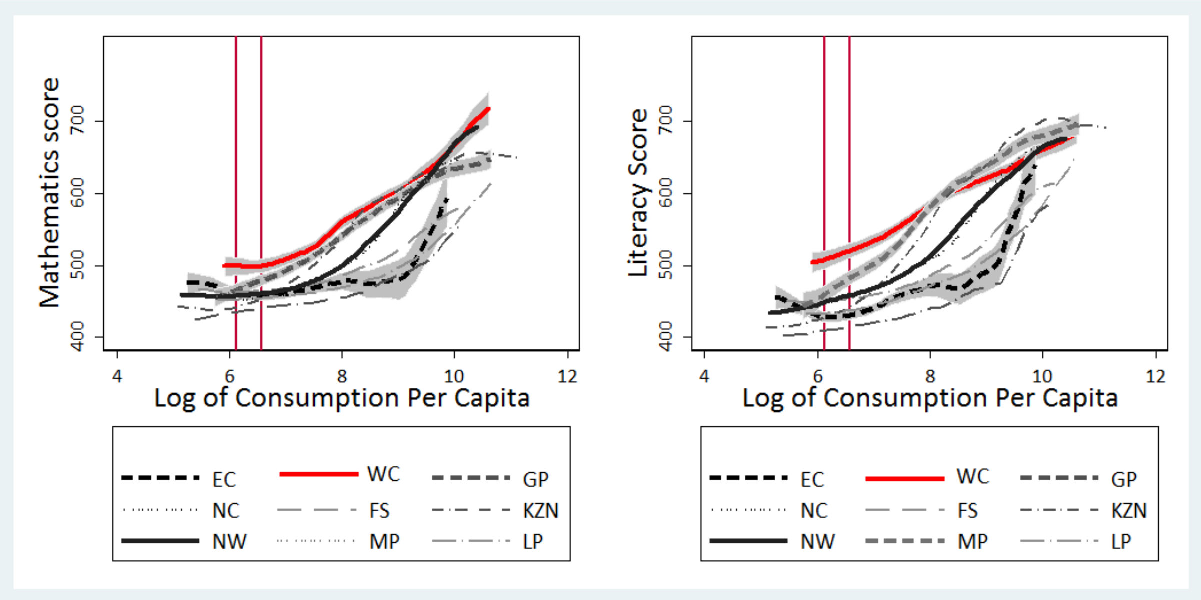
The method is deceptively simple and can be executed in three steps:

- A context specific asset index (A_c) is derived for each country which is to be included in the comparison. The students are then ranked from poorest to wealthiest according to this index.
- Households with school going children of a similar age to those who participated in the test are ranked from poorest to wealthiest based on their per capita income (I_c) as measured by a national income or expenditure data.
- The final step of the method relies on the assumption that the rankings in both distributions will be similar. That is that students from the n^{th} percentile in the asset index distribution will also be in households that are in the n^{th} percentile in the income distribution. This means that a student from the n^{th} percentile in the SES distribution can be allocated the per capita household income value of the student from the n^{th} percentile in the income distribution. To make these per capita incomes internationally comparable, they are converted to be denoted in purchasing power parity dollars (PPP $).

The traditional asset-based SES will therefore become an adjusted SES, measured in a per capita income metric. The result is therefore a single, internationally comparable measure of the SES of a student, and can be applied to every international evaluation for which an asset index can be derived. Moreover, this new wealth indicator will enable the comparison of equally poor students under different education systems. For example, the level of literacy of a child living under $2 a day in Malawi can be compared with the level of literacy of a child who is equally poor in Peru.

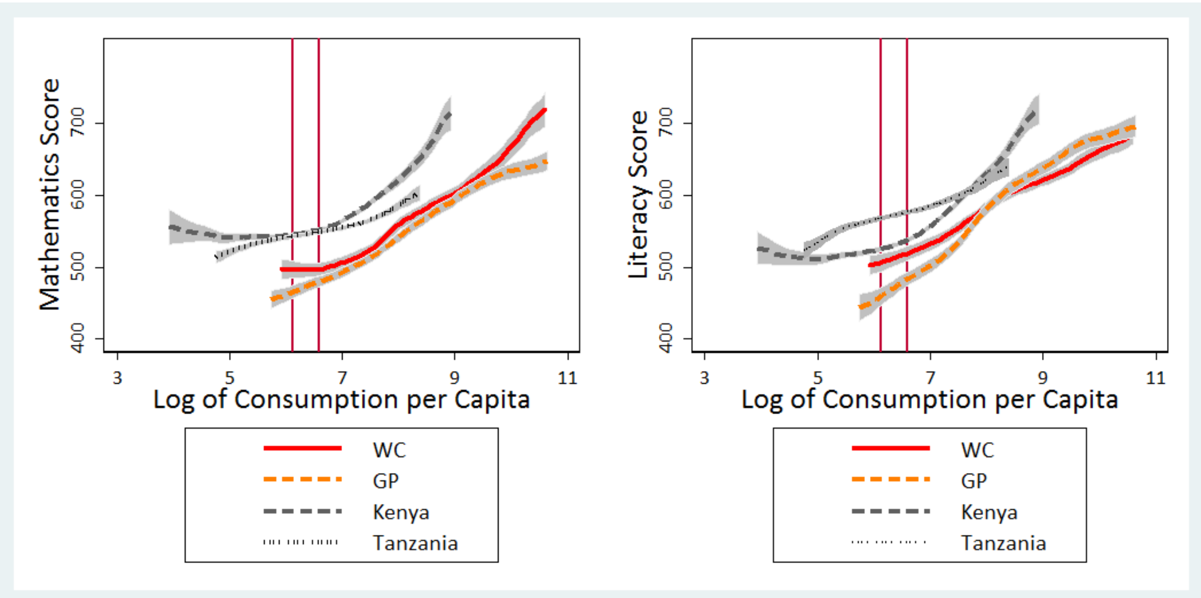
In order to further increase the accuracy of a comparable SES measure, the social gradients will be adjusted to account for those children who are not in school. Although access to schooling has increased significantly, it is evident from figure 1 that a 100 percent attendance rate is not yet a reality for the poorest households in the majority of Sub-Saharan Africa. This adjustment is done by calculating the percentage of eleven to fifteen year olds who are currently not in school at each percentile. The assumption is then made that students who are not in school in this age group would have performed at the same level as the lowest performing 5^{th} percentile, had they written the SACMEQ tests. This is still a rather optimistic assumption as students who drop-out of school before the sixth grade are highly unlikely to be literate or numerate.

Figure A1: Mathematics and literacy scores for grade 6 students by student log of per capita consumption, provincial comparisons including confidence intervals



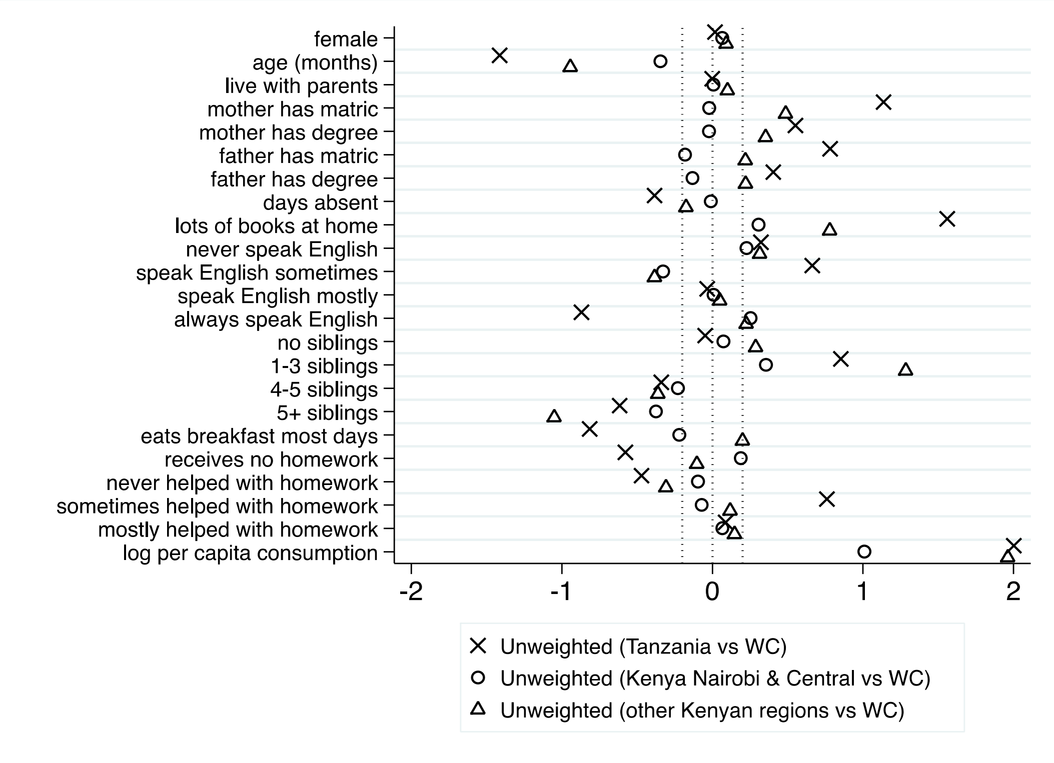
Notes: For ease of interpretation, confidence intervals are included only for Gauteng, Western Cape and Eastern Cape profiles.

Figure A2: Mathematics and literacy scores for grade 6 students by student log of per capita consumption, country comparisons including confidence intervals



Notes: Grey areas represent confidence areas.

Figure A3: Standardised differences in mean student and home background factors between the Western Cape and Kenya and Tanzania



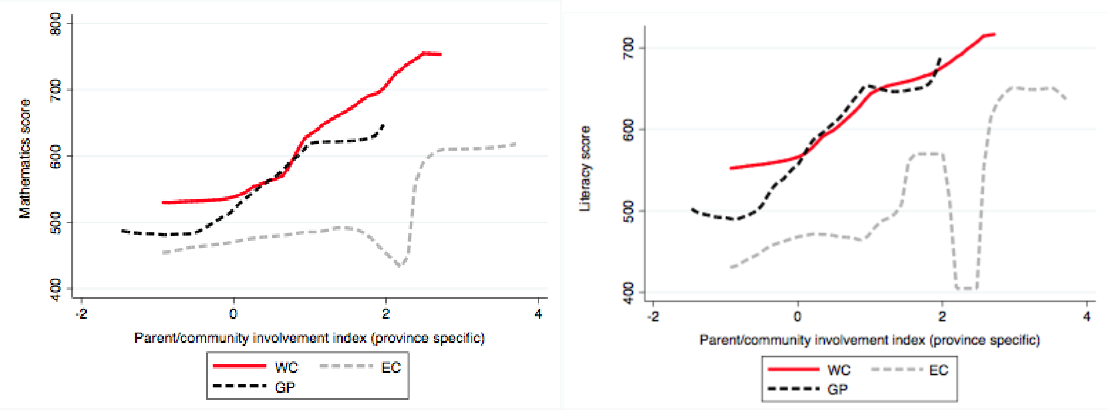
Notes: Mean difference is calculated as Western Cape mean less comparator country mean.

Table A1: Correlations between school average SES and an index for parental involvement

Region/country	Correlation between school average SES and parent involvement
Western Cape	0.725
Kenya	-0.082
Botswana	0.336
Mauritius	-0.093
Tanzania	-0.024
Eastern Cape	0.222
Gauteng	0.742

***Notes**: Parental involvement is calculated using factor analysis to derive a composite index of the parent/community involvement indicators listed in table 5. The school average SES is calculated as the average log per capita consumption of students in the school in all countries but Botswana and Mauritius where the SES weighted asset index is used.*

Figure A4: Grade 6 mathematics and literacy scores by school parent involvement, SACMEQ III 2007



***Source**: SACMEQ III. **Notes**: School parent/community involvement is computed using factor analysis of 14 indicators of parent and community contributions to the school, as reported by the school head. The local polynomial regressions control for propensity reweighting so that differences in student socio-economic and home background factors are accounted for.*