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Abstract

In South Africa the wages of school-based personnel (teachers and teacher-managers) make up 3.5% of GDP, the largest single line item in the government budget. In this paper, we analyze a decade's worth of publicly available data on expenditure, collective bargaining agreements, teacher demographics, and learner enrolment. We show that discounting historical educational expenditures using CPI is naive when wages make up approximately 80% of the education 'price basket' purchased by government. To remedy this we create a sector-specific Basic Education Price Index (BEPI) for South Africa that is weighted by the real cost drivers in education (i.e. ~80% wages and ~20% CPI). Using BEPI we find that there has been a -2.3% decline in real per-learner expenditure over the period 2009-2018 with much larger declines seen in the Free State (-13%), Limpopo (-13%) and the North West (-11%). Despite a rise in fertility and subsequent enrolment over the period we show that only 30% of the decline is due to the rise in enrolment while 70% is due to the rise in wages. The two main impacts of this real decline in purchasing power is that class sizes have increased and hiring freezes have been implemented. Analysis of government payroll extracts from 2012 and 2016 shows that nationally there were fewer teachers employed (-2%), fewer principals employed (-9%), fewer deputy-principals employed (-8%) and fewer Heads of Department (HODs) employed (-7%), despite there being only -2% fewer schools in 2016 compared to 2012. In Limpopo alone, there were -23% fewer deputy principals in 2016 compared to 2012. We conclude by making the case for BEPI being used when analyzing expenditure trends and projections in education. The argument presented throughout the paper is not that educator salaries should not have increased, but rather that there has been a disconnect between government budget allocations and wage and benefit agreements. The longer that wage and benefit increases outpace overall budget increases, the greater the consequences for the education system. Wages must be contained, or educational expenditures must rise, but the status quo is not sustainable for the long-term health of the education system.

Key words: *Education funding in South Africa; education price indexes, Estimates of Provincial Revenue and Expenditure (EPRE), hiring freezes*

Executive Summary

The aim of the present analysis is to determine how the real resources available to the average child in South Africa have changed over the period 2008 to 2018. In order to do so the paper makes the argument that existing measures of discounting educational expenditures, notably using the Consumer Price Index (CPI) are inadequate, and in our view, incorrect. They drastically over-estimate the rise in real spending on education and do not take into account the overall rise in enrolments resulting from an unusual birth-spike in 2005. Furthermore, such an approach cannot explain why there has been a simultaneous rise in "real spending" coinciding with the widespread implementation of hiring-freezes, a well-known cost-cutting measure implemented by provinces.

To remedy this, we develop the Basic Education Price Index (BEPI) which uses the prices of the real cost drivers of education in South Africa and weights them in the same proportion as that which makes up actual expenditures in the budget (Estimates of Provincial Expenditure and Revenue). Because educator wages - that is, teachers, school managers and administrators – make up approximately 80% of the education budget, changes in educator wages should be used when discounting historical educational expenditures. Put simply, we ask how much it costs to employ 100 teachers in 2008 and 100 teachers in 2018, rather than how the prices of an average basket of consumer goods (CPI) changed over the period (CPI). We argue for a method that uses the actual cost drivers in education and weights the price-basket in the same proportions as they are found in the budget, approximately 80% personnel and 20% non-personnel. Using this new and more appropriate measure, shows that real per-learner spending in South Africa has shrunk by -2,3% between 2009 and 2018, with much higher figures in some provinces.

The five main findings of the paper can be summarized as follows:

1. **Clear evidence of a fiscal squeeze:** Provinces are clearly facing a 'fiscal squeeze' where increases in teacher salaries have outpaced increases in budget allocations to education. While this has led to declines in real per learner spending of -2.3% nationally, this is considerably higher in the Free State (-13%), Limpopo (-12,5%) and the North West (-11%) between 2009 and 2018.

2. **Provinces coping using hiring freezes:** Provinces seem to be 'coping' with this squeeze by implementing cost-saving measures such as hiring freezes and leaving vacant posts unfilled. Unsurprisingly these hiring freezes are largest where the real per-learner declines are greatest. Importantly, hiring freezes are disproportionately affecting school management posts rather than regular teaching posts, although there has been a decline in the latter as well. It is uncanny how similar the declines are in per-learner spending between 2009 and 2018 to the declines in the number of principals employed between 2012 and 2016 (the years for which we have PERSAL data). In the Free State per-learner spending declined by -13%, principal posts declined by -14%. In Limpopo per-learner spending declined by -13%, principal posts declined by -13%. In the North West per-learner spending declined by -11%, principal posts declined by -12%.

3. **Historical overestimation of spending on education:** We show that any historical analysis that uses CPI to discount educational expenditures overestimates the real spending on education since the real cost drivers have, especially teacher salaries, have been increasing much faster than CPI. In South Africa a traditional approach of using CPI as the discount rate leads one to conclude that 'real' aggregate educational expenditures have increased by 42% between 2008 and 2018, when in fact they have only increased by 8% when using the correct discount rate. Furthermore, when comparing 2009 and 2018 using CPI-discounted figures the aggregate increase was 30% when in actual fact it was only 3% when using the correct discount rate. This is primarily because the vast majority of additional educational spending over this period has simply been on paying existing teachers more, rather than hiring more teachers or buying more non-personnel resources.

4. **Per-learner figures vs aggregate figures:** Much of the existing literature and government reporting is at the aggregate level. Yet the meaningful unit of analysis is the child – what is available to the average child in South Africa? While this may not matter if a population is stable over time, a situation of rising births (as in South Africa) means that resources are being spread over a larger number of children than before. This makes a considerable difference to the conclusion. Between 2009 and 2018 real expenditure on education rose by 3% when looking at the aggregate level and fell by -2.3% when looking at the per-learner level (both using real cost drivers). While there was slightly more money (+3%) being spent on education in 2018 compared to 2009 when looking in the aggregate, for the average child there was slightly less money being spent on them in 2018 compared to 2009.

5. **Significant inter-provincial variation in spending per child:** It is clear that some provinces spend more public money per child than others, despite alleged equal funding per child in the national funding formulas. For example, Gauteng spent R2,500 more per child per year compared to KwaZulu-Natal or Limpopo (R20,037 in Gauteng compared to R17,563 in KwaZulu-Natal and R17,503 in Limpopo in 2018).

Finally, we argue that the national government has agreed to higher teacher wages and benefits without budgeting for those increases, and in the process undermined the education system. This has led to a host of unintended consequences. Provincial departments experiencing salary increases that have outpaced their budget increases have attempted to deal with the subsequent fiscal squeeze by implementing hiring freezes and allowing class sizes to rise. Payroll data shows that even after accounting for a small decline in the number of schools, there are -7% fewer principals employed in 2016 compared to 2012. In the three most severely affected provinces the declines in employed Principals, Deputy Principals and HODs range from -13% to -23% when comparing 2012 and 2016.

The main contribution of the paper, to both the research literature on South African education, and also to policymakers, is to help explain the conundrum of the co-existence of widespread hiring freezes and the alleged rising per-learner spending on education (using CPI as a deflator). The answer to this conundrum is that CPI is the wrong deflator for education – both in South Africa and internationally. When using the correct deflator (the Basic Education Price Index) there is a logical explanation behind both increases in class sizes and the implementation of hiring freezes. The provincially devolved nature of South African spending provides further corroborating evidence. Provincial disaggregation of spending trends and hiring freezes shows quite clearly that those provinces experiencing the largest declines in real per learner spending are also the ones who have the highest number of vacancies. This is not a coincidence. For those researchers who are unconvinced that BEPI is the correct discount rate, and instead believe that real education expenditures have been increasing monotonically for the last decade, we ask the following question: If real educational expenditures per learner have been rising over this period, why is it that provinces are implementing hiring freezes?

Finally, we argue that government officials from the National Treasury and the Department of Basic Education need to take account of the dynamics presented in this paper when entering wage negotiation agreements with teacher unions. While many of the choices made in such negotiations are necessarily political, it is fair to ask government to acknowledge the trade-offs and costs in their decisions and to make those trade-offs and decisions public.

Introduction and overview

Educator wages make up 3.5% of GDP in South Africa, the largest single line item in the government budget. In 2019 the South African government employed 407,001 teachers (DBE, 2020: p.1), more than four times the largest private sector employer in the country, Anglo American with 92,000 employees (Anglo American, 2019: p.7). Despite its import, a lack of scholarly attention to the dynamics of the growing basic education wage bill has led to a number of key misunderstandings.

The most costly misunderstanding is how one calculates 'real' educational expenditures. That is, educational expenditures that take account of the rise in input costs, or 'inflation'. Traditionally one uses the Consumer Price Index (CPI), which represents the overall national inflation rate, as a proxy for input costs and discounts expenditures using this index. We point to international literature (Halstead, 1983; Rothstein et al., 1996; Walters & Dunfield, 2010; GFOA, 2010) and show that this approach has serious shortcomings. When personnel costs make up over 80% of educational expenditures, as they do in South Africa, looking to the changing cost of an average basket of consumer goods over time is misleading.

The salient question is "How much money was needed in 2018 to buy the same educational inputs available in 2008, or 2010, or 2013?" To answer that question, one has to discount educational expenditures by the real cost drivers of education. This is the focus of our paper. We collect, summarize and analyze all publicly available records from the South African National Treasury on provincial estimates of government expenditures on Basic Education from 2008-2018, as well as all collective bargaining agreements arising from the Public Sector Coordinating Bargaining Council (PSCBC) and the Education Labour Relations Council (ELRC) as published in Government Gazettes for the period 2008-2018. We use this data to develop a "Basic Education Price Index" (BEPI), approximately 80% of which is made up of personnel costs and the remainder of which is regular CPI. We also take into account both the age distribution of the educator labour force in

South Africa and the growing number of learners in the system (Gustafsson, 2018)[1]– both of which impact overall per-learner expenditures. We discount historical basic education expenditures using the BEPI and account for changes in enrolment in order to answer our primary research question: "How has real provincial per-learner educational expenditure changed in South Africa over the period 2009-2018?"

We find that increases in teacher salaries have outpaced increases in overall educational expenditures leading to a -3,2% decline in real per-learner expenditure over the period 2009 to 2018. There are also large inter-provincial variations with the biggest declines in per-learner spending between 2009 and 2018 seen the Free State (-13%), Limpopo (-13%) the North West (-11%), and the Western Cape (-9%).

The consequences of this decline can be seen in widespread 'hiring freezes' of school-based personnel (notably school management posts) as a cost-saving device. Analysis of government payroll extracts from November 2012 and November 2016 shows that there were fewer principals employed (-9%), fewer deputy-principals employed (-8%) and fewer Heads of Department (HODs) employed (-7%) across the country, despite there being only -2.2% fewer schools in 2016 compared to 2012. While fairly widespread, these hiring freezes have been concentrated in three provinces: Limpopo, the North West, and the Free State. Looking specifically at the four-year period 2012 to 2016, Limpopo 'lost' approximately 15% of its principals (513 individuals), 27% of its deputy principals (417 individuals), and 21% of its HODs (1,282 individuals), despite only having 2% fewer schools in 2016.compared to 2012 [2](68 fewer schools). In fact, in 2016 nearly a quarter of Limpopo schools (23%) had no principal employed,[3] compared to 11% in 2012. By comparison less than 1% of schools in Gauteng and the Western Cape did not have a principal employed in either period. The data also suggests that there have been increases in average primary school class sizes, although the magnitude of the increase depends on the data source used.

We show that the decline in real per-learner spending over this period is driven primarily by large increases in educator compensation that have outpaced overall per-learner spending on education. This has led to a growing disconnect between budget allocations and teacher salaries, the cumulative impact of which is significant. While part of the overall per-learner decline is due to a rise in fertility and a rise in subsequent enrolments, this rise explains only 30% of the decline in per-learner spending, while the remaining 70% of the decline is due to the rise in teacher wages.

The present paper builds on earlier work by our colleague Martin Gustafsson (DBE, 2017). While we use broadly the same approach, our analysis builds on his work in four ways: (1) We have extended the date range of the analysis and now include 2017-2019 data; (2) We take account of government expenditures on Workbooks; (3) We do a slightly more comprehensive adjustment for reporting changes in government budgeting processes (specifically Programme 5 expenditure adjustments), and analyze some of the possible impacts of these changes in real per learner expenditure; and (4) We situate this local analysis within a broader international literature on education price indices.

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1   Theoretically, any and all line items in the budget could be investigated for their deviance from CPI, not just teacher wages. This would mean the remaining 20% of the budget could also be the subject of this analysis. However, it is the dominance of teacher wages in the budget and the particular nature of wage-setting which makes teacher wages so important to investigate – not deviance from CPI per se.

2   According to the DBE's School Realities documents there were 24,255 schools in 2012, and 23,719 schools in 2016 (DBE, 2012: p.1; DBE, 2016, p.1).

3   Although every school must have an acting principal who is also a teacher.

Background and literature

2.1. Creating a longitudinally comparable series of education expenditures: the international literature

The question of how to discount and compare educational expenditures over time is one that has received some scholarly attention from educational planners and policy analysts around the world, particularly in the United States. Although there were a few initial studies on specialized price indexes for education in the 1960's and 1970's (Wasserman, 1963; Halstead, 1963; Furno & Cuneo, 1971; O'Neil, 1971; and Wynn, 1975), the two studies reporting a true time-series of price indexes were conducted by Kent Halstead, firstly for higher education (Halstead, 1975) and later for schooling (Halstead, 1983). These were referred to by the author as the 'Higher Education Price Index' and the 'School Price Index.' The logic behind developing such an index is relatively straight-forward: "...institutions can benefit from an index that can be used to adjust nominal figures to constant dollar values so as to compare real resource levels over time. Although the Consumer Price Index is readily available and, for lack of a more appropriate index has been used to deflate education dollar figures, the CPI does not measure price changes for the goods and services purchased by schools and colleges" (Odden in Halstead, 1983: p.iii).

These indexes usually take the form of a weighted average of fixed inputs, such as Laspeyres formulas (Halstead, 1983: p.21). Although they have been variously labelled in the literature, the principle is the same. Some of the names that have been used include: a Net Services Index (Rothstein & Miles., 1995: p.6), an Employment Cost Index (Fowler & Monk, 2001: p.49), a Municipal Price Index (Walters & Dunfield, 2010: p.44), and a Cost of Education Index (Taylor et al., 2002: p.261). The basic premise underlying all of these measures is to create an index representing the actual cost of purchasing a fixed basket of education goods over time. To quote Halstead again (1983: p.12):

"A price index measures the effect of price change, and price change only, on a fixed group of consumer items. The change in price index values from year to year may be interpreted as the change in resources required to offset the effects of inflation in buying the same kinds and amounts of goods and services previously purchased. For example, if the index shows a yearly price increase of 6.5 percent, first-year expenditures of $1million must be increased by $65,000 in the second year to purchase the same goods and services. What makes a price index so valuable is that by reporting only price increases, without quality or quantity changes, an index series documents the additional revenues required for continuation of business as usual. Few financial supporters can deny that funding should at least maintain the status quo if not improve upon it. Thus, price indexes reliably report increased funding requirements that can be defended as essential if services are to be maintained."

While it is generally agreed in the literature these indexes are helpful and under-utilized, there are three prominent critiques: (1) the potential circularity of the approach, (2) ignoring the substitutability of inputs in the decision-making process, and (3) the in-feasibility of creating sector-specific price-indexes for all sectors.

The first critique arises when these sector-specific indexes are used uncritically in budgeting processes, especially when there are strong collective bargaining powers (as in South Africa). As Walters & Dunfield (2010: p.47) explain, "…with labor being the major cost component, the [Municipal Price Index] calculation is somewhat circular. The local council…approves collective bargaining settlements, which strongly influence overall costs, and those figures are then used to rationalize budget requests. However, this process also reinforces the need for the council to be cognizant of the budgetary effect of approved labor settlements."

In the context of South Africa this critique is especially relevant and is understandably raised by Treasury officials. South Africa has a well-established system of collective bargaining, the presence of powerful teacher unions, as well as a formal ruling alliance between the African National Congress (ANC) and the Confederation of South African Trade Unions (COSATU), of which SADTU[4] is the largest member. As further evidence of this, when reviewing the significance of collective bargaining for inflation dynamics, the Bank of International Settlements (2009: p.71) places South Africa in the "High Significance" category, together with Mexico, Argentina and the Czech Republic.

The second critique, ignoring the substitutability of inputs, depends on the sector and on union bargaining power. When comparing CPI over time the assumption is that consumers have no individual power over the price of the goods and services they consume (an uncontentious assumption) and therefore regularly substitute inputs to optimize their own utility. However, if one takes as given the current number of teachers employed and accepts their 'price' (i.e. their wages) as a fait accompli one precludes the possibility of substituting this resource for alternatives (teacher assistants, technology, alternative class-sizes etc.) or for influencing the 'price' through negotiations in collective bargaining councils. One approach to overcome this problem is to not use actual teacher salaries but rather an index of salaries of comparable workers. This has been advocated by various authors in the U.S. (Guthrie & Rothstein, 1999; Goldhaber, 1999; Rothstein & Smith, 1997). As Rothstein et al. (1996: p.167) explain:

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4. SADTU is the South African Democratic Trade Union (SADTU) and is the largest teacher union in South Africa by a significant margin. Payroll data for 2013 shows that 72% of post level 1 teachers who were affiliated to a union are affiliated to SADTU (DBE, 2017: p:15). If one looks at all teaches (affiliated and unaffiliated) the figure is 57%.

"…we have no theoretical disagreement in principle with a sectorally specific index, an education price index. Our point here is only that, if an education specific index is desired, its component parts should not be the prices of the actual inputs used by schools, but should be the prices of "comparables" or "substitutables" (weighted by the relative importance of these inputs in education), because only by using such surrogates can the impacts of wage setting in education and its quality effect be judged. Only in this way can an inflation index tell the public how much more schools have "had to" pay for similar resources."

This critique is less relevant in the South African context. Because of the strong union presence and because collective bargaining agreements are conducted at the national level and are then binding on all provinces. Thus, provincial departments of education have little choice but to accept the "price" of teachers as given.

The third critique has been expressed by a number of government officials, particularly those within the National Treasury, who argue that one cannot create a separate price-index for every sector of the economy. They cite the logistical complexity of collecting the various prices needed for the index and that having too many price-indexes is not helpful. We differ with this view. When a sector of the economy, Basic Education, makes up 5% of GDP, and a single price component, the education wage bill, makes up 3.5% of GDP, it is clearly worth getting the numbers right. Using CPI to discount educational expenditures masks the significant changes in real purchasing power of the education budget over time.

Notwithstanding the above critiques, education price indexes are used by some sophisticated education authorities when budgeting and forecasting. For some examples see Walters & Dunfield (2010) for the case of Calgary in Canada, and Taylor et al. (2002) for the case of Texas, in the United States.

Given the federal nature of South Africa where expenditure powers are devolved to provinces, a fixed-input price index is particularly relevant. Although country-wide teacher wages are set centrally at the national level and are consistent across the country (in the Public Sector Coordinating Bargaining Council, PSCBC) (Adair & Albertyn, 2000: p.817), it is provinces who must abide by these agreements and pay teachers. Thus, for provinces teacher wages can be considered an exogenous price over which they have almost no control. This is discussed in more detail in the next section which focuses on the particularities of the South African case.

2.2. The relevant South African literature on creating a longitudinally comparable series of per-pupil education expenditures

In this section we survey the South African literature and explain three underlying topics that are relevant for our purposes: (1) The existing use of sector-specific price indexes, (2) The role of the Integrated Quality Management System (IQMS) in affecting wages, and (3) The rise in births and enrolments since 2005 in South Africa.

2.2.1. The existing use of sector-specific price indexes

To date there has been little awareness or use of sector-specific price indexes in South Africa in both academic and policy circles. While there is a small but significant literature on this in

many high-income countries, this research is virtually non-existent in South Africa. A literature search reveals only one report (Aardt & Olivier, 2014) which calculates a Higher Education Price Index (HEPI), commissioned by Higher Education South Africa (HESA). It is silent on schooling. A somewhat dated report commissioned by National Treasury on 'Administered Prices' (Storer & Tiljoer, 2003) mentions that education is covered in the second volume of the report which allegedly includes detailed sector analyses (Tiljoer et al, 2003) but the second volume only covers telecommunications, electricity and transport, and not education.[5] While Statistics South Africa does include an education component in its calculation of CPI (StatsSA, 2017), this is with reference to educational expenditures by private citizens that would contribute to their weighted basket of consumption, rather than the type of education price index envisaged here.

2.2.2. The role of the Integrated Quality Management System (IQMS) in affecting wages

One of the under-appreciated factors affecting the South African teacher wage bill is the Integrated Quality Management System or IQMS. In 2003 the Department of Education introduced a new quality management system that represented an agreement between the Department and teacher unions (ELRC, 2003). Weber (2005: p.64) summarizes the threefold purpose of IQMS as follows: (1) to evaluate individual teachers for development (Developmental Appraisal), (2) to evaluate individual teachers for rewards, incentives and promotion (Performance Measurement) and (3) to evaluate the overall performance of the school (Whole School Evaluation). While this was the intention of the policy its implementation bears little resemblance to this original design. While originally the IQMS system had little impact on teacher remuneration, this has subsequently changed, as Gustafsson (2019a: p:57) explains:

> *"In 2008, what appeared to be the most radical changes to these rules since the removal, in the 1990s, of the race-based salary scales, were promulgated. The Occupation Specific Dispensation for educators involved paying larger annual increases to teachers classified in any year as 'good' or 'excellent' in the performance management system, known as the IQMS, which had existed since 2003. Previously, one's IQMS classification had made virtually no difference to one's annual experience-linked increase. The additional costs of the new system were justified on the basis that this would improve learning outcomes, particularly in historically disadvantaged schools. However, there were serious gaps in the policy signed by the employer and unions, gaps which would be exploited by unions when they made an about-turn in 2009 and successfully cancelled the policy. How the financially lucrative IQMS classifications would be rationed across schools to prevent over-expenditure, or how one would deal with the increased need for anti-corruption controls, now that classifications were being attached to money, were not made clear. The latter policy challenge is particularly difficult to resolve, given inherent difficulties in individual performance-linked incentives for teachers. In a dramatic turn of events, in 2009 SADTU ensured that the funding for the policy was retained, whilst removing the performance-linked differentiation across teachers, essentially meaning the money would be spread across all teachers. This was possible partly because the ruling party wanted to maximise votes from teachers in the upcoming 2009 elections. However, policy design weaknesses played a role too" (Gustafsson, 2019a: p:57).*

Coming from an angle of teacher development, De Clerq (2013) argued that contestations between the Department and teacher unions around the sequencing of teacher development

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5. Even if this analysis were available it is unlikely to be of much use for the present purposes. As the authors state (Tiljoer & Storer, 2003: p.33), "The data only allow for a piece-meal analysis of education costs and not an integrated, time-series analysis – which suggests that much more research and analysis are required to understand the various dimensions of and the factors influencing education costs in South Africa."

opportunities and accountability initiatives led to teachers collectively circumnavigating all forms of accountability from IQMS:

> *"The IQMS agreement was far from being a rational outcome but rather the result of [Education Labour Relations Council] compromises with stakeholders having different designs and interpretations. The department hopes the IQMS could become the backbone of a national monitoring system, which would report on the most effective and ineffective schools and teachers (cited in De Clerq, 2011). The unions, and SADTU in particular, remained oppositional and continued to pressurize the department for a large-scale [Teacher Development] plan and attending strategies. The existing poor department support frustrated unions and teachers so much that they decided to manipulate the IQMS scores to qualify for a bonus" (De Clerq, 2013: p.14).*

These assertions by De Clerq and Gustafsson are important for the present analysis, and helpfully, are empirically verifiable. The IQMS system involves an evaluation process where a committee of peers (teachers and principals) rate their fellow teachers on a scale of 1 - 4 with the categories being 1 (Unacceptable), 2 (Meets minimum requirements), 3 (Good), and 4 (Outstanding) (IQMS Annual Report 2012: p.40). The original purpose of IQMS was so that teachers could "accelerate their progression to higher salary notches based on their consistent good performance" (ELRC, 2006: s4.3). The additional resources to implement the policy were made part of the law: "Additional funds have been made available by National Treasury to make provision, inter alia, for enhanced career pathing opportunities and accelerated salary progression in education" (ELRC, 2006: s3.1). The agreement specifies that teachers can qualify for a 1% increase in their annual salary (1 'notch' increment per year) contingent on "Satisfactory performance" (s4.10.1) which is defined as an IQMS score of 56 or higher for post-level 1 educators. This essentially[6] means that as long as teachers do not receive an "Unacceptable" rating from their fellow teachers (an IQMS rating of 1) they qualify for 1% higher salary every year.

The only IQMS Annual Report that is publicly available (2011/12) shows that practically all teachers (99.6%) received a rating of 2 or higher (IQMS 2012: p.17) qualifying them for the bonus. A 2017 research report by the Department of Basic Education analyzed the 2014 and 2015 national salary database (Persal) and found that 99.9% of educators were rated Level 2 or higher (DBE, 2017: p.5) and thus qualified for the additional 'bonus'. An initiative that was meant to "promote accountability and performance improvement of educators through on-going learning and development" (DBE, 2018: p.44) is now essentially an unconditional de facto annual salary increase for all teachers, regardless of performance.

Very recent developments (September 2019) show that this approach to increasing teacher salaries through political maneuvering continues. In 2009 SADTU single-handedly changed the terms that had been agreed to by multiple unions in ELRC Collective Agreement No.1 of 2008, which had included a 1.5% pay progression with additional accelerated progression for "Good" or "Outstanding" performance. Because they represent the majority of employees in the ELRC, SADTU signed Collective Agreement No.4 of 2009 which changed pay progression from 1.5% to 1%, removed accelerated pay progression for higher performance, and awarded a 1% salary increase for every 3 years. In 2009 the Department of Basic Education began discussions about introducing a Quality Management System (QMS) that would replace IQMS, essentially a rebranding with

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6   The rating categories are 0-49 (Unacceptable, Rating 1), 50-69 (Meets minimum requirements, Rating 2), 70-84 (Good, Rating 3), 85-100 (Rating 4: Outstanding) (IQMS Annual Report 2011/202: p.40). There is a second lesser-known provision in the original 2006 Collective Agreement 5 that allows for a 3% increase every 3 years (3 notch increase) 'Accelerated salary progression' conditional on "good" performance which translates to an IQMS score of 78 or higher for Post level 1 school-based educators (s.4.10.2), which is a rating of "Good" (Rating 3) or "Outstanding" (Rating 4) on IQMS. This was subsequently revoked in 2009 as described in the text.

some additional benefits. According to the Department's presentation to parliament (DBE, 2015), "On 13 November 2014, the QMS was adopted by parties to the ELRC and circulated for signing." The Combined Trade Union-Autonomous Teachers Union (CTU-ATU) - an amalgamation of all teacher unions except SADTU - all signed the document as well as the Acting Director General (p.8). The presentation goes on to say that, "SADTU stated it was committed to the agreement, but would append its signature upon agreement of an additional 0.5% pay progression increase."

As the DBE (2015: p.9) notes, "By law the QMS Collective Agreement (No. 2 of 2014) is a binding agreement […], technically the agreement could be enforced. However, the majority union may influence its members not to cooperate with officials of the [Provincial Education Departments] who will be rolling out the training leading to the implementation of the agreement." As a result, the agreement was not enforced for a further four years until in September 2019 the Department agreed to the 0.5% pay progression increase.[7] Although this was explicitly understood as meeting the SADTU demand for 0.5% greater annual pay progression, it was framed as "equalization of pay progression across the public service at 1.5% per annum for all employees including educators [...], this implied that an additional 0.5% increment was to be implemented for educators in order to achieve equalization" (Mweli, 2019: p.1), despite SADTU having itself agreed to the 1% increment (rather than 1.5% increment) a decade earlier in exchange for other benefits.

In effect, this would increase all teacher's salaries by an additional 0.5% each year until retirement. If past trends continue, 99.9% of teachers will now receive a 1.5% increase in salary per year due to 'acceptable performance'. We estimate a roughly R1-billion additional cost in each year due to this increase in the notch increment. [8]While extremely consequential for the national fiscus, and a significant victory for SADTU, there was only one minor media article written about this in the two months following the agreement (Fengu, 2019).

2.2.3. The rise in births and enrolments since 2005

Up to this point we have considered the factors that affect the real resources that are available in the education system as a whole ("How many educator salaries can be paid for with resources that were available in x, y or z year?"). However, a more meaningful unit of analysis is the individual child; i.e. what education resources are available per child in the schooling system? While this may seem like a technicality in most high-income countries, rapid expansions in enrolments in developing countries make the per-learner metric essential.

Although South Africa has had relatively stable (and comparably high) enrolment rates for the last two decades, recent research has shown a peculiar change in the birth rate. Using three independent sources of data (the DBE's Annual Survey of Schools, the Learner Unit Record Information Tracking System (LURITS), and the Department of Home Affairs birth registration data), Martin Gustafsson shows conclusively that there was an increase in births of around 13% between 2003 and 2005 in South Africa. This led to a 13% increase in enrolments between 2009 and 2015 when those children entered school (Gustafsson, 2018: p.1). It is worth quoting Gustafsson (2018: p.1) in full:

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7   Government Gazette 42712: No.1177 of September 2019

8   In the first year every employee who remains in the system receive an additional 0,5%. Those who exit (e.g. retirees) are not affected, neither are new hires who start at the same opening salary and are not affected by the change in notch increment in the first year. Accordingly, since total compensation of employees in basic education was R1.9 bil in 2018 Rands, 0,5% amounts to R965 mil.

"Over the six-year period 2009 to 2015, grade 1 enrolments increased by 13%. These increases were not expected, and came after many years of enrolment decline. The current paper concludes that the enrolment increases were due to population increases. They were not caused by fraudulent over-reporting or increases in grade repetition. They were clearly the outcome of a remarkable increase of around 13% in births, in particular during the years 2003 to 2005. […] After 2008, births declined somewhat and settled at a level which was around 6% lower than the 2005 to 2008 'plateau'. However, this decline was not large enough to take birth numbers back to their pre-2003 levels. A brief discussion of the aggregate statistics relating to the child support grant and anti-retroviral treatment, and of some available research on causation, leads to the conclusion that it is not easy to explain the increase in births, though the available evidence leans towards anti-retroviral treatment, rather than child support grants, as the most likely explanation."

This 'birth spike cohort' is currently in Grade 10 in 2020. This is an important part of the story when assessing the real resources available per pupil in the country over time. If there are more pupils over which to spread a constant budget, the per-pupil amount will decline. In the data and analysis sections below we account for changing enrolment by dividing the real educational expenditures by the total number of learners in the system in each year.

In the next section we discuss how each of the above features are accounted for when deflating educational expenditures using the Basic Education Price Index (BEPI).

Data and Methods

3.1. Overview: Creating the Basic Education Price Index (BEPI)

At a high-level one can think of the BEPI as a weighted index where roughly 80% of educational expenditures are discounted using an index created from the cost of teachers (wage agreements, benefits, demographic effects) and 20% of educational expenditures are discounted using the regular CPI inflation index.

Utilising CPI as the price index for non-personnel spending is imperfect in the absence of a formal review of the non-personnel basket of goods consumed over time. Anecdotal conversations with Gauteng basic education officials suggest that prices in the non-personnel component of the budget have in fact increased even faster than teacher wages, suggesting that using CPI for BEPI is a conservative undercount. Any decline in overall per-pupil spending reported in this paper is therefore likely to be an under-estimate of the true decline. For example, in Appendix G we model[9] what the impact would be if non-personnel expenditures increased at CPI+1% per year instead of the assumed CPI per year as in the body of this paper. The impact of even a small increase in non-personnel is large.

We estimate inflation in educator wages using two methods: Government Gazette wage increases from 2008-2018, as well as comparisons of average nominal educator wages throughout the time period. Following this, for both estimates, we anchor the ratio of personnel to non-personnel spending at a dynamic rate based on each year's total Cost of Employment as a percentage of total current expenditure in basic education. That is – given small variations in personnel to non-personnel spending over time, each year's BEPI is reflective of that year's ratio. We use these as

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9   As an illustration of the potential severity of this under-estimate, in Appendix G we replicate our method used here except we assume non-personnel price increases were CPI+1%. This is an arbitrary value and the results derived do not serve as an estimate of per pupil funding. They are only a guide as to the how above-CPI increases in non-personnel costs influence the overall figures and conclusions we present in this paper. Overall, a CPI+1% inflation rate for non-personnel spending would mean real per learner spending declined by -3,6% (rather than -2,3% as here). In Limpopo and the Free State, the declines would be -14% (rather than -13% as here. See Appendix G.

weights to create a new price index basket (the BEPI), with wage inflation constituting just over 80% of the index and CPI making up the remainder. We use this BEPI to discount educational expenditures, and then divide by enrolment to get real expenditure per-learner each year.[10]

Figure 1 provides a high-level overview of how funds are allocated to education in South Africa. (1) At the start of the process, each year the National Treasury allocates a portion of total government income to each province based on the Equitable Share Formula (ESF), a formula that is primarily influenced by the share of the country's population resident in that province (Motala & Carel, 2019). (2) Each Provincial Treasury then decides what portion of that total provincial income is allocated to education, what percentage to health, etc. Steps 3-6 in the diagram indicate how the education budget is spent in each province. In Step 3, given that all publicly employed educators are paid according to the same salary scales, provinces take as a given the nationally agreed upon salary scales. These are agreed upon in the Public Sector Coordinating Bargaining Council (PSCBC) and the Education Labour Relations Council (ELRC) where there are representatives from organised labour and government. In Step 4 these cost scales are then applied to the total number of posts (and level of the posts) that have been allocated for the upcoming year in the province[11], the cost of which is determined by the average age and number of teachers in the province. It is important to take account of the age of the overall educator workforce since older employees have higher salaries on average, largely due to IQMS increases. All of these steps result in the total increase in provincial personnel costs (Step 5). The remainder of the budget is spent on non-personnel items (Step 6), before finally being divided by the total number of enrolled learners in the province (Step 7) to provide a per-learner figure.

Figure 1: Overview of education expenditure allocations and components in South Africa

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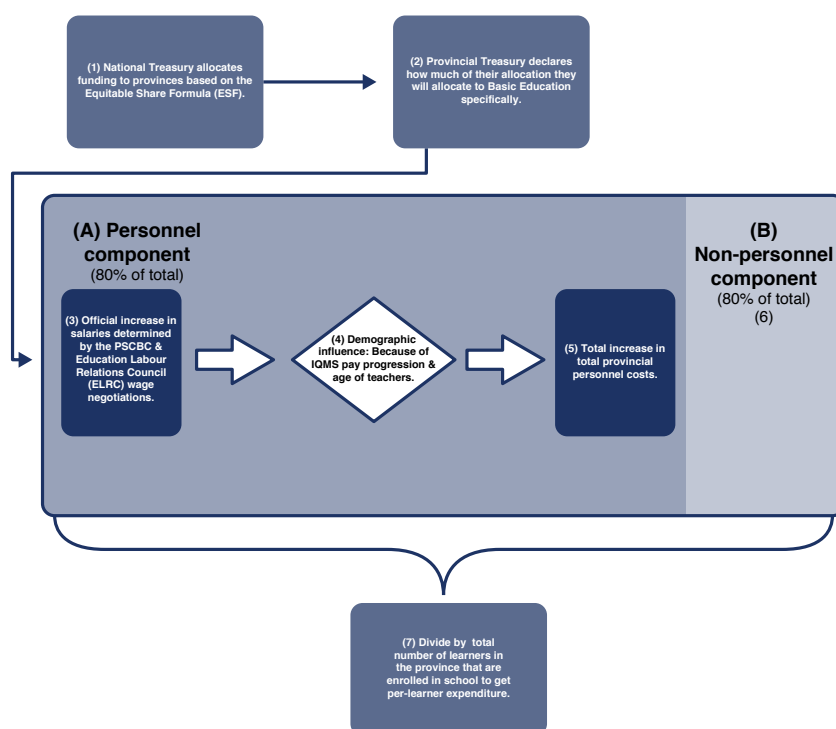
10   The Gazetted wage increases apply to salaries while CoE includes both salaries and benefits. However, many benefits are linked to salaries, such as pension contributions. Those benefits that are not linked to salaries (such as housing and medical) make up less than 10% of CoE (Gustafsson, 2012: 31).

11   While it is not the focus of this paper, it is worth noting that different provinces take different approaches when deciding on the number of available posts for the upcoming year. A 2013 report by Deloitte - "Assessment of National Implementation of the Post Provisioning System" - found that only Gauteng and the Western Cape followed the model of pre-emptively deciding on a particular split between personnel and non-personnel spending and then allocating posts based on that (i.e. beginning with the budget and then allocating posts). All other provinces started with the total number of currently employed teachers and worked backwards from that (i.e. started with existing posts and allocated the budget to ensure the current number of teachers remained unchanged) (Deloitte, 2013: p.38).

In the sections that follow we outline the data sources for each component and how we construct the Basic Education Price Index (BEPI) and apply it to expenditure figures in South Africa.

3.2. Data Sources

3.2.1. Overview of Data

We use Treasury's Estimates of Provincial Revenue and Expenditure (EPRE) reports[12] to get raw spending figures for each province. Workbook expenditure, which is financed nationally, is sourced from National Budget Review publications.[13] Historical CPI figures are available from Statistics South Africa,[14] while CPI projections are available from the South African Reserve Bank.[15] Official personnel wage increases are sourced from Government Gazettes[16]. Student enrolment numbers are available from the Department of Basic Education (DBE) 'School Realities' reports.[17] To account for the effect that employee age has on the wage bill (older teachers are more expensive), as well as to validate our results using payroll data, we use statistics provided by Professor Martin Gustafsson, and reproduced herein (see Section 3.4).

3.2.2. Estimates of Provincial Revenue and Expenditure (EPRE)

The primary sources of data used throughout this paper are those published annually by the South African National Treasury in their Estimates of Provincial Revenue and Expenditure (EPRE) reports available on their website. These reports detail the provincial expenditure on education for the current year, as well as for four years prior and three years subsequent (projections). The EPRE reports are slightly different for each province and each year, but they all include roughly the same table headed "Summary of provincial payments and estimates by economic classification: Education". An example is given in Figure 2 below for the Western Cape for the 2019/20 financial year.

12   URL: http://www.treasury.gov.za/documents/provincial%20budget/default.aspx

13   URL: http://www.treasury.gov.za/documents/national%20budget/default.aspx

14   URL: http://www.statssa.gov.za/publications/P0141/CPIHistory.pdf

15   URL: https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/9165/March%20MPC%20Statement_28%20March%202019.pdf

16   URL: https://www.education.gov.za. Gazette numbers are 31328 (2008); 32612 (2009); 33694 (2010); 34559 (2011); 35601 (2012); 36558 (2013); 37628 (2014); 39082 (2015); 40062 (2016); 40815 (2017); 41750 (2018)

17   URL: https://www.education.gov.za/Programmes/EMIS/StatisticalPublications.aspx

Figure 2. Example EPRE table, Western Cape 2019/20

Economic Classification R'000	Outcome							Medium-term estimate		
Summary by economic classification **Table 7.2 Summary of payments and estimates by economic classification**										
	Audited 2015/16	Audited 2016/17	Audited 2017/18	Main appropriation 2018/19	Adjusted appropriation 2018/19	Revised estimate 2018/19	2019/20	% Change from Revised estimate 2018/19	2020/21	2021/22
Current payments	14 887 208	16 268 696	17 523 898	18 796 048	18 780 294	18 765 509	20 215 743	7.73	21 321 448	22 700 312
Compensation of	13 117 244	14 133 743	15 178 886	16 477 816	16 349 134	16 346 047	17 729 599	8.46	18 911 880	20 077 057
Employees										
Goods and services	1 769 964	2 134 953	2 345 012	2 318 232	2 431 160	2 419 462	2 486 144	2.76	2 409 568	2 623 255
Transfers and subsidies to	1 623 608	2 012 107	2 074 117	2 288 873	2 206 616	2 212 154	2 337 791	7.94	2 482 863	2 632 858
Departmental agencies and accounts	6 461	6 857	7 278	9 408	9 431	9 431	9 959	5.60	10 516	11 083
Non-profit institutions Households	1 525 938 91 209	1 912 945 92 305	1 980 378 86 461	2 174 168 105 297	2 098 188 98 997	2 099 453 103 270	2 273 490 104 342	8.29 1.04	2 362 163 110 184	2 505 641 116 134
Payments for capital assets	1 121 089	1 011 685	958 096	1 102 656	1 157 135	1 166 382	1 059 510	(9.16)	1 217 035	1 214 198
Buildings and other fixed structures	1 072 694	945 748	883 625	1 062 698	1 113 419	1 121 613	1 013 098	(9.67)	1 168 024	1 162 540
Machinery and equipment	46 519	65 873	74 408	39 942	42 595	43 623	45 230	3.68	47 763	50 343
Software and other intangible	1 876	64	63	16	1121	1 146	1 182	3.14	1 248	1 315
Assets										
Payments for financial assets	5 437	8 689	10 725	5 735	5 735	5 735	6 045	5.41	6 384	6 729
Total economic classification	17 637 342	19 301 177	20 566 836	22 193 312	22 149 780	22 149 780	23 669 089	6.86	25 027 730	26 554 097

Source: National Treasury, 2019

The first three columns refer to the audited figures for previous years (going back four years), the three middle columns refer to expenditure for the previous year, and the three right-most columns refer to the projected figures for 2019/20 (the current year) to 2021/22. Our analysis goes up to 2018/19. For that year's data, we use the revised estimate (column six) as this is considered the most appropriate figure to reflect actual spending (Gustafsson, 2019).

Table 1 below shows the EPRE years that are used as the data source for each calendar year. Because we use audited figures wherever these are available, the best estimates for 2008/9 are those found in the 2012/13 EPRE files, the best estimates for 2009/10 are those found in the 2013/14 EPRE files and so on.

Table 1. Reference key for EPRE source files

	YEAR									
Province	2008/09	2009/08	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
EC	EPRE 2012/2013	EPRE 2013/2014	EPRE 2014/2015	EPRE 2015/2016	EPRE 2016/2017	EPRE 2017/2018	EPRE2018/ 2019	EPRE 2019/20		
FS										
GP										
KN										
LP										
MP										
NC										
NW										
WC										
SA	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total

Note: At the time of writing the 2018/19 MP report had not been released. EPRE files are available at http://www.treasury.gov.za/documents/provincial%20budget/default.aspx

Raw expenditure figures taken directly from the EPRE files can be found in Appendix A. We provide the total expenditure figures ("Total economic classification" in the last line of the table in Figure 2), the COE ("Compensation of Employees" in the second line of the table) and Capital Spending ("Payments for capital assets" which is the third bold line heading). We also provide current account spending figures which is here defined as total spending less capital spending. The total expenditure on basic education in 2018 in the Western Cape was R22-billion. This total is made up of (1) current payments (85%), which in the EPREs includes compensation of employees (74%) and goods and services (11%); (2) transfers and subsidies (10%), (3) payments for capital assets (5%), and payments for financial assets (0.03%). It should be noted that 'Current payments' in the EPREs is different to 'current spending' used in this paper. In the EPREs, current payments only include compensation of employees and payments for goods and services (totalling 85% of total spending). In this paper, current spending includes everything except payments for capital assets (totalling 95% of total spending).

In the results to follow, we provide estimates of both current and total expenditure. We estimate two BEPI indexes, one for deflating current expenditure and one for deflating total expenditure. We include a focus on current expenditure because capital spending is often lumpy and difficult to amortise. Rental expenditure, on buildings or land, is essentially excluded since 90% and 84%[18] of buildings and land are state owned, respectively.[19] Note that we do adjust for two technical issues

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18   As a proportion of known ownership (2008-2018). 24% of ownership is unknown for both buildings and land. URL: https://www.education.gov.za/Programmes/EMIS/EMISDownloads.aspx

19   That is, rental expenditure is included but there is very little that happens as a proportion of overall expenditure. Schools that pay rent for buildings or land are most often in rural areas (Salie Abrahams, personal communication, May 2019).

related to the EPRE files: the shift of Further Education and Training (FET) expenditures (referred to as "Programme 5") from provincial to national in 2015, and we include the nationally-funded expenditure on the DBE Workbooks. This discussion can be found in Appendix B.

3.3. Calculating wage inflation in education

3.3.1. Defining key terms

Before getting into the discussion on wage inflation, it is perhaps helpful to clarify the terms used here when discussing wage inflation as these are often confused, even in official Treasury documents.

We refer to "wage increases" when referring to the changes in the salaries that employees receive, such as a cost-of-living adjustment applicable to all teachers. These wage increases generally increase the salary of all educators in the system, including starting salaries of each position. In cases where wage increases are at different rates for different salary bands, such as larger raises for lower-paid educators and smaller raises for higher-paid educators, we use an average of the increases to determine the overall wage increase that year. Note that "wage increases" is the over-arching all-inclusive term used for an increase in the amount of money/benefits received by the employee. On our count there are seven different ways [20]wages can increase.

IQMS (Integrated Quality Management System) increases refer to pay progression that 99.9% of teachers receive, as previously discussed. It is not a blanket increase to the entire wage bill; educators who receive an adequate rating who remain in the system receive the increase. It does not affect the starting salaries of teachers or teacher-managers.

"Cost of employment" refers to the total wage bill for the sector, or – when specified - for specific roles (such as teachers, principals, heads of department, etc.). The term "teachers" is used to refer to all teachers, deputy principals, and principals, and excludes administrative and other school staff and non-school staff. When trying to distinguish between (1) teachers and (2) principals, deputy-principals and HODs, we refer to the former as teachers and the latter as teacher-managers. We feel this is appropriate since most HODs, deputy-principals and principals are also teachers in the school, and "managers" alone implies they do not teach.

"Wage inflation" refers to changes in the average salary of education employees. Just as the CPI is essentially a weighted average of prices of a basket of consumer goods, the BEPI's wage inflation measure reflects changes in education employee salaries over time due to cost of living increases, changing demographics, IQMS, and other factors which we discuss below.

3.3.2. Understanding the role of demographics in wage inflation

At the level of the total education wage bill, demographic factors play a particularly large role in wage inflation. In any given year, the age profile is determined by the aging of all current employees by one year, the exiting of employees (primarily older educators retiring), and the entry of new, predominantly younger, employees.

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20   These are (1) cost of living adjustments, (2) Occupation Specific Dispensation, (3) promotions, (4) additional benefits such as a rural allowance, (5) improved qualifications which move employees up salary scale notches as a result, (6) an acting allowance paid for acting in a position that has a higher salary amount. The seventh type is different to the first six and that is the wages paid to temporary teachers. Temporary teachers receive their additional benefits as a lumpsum "upfront." Estimates by Martin Gustafsson point to temporary teacher wages being 37% higher than permanent teachers (DBE, 2016: p51).

Because wage inflation increases as employees get older (due to IQMS increases and other factors, such as promotions), when the average age of educators in the system increases (decreases), the average educator cost also increases (decreases), assuming wage increases are consistent across the system. If the age profile of educators remains identical from one year to the next, the average educator salary – and therefore wage inflation – would remain the same.

3.3.3. Clarifying the impact of IQMS on wage inflation

Note that this effect on wage inflation holds even when all employees who remain in the system receive a 1% pay progression through IQMS. Pay progression increases individual educators' pay, but the wage bill as a whole isn't changed if average educator age remains the same. One can think of IQMS in a given year contributing to the wage bill an additional 1% of the cumulative salaries of all those who receive adequate ratings, while the wage bill simultaneously sees a savings from all those who retire or exit for other reasons. Since new hires are much less expensive, having not accrued a career's worth of IQMS increases, the more employees who retire, the greater the savings to the entire wage bill.

This also illustrates the effect of changing pay progression, such as the recent increase in IQMS notches from 1% to 1.5%. Given that all teachers receive this benefit, the true cost of this policy will only be felt in the coming decades. This is because the cumulative impact depends on how many years a teacher has received the additional benefit. For the additional 1% increase, a 40-year old teacher who entered teaching 10 years ago would have been accumulating 10 years' worth of "additional 1%'s". Next year that teacher will have accumulated 11 years of the 1% benefit and 1 year of the 0,5% benefit. It is only once the additional 0,5% has worked its way through the system such that everyone has been receiving it for many decades that the true cost of the policy will be felt and the system[21] will have reached a new 'steady state.' Thus, even if the average age stays the same, wage inflation would be positive since the magnitude of pay progression has increased.

3.3.4. Wages in relation to total expenditure on education

When adjusting for inflation, 2018 is used as the base year in all cases in this paper. That is, all figures are comparable to 2018 Rand prices. As indicated above, the approach taken in this paper is to move beyond simply discounting total expenditure by CPI inflation, and instead take into account both wage inflation and CPI inflation. Each inflation measure is weighted according to its revealed importance in the budget (wages and the remainder). In South Africa (as in many other countries) personnel expenditure makes up roughly 80% of total expenditure. In 2018, total expenditure on basic education in South Africa was R243 billion, and Cost of Employment (COE) was R193 billion, i.e. 79%. The average trend across provinces is relatively stable and slightly increasing over 2008 to 2018, as can be seen in Figure 3. Capital expenditure makes up only about 5% of total spending, with other expenses including payment for goods and services making up the remaining 15%.

Provincially, the trend is similar, although slightly more variable. Figure 3 below displays the components of expenditure by province in 2018. All provinces hover around 80% COE, with the Western Cape and KwaZulu-Natal having slightly higher COE proportions and Gauteng having the lowest.

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21   Technically it's not a simple average, though we believe it is a good approximation. You could have scenarios where average age decreases but its not evenly distributed across rank, where a disproportionate amount of the older employees who exit are in lower salaried positions.

Figure 3. Composition of total national expenditure on education, 2008 to 2018
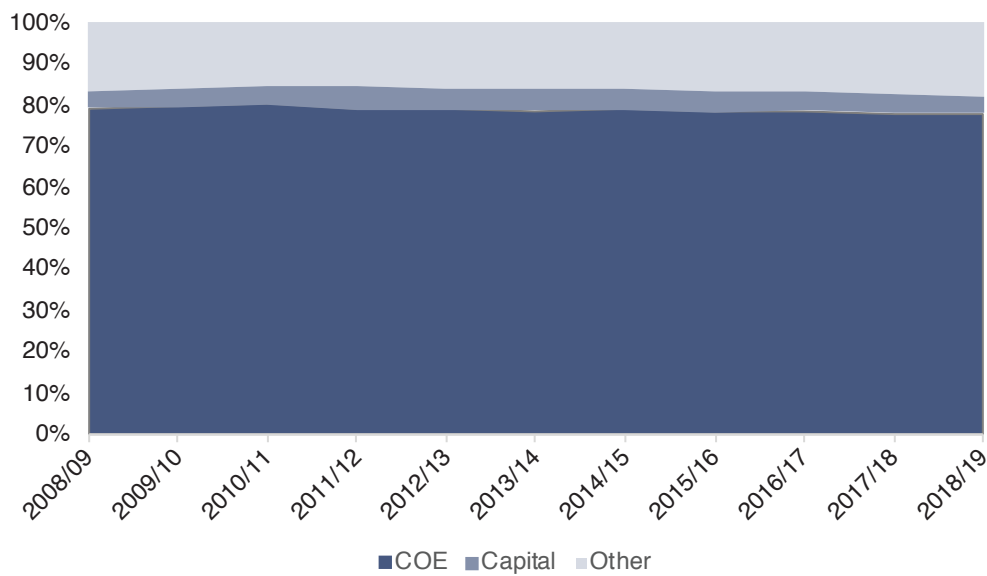
Notes: 1. Figures derived from EPRE reports. 2. COE is Cost of Employment.

Figure 4. Composition of total provincial expenditure on education, 2018/19
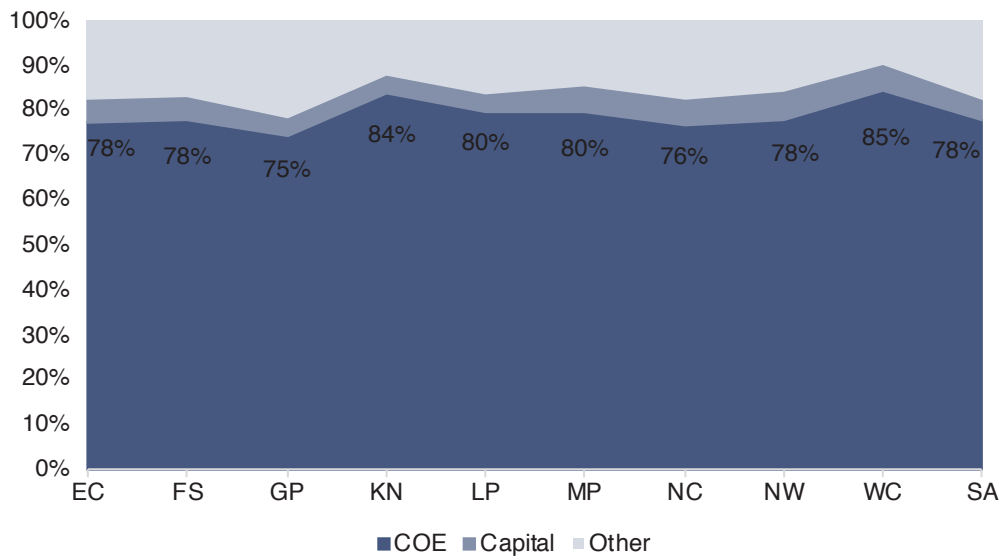
Notes: 1. Figures derived from EPRE reports. 2. Values for 2018/19 onwards are EPRE projections. COE is Cost of Employment.

3.3.5. Ages and wages

One factor that affects teacher wages over time is the change in the underlying age distribution of teachers. Older teachers have higher salaries (due to accumulated IQMS benefits, promotions, higher qualifications etc.) and therefore an increase in average age will also increase teacher wages other things being equal. Although average teacher qualifications seem not to have changed over the period 2008 to 2018, the same cannot be said for average teacher wages. Figure 5 below shows that average teacher age increased steadily from 2004 until a peak in 2013, after where it plateaued and declined somewhat.

Figure 5. Average age of educators, 2004 - 2017
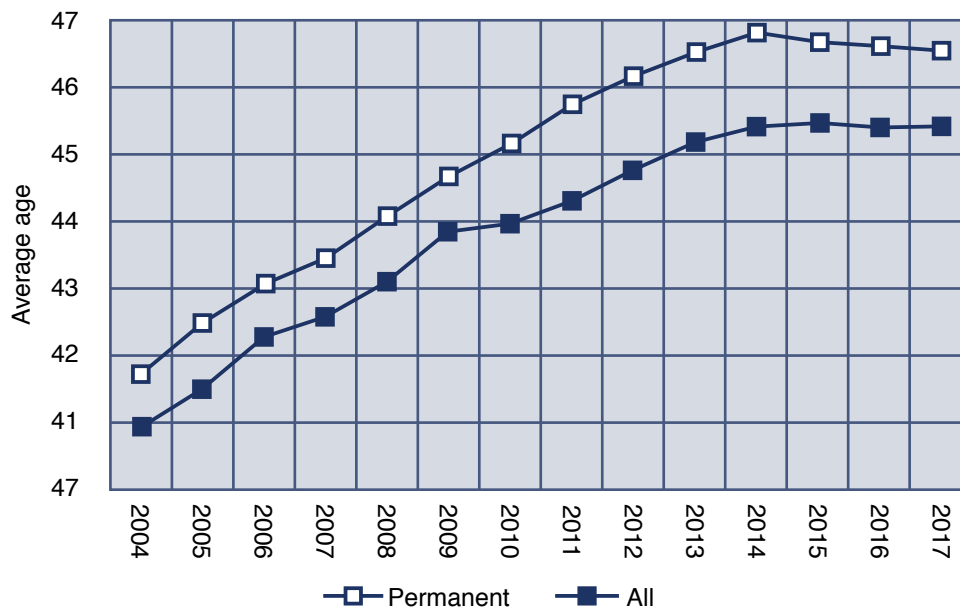
Figure 6 below shows the average wage per teacher age for the year 2017 (using payroll data from 2017 (Gustafsson, 2019b). We use these two figures each year to adjust the rate of inflation for demographic changes.

Figure 6. Average wage cost by age
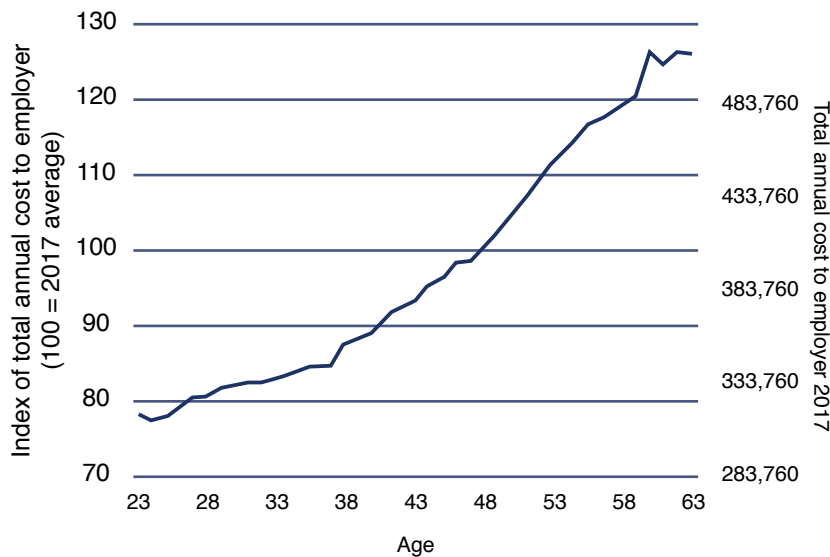
Three assumptions have been made here: (1) that changes in educator qualifications did not substantially affect educator wages over the period, (2) that average age is a sufficient approximation of overall age changes along the age distribution, and (3) that the age-to-wage gradient has remained stable over the period. These assumptions apply to the estimate of educator wage inflation that uses the Government Gazettes as a guide for assessing changes over the period. They do not apply to our second method of estimating educator wage inflation, which uses average

nominal educator wages over the period directly from government expenditure records. The fact that we use two approaches to estimate the same thing should help illustrate the sensitivity of the assumptions and thus the reliability of the results.

3.4. Creating a Basic Education Price Index (BEPI)

3.4.1. Creating an overall BEPI for the sector: Accounting for wage increases, IQMS and demographics

As discussed in the literature section above, the standard method for adjusting for inflation in a particular sector is to create a sector-specific price index that is calibrated using the underlying prices and weighted according to the relative revealed importance of that item in the sector-specific price basket. This what we do here.

In Table 2, we calculate the BEPI using only government gazetted wage increases, together with publicly available information on CPI and age demographic information from Figure 5 and 6 above. First, we construct the wage component by combining all official wage increases in that year (Cost of Living adjustments and Occupation Specific Dispensation). Second, we multiply this by the age influence, which is calculated by finding the average age of educators in that year (Figure 5, "All") and the index of total cost to employer of that age (Figure 6, left Y-axis). This gives us the "Realised Wage inflation." We do not need to incorporate the effect of IQMS here as it is already captured in the age-wage relationship. Third, we calculate the weight of Realised Wage inflation and CPI in the BEPI formula as the relative share of Cost of Employment divided by total current expenditure in each year (for example, "Realised Wage inflation" is weighted 83% in 2008 and CPI is weighted the remaining 17% in 2008). We apply these weights to Realised Wage inflation and CPI to get the 'BEPI growth rate' each year. Finally, we then create the BEPI by assigning the base year, 2018, as 100, and divide by each year's BEPI growth rate to give that year's BEPI value. Thus, this 'BEPI-from-Government-Gazettes' is the weighted index of real-cost drivers in Basic Education in South Africa drawing primarily from official wage increases in government gazettes. We will refer to this as BEPI-GG. An equation describing this method is given below. In Table 2, we provide BEPI-GG for current expenditure. It is slightly different for total expenditure but the difference is not such that it warrants additional inclusion here.

$$BEPI_{GG} = \left(\left[1 - COE_p \right] X \, CPI \right) + \left(COE_p \, X \, Wage_{inf-gg} \right)$$

Where COE_p is the proportion of expenditure that is made up of COE and

$$Wage_{inf-gg} = (COL_{inf} + OSD) \, X \, Age_{influence}$$

Table 2. Wage inflation, 2008-2018, calculated using wage increases prescribed in Government Gazettes

	Year									
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
COE as % of Current Expenditure	83,5%	83,9%	83,6%	83,2%	82,9%	83,0%	82,8%	82,8%	81,9%	81,3%
CPI	6,6%	4,3%	5,0%	5,7%	5,7%	6,2%	4,5%	6,3%	5,3%	4,7%
COL Increase	10,5%	11,5%	7,5%	6,8%	7,0%	6,6%	7,4%	7,0%	7,6%	7,3%
OSD	0,0%	5,4%	7,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
Age influence	0,98	0,99	0,99	1	1,01	1,01	1,02	1,02	1,02	1,02
Realised Wage inflation	10,5%	16,9%	15,5%	6,9%	7,1%	6,8%	7,6%	7,2%	7,8%	7,4%
BEPI Growth Rate	9,8%	14,9%	13,7%	6,7%	6,9%	6,7%	7,0%	7,0%	7,3%	6,9%
BEPI-GG (Base 2018)	47,87	54,99	62,55	66,74	71,34	76,09	81,45	87,16	93,53	100

Notes: 1. Mean age 2008-2017 from Gustafsson (2019b). 2. Mean age 2018 estimated using the quadratic trend from Gustafsson (2019b). 3. Age influence takes the average age in Figure 5 and maps it onto the index of total annual cost to employer in Figure 6. 4. Official increases 2008-2018 from government gazettes. 5. Official increases for 2009 and 2017 are the average of the band given in the relevant gazette. 6. The BEPI figure for 2008 can be calculated by BEPI-GG in 2009 divided by BEPI Growth Rate on 2009, which equals 43.6.

In order to verify whether or not the above analysis accords with actual government payments, we create an additional model using actual wage payment information from the government's payroll database (Persal).

In Table 3, we use annual changes in average permanent teacher wages (Persal) to calculate wage inflation. This data reflects the actual cost to the employer, on average, each year since 2008. To create the BEPI, we again use EPRE's COE as a percentage of total current expenditure as our weights for personnel and non-personnel expenditure to give us the BEPI growth rate each year. The only difference here is that we have substituted actual wage increases (Persal) instead of Government Gazette increases. Note we do not have to adjust for the influence of age since this is already reflected in the average wages. We then create the BEPI by assigning the base year, 2018, as 100, and divide by each year's BEPI growth rate to give that year's index value.

$$BEPI_{Persal} = \left(\left[1 - COE_p \right] X\ CPI \right) + \left(COE_p\ X\ Wage_{inf-persal} \right)$$

Where COE_p is the proportion of expenditure that is made up of COE and $Wage_{inf-persal}$ is the inflation in the average wage paid to educators.

Table 3. Wage inflation, 2008-2018, using analysis of annual change in Persal educator wages

	Year									
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Wage inflation (from Persal extracts)	11,7%	11,7%	16,6%	7,2%	4,9%	8,0%	6,6%	8,9%	5,8%	7,9%
CPI	6,6%	4,3%	5,0%	5,7%	5,7%	6,2%	4,5%	6,3%	5,3%	4,7%
COE as % of Current Expenditure (national average)	83,5%	83,9%	83,6%	83,2%	82,9%	83,0%	82,8%	82,8%	81,9%	81,3%
BEPI Growth Rate	10,9%	10,5%	14,7%	6,9%	5,1%	7,6%	6,3%	8,5%	5,7%	7,3%
BEPI-Persal (base 2018)	49,9	55,1	63,2	67,6	71	76,5	81,3	88,2	93,2	100

Notes: 1. Wage inflation, calculated as change in average permanent educator cost to employer 2007-2018, personal communication with Martin Gustafsson (2020) Since data was provided in 2007 but not 2008 or 2009, we calculate 2009's Wage Inflation rate as the average annual increase from 2007 to 2010. 2. 2008-009. 3. The BEPI figure for 2008 can be calculated by BEPI-Persal in 2009 divided by BEPI Growth Rate on 2009, which equals 45. (Source for Persal: Personal communication with Martin Gustafsson, 12 March 2020).

In a sense one can think of these two indices as reflecting de jure increases (BEPI-GG) and de facto increases (BEPI-Persal) given that their main sources are policy documents (BEPI-GG) and payroll data (BEPI-Persal). It is encouraging to see how these two data sources map onto each other almost perfectly. Across the 11 years the average difference between BEPI-GG and BEPI-Persal is 0.5 units. The fact that there are small discrepancies is not unexpected and there are a number of plausible explanations[22] for this. However, even small inconsistencies can have nontrivial effects on estimated results. We therefore report both sets of results in the Appendix, but use BPI-Persal as our main index. We choose BEPI-Persal because we feel that de facto increases are more reliable than de jure increases.

3.4.2. Calculating per-learner changes in real expenditure

To calculate per-learner real expenditure, we divide the BEPI-deflated expenditure figures by the total number of learners enrolled in each year. As has been discussed earlier, South Africa has experienced a rise in overall enrolment due to a birth spike between 2003 and 2005 (Gustafsson, 2018). In Appendix D the enrolment numbers for all children in public schools in Grades R-12 are reported. These are taken from the DBE's School Realities Survey (DBE, 2008-2019). Figure 7 shows the trend in national enrolments in public ordinary schools in Gr R to Gr 12 from 2008 to 2019. It is clear from the figure that enrolments have been increasing steadily for some time.

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22   These include: (1) the fact that the Persal data used here is only for permanently employed teachers and teacher-managers and excludes part-time teachers, (2) any changes in average teacher qualifications over the period, (3) any acting allowances and changes in the number of vacancies and province's practices of appointing people in acting positions (4) Policy figures were calculated using annual figures, but implementation happens at slightly different times in some years, (5) Persal exports include other payments, such as overtime and examination payments, which could have changed at variable rates over the time period.

Figure 7. National Enrolments in Public Ordinary Schools in GrR to Gr12, 2008 to 2019
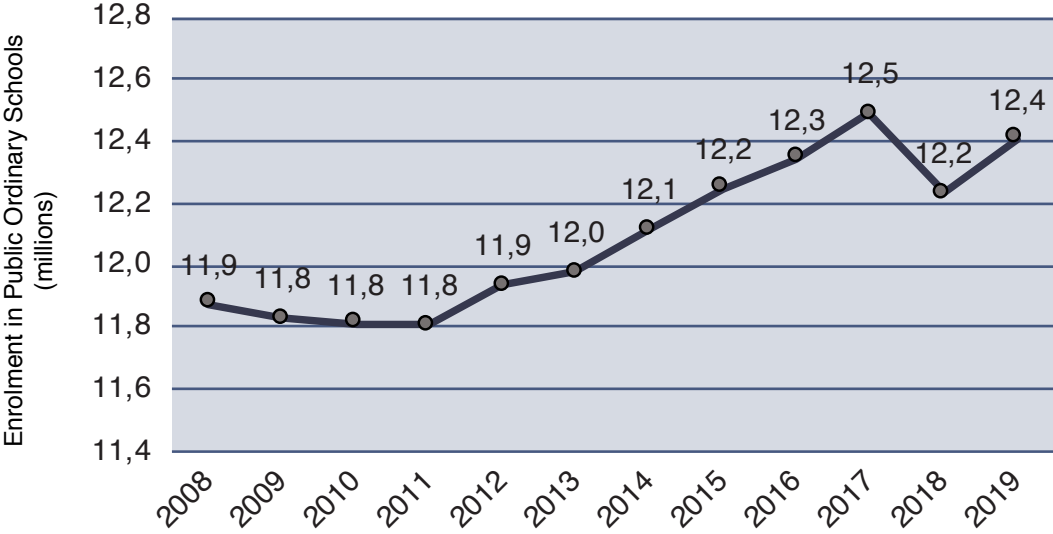
Clearly, however, the enrolment numbers for 2018 do not follow the general trend. While enrolment has been increasing by roughly 100,000 learners every year between 2011 and 2017, it dips by 260,000 learners in 2018 and then increases by 180,000 learners again in 2019. To examine this further, Figure 8 displays the provincial trends for the period 2008-2019. The issue is far less obvious when viewed this way. In fact, none of the provinces appear to have particularly major dips in 2018, while the Eastern Cape and Gauteng display a major dip and major jump (respectively) in 2017. The lack of obvious cause for the 2018 dip here points to the possibility that the 2018 enrolment numbers may represent a systematic underreporting across some provinces, or simply an error. When combined, the relatively small dips in 2018 observed in KwaZulu-Natal, Limpopo, Mpumalanga, and the Western Cape total 160 000 learners (over 60% of the total decline).

Figure 8. Provincial Enrolments in Public Ordinary Schools in GrR to Gr12, 2008 to 2019 (in millions of learners)
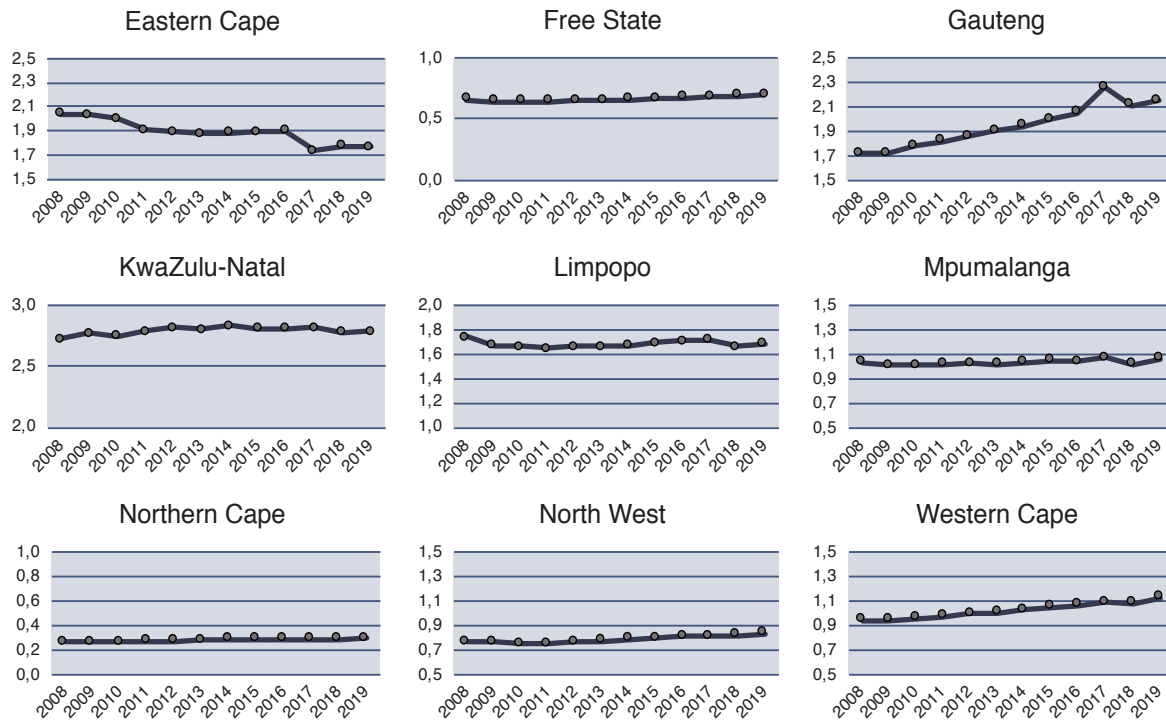
To ensure that we do not overestimate per pupil funding by using underreported enrolment rates, we will use two sets of enrolment figures in our calculation of per pupil expenditure. We provide results using the DBE-released enrolment numbers (as in Figure 7) as well as a second set of results using an adjusted 2018 enrolment figure. Given that every other year can be estimated within 0.5% of its true value by taking an average of the preceding and following year, we estimate the second 2018 enrolment figure by taking the average of the 2017 and 2019 enrolment numbers. The trend in national enrolments from 2008 to 2019 using the new 2018 estimate is given below.

Figure 9. National Enrolments in Public Ordinary Schools in GrR to Gr12, 2008 to 2019
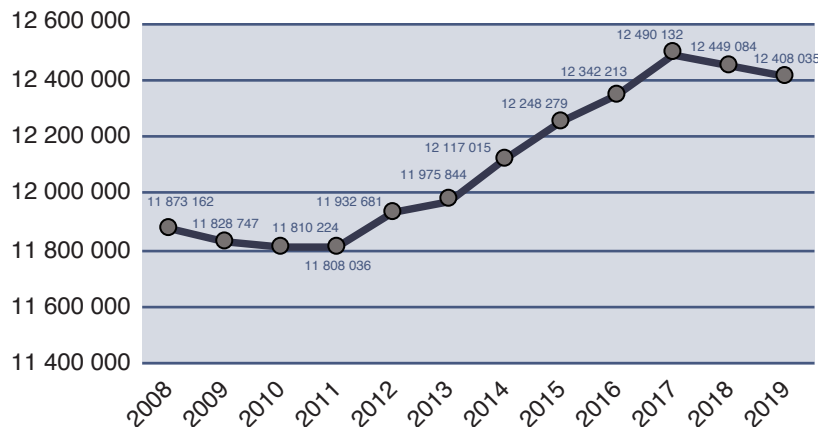
To summarise the above, in order to get from raw nominal EPRE expenditure data to comparable BEPI-adjusted figures we do the following: (1) Adjust for the removal of Programme 5 from provincial budgets, (2) Add DBE Workbook expenditure, (3) Adjust for the real cost drivers of education by combining CPI and wage inflation figures [23]to create the BEPI index, (4) Discount the adjusted

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23   Note that these wage inflation figures include both the IQMS adjustment and account for the demographic impact of the changing average age of the teacher labour-force.

EPRE figures using the BEPI to create comparable estimates of total and current educational expenditure over time, (5) Divide these comparable estimates by annual learner enrolments to yield a real, provincial, per-learner expenditure figure that is comparable over time.

In line with the discussion above, we estimate six sets of per-learner figures: First, we estimate wage inflation using (a) Government Gazettes and (b) average educator salaries from payroll data. We then estimate (c) total and (d) current expenditure. Finally, we estimate per-learner expenditure using (e) original DBE and (f) adjusted 2018 enrolment figures. Although we also estimate per-learner expenditure using CPI+1% for non-personnel expenditure, this is not part of our set of main findings since we have no evidence of how much non-personnel spending increased above CPI over the period, if it did at all.

We feel that each estimate is necessary to provide a full, transparent, picture of per-learner expenditure in South Africa. However, for the sake of clarity, not all estimates will be presented in the results section below. All per-learner expenditure tables not available in the results section can be found in the Appendix.

Results

4.1. Wage inflation and CPI inflation

Given the importance of the comparison between wage inflation and CPI and their effect on the budget, in the discussion that follows, we also report Table 4 below which presents a comparison of wage inflation to CPI inflation figures and the nominal budget. The first column gives the wage increases (using Persal data), the second CPI inflation figures for the year, while the third column provides the nominal budget increases. The last two columns present the percentage point difference between the wage increases and CPI inflation, and wage inflation and budget increases. On average, wages increased by 9.2% each year between 2008 and 2018, while CPI inflation averaged only 6.3% over the same period. The greatest increase above inflation for these years was 10% in 2012, during part of the implementation of the Occupation Specific Dispensation (OSD).

Table 4 shows that wage increases have been far higher than CPI inflation, but also that nominal budget increases are always far higher than both CPI and wage inflation. At first glance, it appears as though nominal budget increases should be enough to cover (1) inflation, (2) wage increases, as well as (3) enrolment increases.

Table 4. Wage to CPI inflation comparison

Year	Average wage increases (%)	CPI inflation (%)	Budget Increases (nominal) (%)	Percentage point difference (official wage increases − CPI)	Percentage point difference (budget increases - official wage increases)
2009	11,7%	4,5%	20,8%	7,2%	9,1%
2010	11,7%	7,1%	16,9%	4,6%	5,2%
2011	16,6%	11,6%	20,1%	0,1%	3,5%
2012	7,2%	6,6%	14,1%	10,0%	6,9%
2013	4,9%	4,3%	21,6%	2,9%	16,7%
2014	8,0%	5,0%	16,8%	0,0%	8,8%
2015	6,6%	5,7%	8,8%	2,3%	2,2%
2016	8,9%	5,7%	16,9%	0,9%	8,0%
2017	5,8%	6,2%	15,5%	2,8%	9,7%
2018	7,9%	4,5%	17,7%	1,3%	9,8%
Average	9,20%	6,30%	16,90%	1,60%	7,70%

Notes: (1) Wage inflation calculated above. (2) Historical CPI figures are from StatsSA, average inflation over the year is used throughout.

Figure 10 below shows the trend of real current expenditure on education when discounting using two different indexes: (1) CPI and (2) BEPI-Persal. Note that this graph looks the same when total expenditure is used instead of current expenditure. If one uses the CPI index to discount current expenditures, then it would seem that there was a 42% 'real' increase from R167.3-billion to R237.8-billion between 2008 and 2018. If we instead look at the trend for BEPI-Persal discounted real current expenditures, then there was only an 8% real increase (from R219.4bn to R237.8bn). While both indexes point to an increase when looking at current expenditure, the CPI increase is five times larger than the "true" increase as reported by BEPI-Persal.

Figure 10: Comparing real current expenditure when discounting by CPI and BEPI
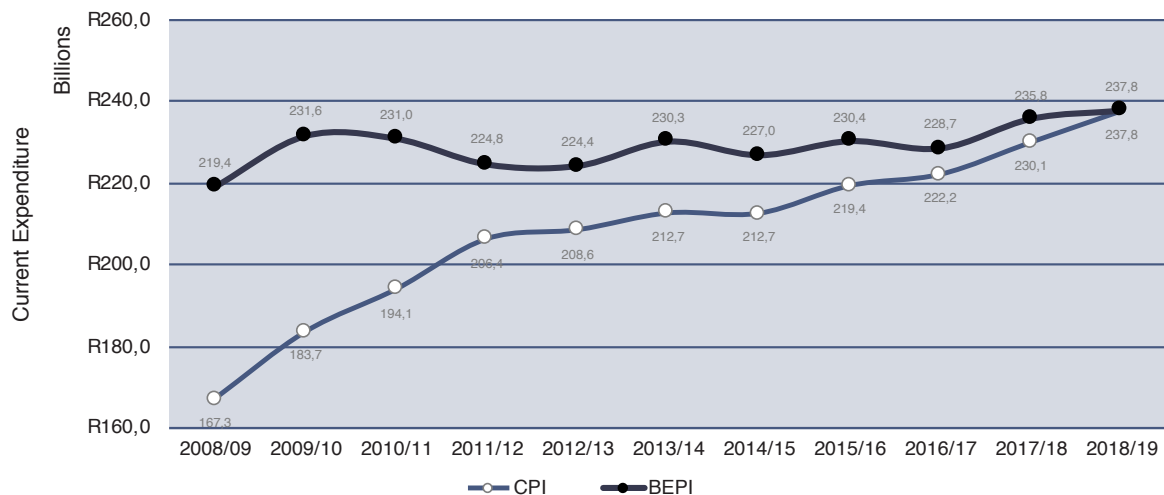
This is the first main finding from the current analysis. The traditional approach of using CPI as the discount rate leads one to conclude that 'real' educational expenditures have increased by 42% when in fact they have only increased by 8% in real terms. Thus, while total (not per-pupil) current expenditure has been increasing in real terms over this period, the increases are one fifth of what has traditionally been thought to be the case in South Africa.

4.2. Trends in BEPI-discounted per-learner expenditure

While the figure above reports that real current expenditure on education increased by 8% over the period, it does not report the real resources available to the average child since it does not include enrolment in its calculation. Figure 11 and 12 below report the trend in BEPI-Persal discounted expenditure per pupil in South Africa from 2008 to 2018. Figure 11 reports total expenditure per pupil and Figure 12 reports current expenditure per pupil. Two estimates of 2018 per learner expenditure figures are shown in each graph – one using the adjusted 2018 enrolment estimate (the default in this case) and a second using the unadjusted 2018 enrolment estimate (labelled as such).

While there was an initial spike from 2008 to 2009 as a result of OSD budget allocations, from 2009 to 2018 there has been a relatively consistent decline in both total and current expenditure. When viewing the adjusted 2018 enrolment figure,[24] total and current per pupil expenditure declined by -2.6% and -2.3% respectively between 2009 and 2018.

Put differently, in real terms South Africa spent R695 less per child in total in 2018 than it did in 2009. If one looks at current expenditure South Africa spent R484 less per child in 2018 than it did in 2009. If real per-learner expenditure were to have kept pace with wage inflation over the period then real total expenditure would need to be R8.7-billion more in 2018 (R4.1 billion with unadjusted enrolment). Whether adjusted or unadjusted enrolment numbers are used, this has significant implications for purchasing power within education and the real resources that are available on the ground for the average child. It should further be noted that these are the national averages and hide considerable inter-provincial variation, a point we turn to next

Figure 11. Comparable total expenditure per learner discounted using BEPI-Persal, (2018 Rands)

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24 The decline is much smaller when using the unadjusted 2018 enrolment numbers – 0.8% and 0.6% for total and current expenditure respectively. Given that enrolment rates do not typically see such large increases from one year to the next we believe the adjusted figure to be the more accurate estimate. If one uses the unadjusted figures then the declines reported in the subsequent sentence are R339 decline in total and R142 decline in current expenditure per pupil in 2018 compared to 2009.

Figure 12. Comparable current expenditure per learner discounted using BEPI-Persal, (2018 Rands)
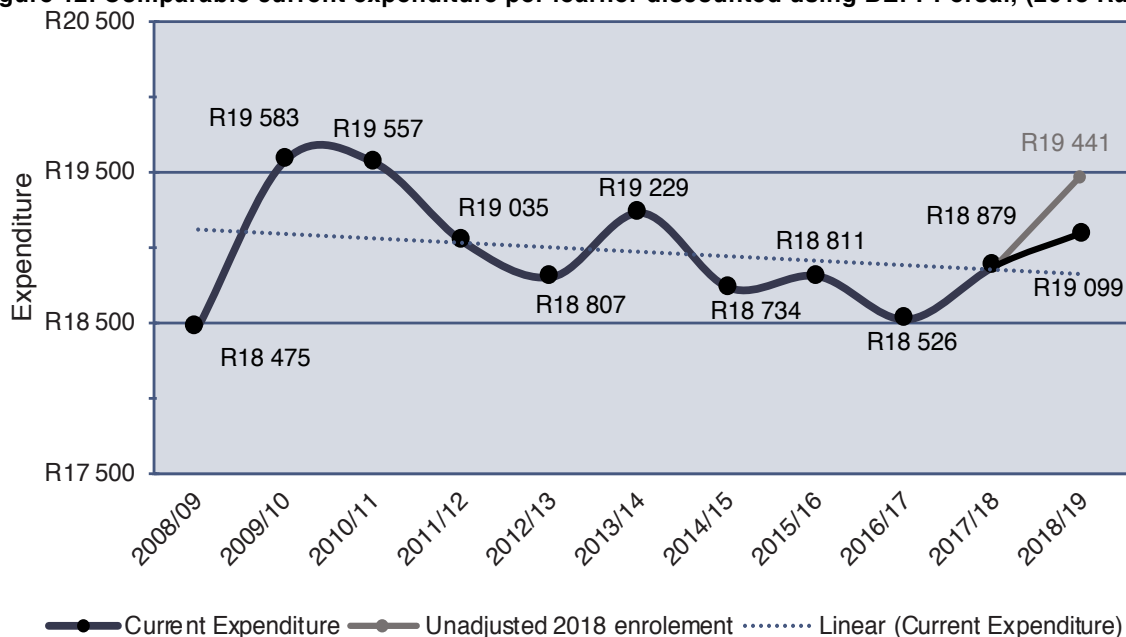
Notes: 1. Deflated using BEPI-Persal inflation index.

Table 5 provides the exact figures of BEPI-Persal deflated current expenditure for all provinces and South Africa as a whole for the period under review using the adjusted 2018 enrolment figures. In our view, these estimates can be considered the 'primary tables' reporting inter-temporally comparable figures of educational expenditures per learner in South Africa over this period. The alternative estimates – on total expenditure, using BEPI-GG, and using unadjusted 2018 enrolment figures – can be found in Appendix E.

Table 5. Final per learner current expenditure, real 2018 Rands (using BEPI-Persal)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Eastern Cape	R17,320	R19,190	R19,264	R19,197	R18,839	R19,034	R17,937	R17,800	R17,444	R19,244	R19,248
Free State	R20,547	R21,978	R22,462	R21,818	R21,906	R22,138	R21,082	R19,756	R19,448	R19,196	R19,538
Gauteng	R19,525	R20,990	R20,641	R20,243	R20,168	R20,871	R20,596	R21,021	R20,408	R18,792	R20,037
KwaZulu-Natal	R17,196	R17,389	R17,180	R17,450	R16,814	R17,489	R17,212	R17,701	R17,547	R17,644	R17,563
Limpopo	R18,062	R19,382	R20,013	R18,335	R18,154	R18,217	R18,130	R17,445	R17,285	R17,335	R17,503
Mpumalanga	R18,559	R20,152	R19,269	R18,465	R19,021	R19,151	R18,834	R18,851	R18,544	R18,549	R18,542
Northern Cape	R21,295	R22,110	R21,954	R21,422	R20,861	R20,905	R20,075	R20,360	R20,044	R20,485	R21,228
North West	R19,591	R20,608	R20,963	R19,657	R19,621	R20,036	R19,123	R18,826	R18,280	R18,613	R18,626
Western Cape	R20,367	R20,912	R20,786	R19,799	R19,512	R20,124	R19,583	R19,419	R19,508	R19,270	R18,913
Workbooks	-	-	-	-	-	-	-	R96	R93	R412	R398
All SA	**R18,475**	**R19,583**	**R19,557**	**R19,035**	**R18,807**	**R19,229**	**R18,734**	**R18,811**	**R18,526**	**R18,879**	**R19,099**

Notes: 1. Figures are derived from current expenditure and enrolment figures, the prior adjusted for inflation trends. 2. Inflation adjustments take into account CPI figures and personnel wage inflation (i.e. BEPI). 3. Workbooks refers to DBE learner workbooks which are nationally funded.

As in most areas of South African public policy, national averages can be misleading and hide considerable underlying heterogeneity between provinces. While nearly all provinces adhere to the national trend of declines from 2009 onwards, the declines are more severe in certain provinces than in others (Figure 13).[25]

Figure 13. Provincial current expenditure per learner deflated using BEPI-Persal (2018 Rands)
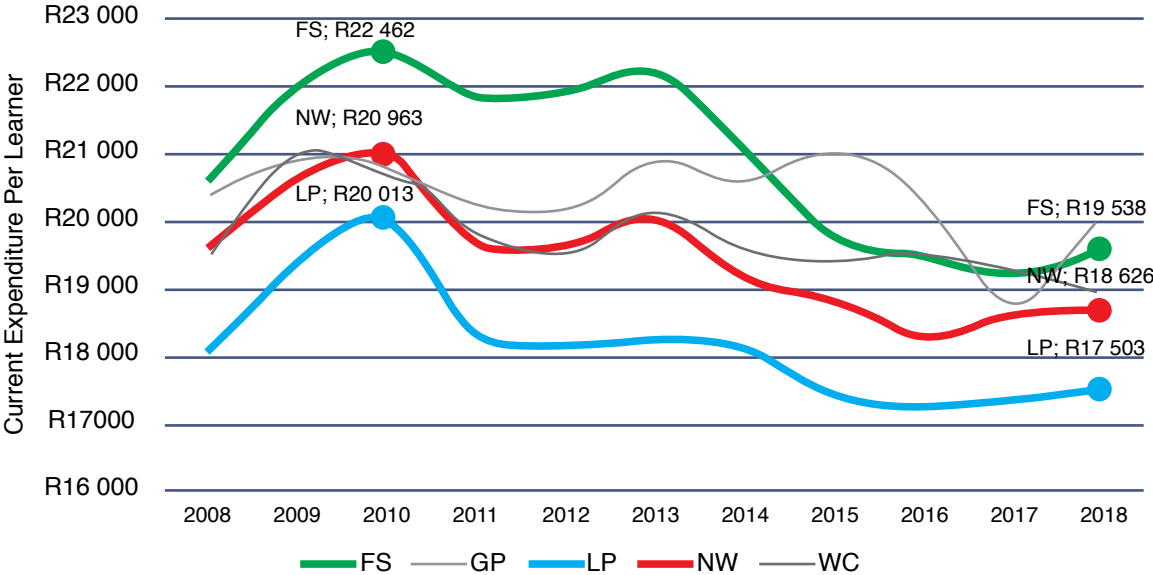
If one looks at the period 2009-2018, the largest declines in real current expenditure per learner can be seen in the Free State (-13%), Limpopo (-13%) the North West (-11%), and the Western Cape (-9%). (Table 6).

Table 6. Declines in Provincial current per Learner Expenditure using BEPI discounted values

Province	From 2009 to 2018
Eastern Cape	-0,1%
Free State	-13,0%
Gauteng	-2,9%
KwaZulu-Natal	2,2%
Limpopo	-12,5%
Mpumalanga	-3,8%
Northern Cape	-3,3%
North West	-11,1%
Western Cape	-9,0%
South Africa	-2,3%

This is the second main finding of the paper, namely, that there is considerable inter-provincial variation in per-learner declines in real current spending, and that the national average is somewhat misleading in this regard. If one averages across these four provinces (Free State, Limpopo, the North West and the Western Cape) real per learner expenditure declined by 11.4% over this 12-year period. To put these numbers in perspective, these provinces were spending approximately R21,000 per leaner in 2010 and only R18,600 per learner in 2018. Or put differently, the average child in these four provinces in 2018 had R2,400 less per year available for their education than the average child in 2010.

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25   Appendix F replicates this graph but uses CPI as the discount rate instead of BEPI (as here). This is for those who wish to see the provincial trends discounted using CPI only.

The third main finding is how large the inter-provincial differences are in per-learner spending. For example, in 2018 the average child in Gauteng had about R2,500 more spent on their education compared to the average child in KwaZulu-Natal or Limpopo (R20,037 in Gauteng compared to R17,563 in KwaZulu-Natal and R17,503 in Limpopo). There are a number of reasons for this which include (1) a province's decision as to what proportion of their allocation from Treasury (via the Equitable Share Formula, ESF) they choose to allocate to education, (2) the distribution of more senior and more qualified teachers across provinces (their salaries are higher), (3) the percentage of independent and fee-charging schools in a province (this is essentially because the ESF is based on the population in a province and not the percentage that are in no-fee, fee-charging, or independent schools, although there is a pro-poor component. Arguably provinces with more independent schools have more money to spend on their public schools since they do not subsidize independent schools at the same rate as public schools. All of these issues are discussed in more detail in Motala & Carel (2019).

4.3. Drivers of the decline in per-learner current expenditure

There are two contributing reasons for the decline in per-learner current expenditure on basic education in South Africa: (1) Rising enrolments which mean that the budget is being split over a larger number of learners over time, and (2) above-inflation wage increases which have outpaced overall increases in allocations to education over the period. Although both have contributed to the overall decrease in real current expenditure per learner, they are not equally responsible for the decline.

Table 7 disaggregates these two cost components to determine how much of the decrease is attributable to wage inflation and how much to enrolment increases. We do this by calculating per learner expenditure in 2018/19 Rands in different ways.

1. We calculate what the per learner expenditure in each year would have been without either enrolment increases or wage inflation above CPI. We do this by deflating the nominal expenditure figure by CPI and using the 2018 level of enrolment across all years. This yields what the per learner figure would have been if there had been no real changes to wages or enrolment.

2. We calculate per learner figures taking only wage inflation into account. Here nominal figures are deflated using the BEPI to take account of wage inflation. Again, only 2018 enrolment figures are used to control for enrolment effects. This yields a measure of inflation-comparable expenditure on learners if enrolment had remained constant.

3. We calculate per learner expenditure taking only enrolment into account. Here, figures are deflated using CPI only and the actual enrolment numbers for each year are used.

4. We use the per learner BEPI-deflated expenditures used previously, which uses actual yearly enrolment figures and the wage-adjusted CPI measure (BEPI), to take both wage inflation and wages into account.

Table 7. Components of per Learner Expenditure Decreases

Year	1. CPI	2. BEPI	3. CPI + Enrol.	4. BEPI + Enrol	5. %enrolment	6. %wages
2008/2009	13334	17483	14090	18475	15	85
2009/2010	14642	18462	15531	19583	19	81
2010/2011	15471	18409	16436	19557	25	75
2011/2012	16454	17914	17483	19035	41	59
2012/13	16628	17886	17484	18807	40	60
2013/14	16956	18354	17764	19229	37	63
2014/15	16949	18092	17550	18734	34	66
2015/16	17488	18364	17914	18811	33	67
2016/17	17710	18224	18004	18526	36	64
2017/18	18337	18793	18421	18879	15	85
2018/19	18950	18950	18950	18950	.	.
Average					30	70

Note: Expenditure figures are given in 2018 Rands.

By comparing these we can ascertain what proportion of the decrease in per learner expenditure seen above is attributable to wage inflation and what proportion to increasing enrolment. Comparing 1 to 4 yields the full effect of both wage and enrolment changes over the period. Comparing 1 to 2 gives the effect of wage changes only. Comparing 1 to 3 gives the effect of enrolment changes only. To get to the proportion of the decline that is attributable to wages or enrolment (columns 5 and 6) the wage-only and enrolment-only changes are compared to the overall change. Specifically, for enrolment as an example, we take the difference between 1 and 3 and divide that by the difference between 1 and 4 to get the effect of enrolment.

On average over the period, 30% of the decrease in real per learner expenditure is attributable to enrolment changes, and 70% to wage increases. This varies over the period, with the compositional effect of wages ranging between a low of 59% in 2011 (2013) to a high of 85% in 2008 and 2017. Hence, although the large increases in enrolments are a contributor to the increasing needs of the sector, it is clearly above inflation wage increases that are the primary drivers of decreasing real per learner expenditure since 2011.

Consequences of wage inflation outpacing educational expenditures

From the above it is clear that there have been declines in real per learner expenditures that have come about due to wage inflation outpacing educational expenditures, especially in certain provinces. As a result of these declines one would expect to see measurable impacts on at least some areas of teaching and learning on the ground. In this section, the trends in two outcomes are considered: (1) the rise in school-based vacancies due to cost-saving measures such as hiring freezes, and (2) rise in class sizes over the period.

5.1. School based hiring freezes

The charts and tables below provide clear evidence that one of the ways that provinces have dealt with the rising teacher wage bill is to hire fewer teachers, administrative personnel (non-educators), and school-based managers (Table 9). This is accomplished primarily by not filling posts when they become vacant. This became not only an informal measure to manage costs but a formally instituted policy by provincial treasuries (KZNDOE, 2018: No.54). For example, the KwaZulu-Natal Treasury Circular No. PT (3) of 2018/19 "Issuing of Updated Cost-Cutting Measures" on 26 April 2018 states that given "sluggish economic performance", government's programme to reduce spending and stabilise the debt portfolio, as well as a need to provide additional funding to new spending priorities, it is necessary to continue with the cost-cutting measures:

"(1) Vacant posts are frozen for both departments and public entities. Departments and entities are permitted to fill critical vacant posts, as long as they remain within their baselines and receive permission to fill these posts from the Premier and the MEC for Finance. (2) Where posts become vacant through natural attrition, or where departments and entities elect to fill critical posts from within their baselines, these may not be filled without receiving approval from the Premier and MEC for Finance. (3) Any revised organograms which have the effect of increasing a department's or

entity's total staff number may not be implemented. Any revisions to organograms must be approved by the Premier and MEC for Finance prior to submission to the DPSA. A detailed assessment must be done of each department's and each entity's personnel in order to move non-productive staff to productive, critical service delivery posts. PERSAL should only reflect the number of posts that the department can afford to fill, i.e. budgeted posts" (KZNDoT,2018: p.1).

Table 8 below uses government payroll data (PERSAL) from November 2012 and November 2016 and reports the number of actively employed teachers, administrators (non-educators) and managers (principals, deputy-principals and Heads of Department (HODs)) in November 2012 and November 2016 (from DBE, 2017: p.21). In this four-year period there was a decline in the number of teachers (-2%) and administrators (-10%), and especially school managers (-16%). This despite an overall rise of 3% in the number of learners in the system. Looking first at the overall number of educators (both teachers and school-managers) shows significant inter-provincial variation. While Gauteng saw a 5% increase in the number of educators, the Eastern Cape (-15%), Limpopo (-12%) and the Free State (-12%) saw significant declines, despite rising enrolment. The last three columns of Table 8 show that when these are seen at a per-learner level the changes are larger still. In the two worst performing provinces, the learner:educator ratio in the Eastern Cape and Limpopo rose by 17-18% in just 4 years.

Table 8. Number of employed educators, manager educators and non-educators by province and national for 2012 and 2016

Category	2012	2016	% Change	2012 total learners (SNAP)	2016 total learners (SNAP)	% Change	Learners per staff category 2012	Learners per staff category 2016	% Change
Educators	423 557	400 964	-5%				28,2	30,8	9%
...Teachers	319 908	314 113	-2%				37,3	39,3	5%
...Manager educators	103 649	86 851	-16%	11 932 681	12 342 213	3%	115,1	142,1	23%
Non-educators	98 883	88 962	-10%				120,7	138,7	15%
Total	522 440	489 926	-6%				22,8	25,2	10%
Educators (by province)									
Eastern Cape	64 828	54 827	-15%	1 895 989	1 898 723	0%	29,2	34,6	18%
Free State	26 877	23 665	-12%	646 093	671 712	4%	24,0	28,4	18%
Gauteng	65 032	68 487	5%	1 858 745	2 048 558	10%	28,6	29,9	5%
KwaZulu-Natal	100 490	97 960	-3%	2 812 844	2 808 137	0%	28,0	28,7	2%
Limpopo	60 752	53 237	-12%	1 665 013	1 706 725	3%	27,4	32,1	17%
Mpumalanga	35 579	33 687	-5%	1 027 851	1 046 234	2%	28,9	31,1	8%
Northern Cape	9 672	10 373	7%	274 189	287 435	5%	28,3	27,7	-2%
North West	27 930	26 417	-5%	760 272	811 340	7%	27,2	30,7	13%
Western Cape	32 396	32 311	0%	991 685	1 063 349	7%	30,6	32,9	8%
South Africa	**423 556**	**400 964**	**-5%**	**11 932 681**	**12 342 213**	**3%**	**28,2**	**30,8**	**9%**

Source: Persal Nov-2012 and Nov-2016 (DBE, 2017: p.21), SNAP survey 2012

A closer interrogation of trends in the employment of school-based managers (principals, deputy-principals, and HODs) over the period shows large declines in Limpopo, the North West and the Free State (Table 9) – the same three provinces that reported the largest declines in per-learner spending in the previous section (Table 6). A small part of this decline can be accounted for by the rationalization of small schools such that there were -2% fewer schools (536 schools) in South Africa in 2016 compared to 2012. Thus, one would expect -2% fewer principals for example. However, the trends in Table 9 are far in excess of this and clearly not explained by the smaller

number of schools. To account for the decline in the number of schools over the period, the last three columns of Table 9 reduce the number of Principals, Deputy Principals and HODs by the number of fewer schools between 2012 and 2016 so that the numbers are comparable for 2012 and 2016.[26]

Analysis of yearly trends in employment categories seems to indicate an almost entire hiring freeze of HOD posts in Limpopo beginning in 2014 (DBE, 2017: p.23). The fiscal logic behind staff numbers by not filling vacant posts is clear; "If all employee numbers, inside and outside schools, had been kept at 2012 levels…overall spending on personnel would have been R165bn, compared to the R155bn…so R10bn higher" (DBE: 2017: p.20). To provide further texture to this picture, in 2016 a province like Limpopo had approximately 3800 schools (DBE, 2016: p.1) yet only employed 2996 principals and 1146 deputy-principals (Table 9). In just four years Limpopo 'lost' 513 school principals, 417 deputy-principals and 1,282 HODs (Table 9). Note there were only 68 fewer schools in Limpopo in 2016 compared to 2012. Similar trends can be seen for the Free State and the North West. Put differently, in 2012 only 11% of schools in Limpopo did not have a principal, but by 2016 as many as 23% of schools did not have a principal appointed in the post. The figures in the Western Cape and Gauteng are less than 1% for both periods.

Figure 16. Percentage change in employed HOD's, Deputy Principals and Principals in November 2012 to November 2016 (national and provincial) taking account of fewer schools.

...HODs employed in 2016 compared to 2012	Deputy Principals employed in 2016 compared to 2012	...Principals employed in 2016 compared to 2012
4% Mpumalanga	14% Mpumalanga	-3% KwaZulu-Natal
1% Gauteng	12% Northern Cape	-4% Eastern Cape
-3% Western Cape	3% Eastern Cape	-6% Gauteng
-3% Northern Cape	2% Gauteng	-6% Western Cape
-6% Eastern Cape	0% Western Cape	-6% Mpumalanga
-6% South Africa	-1% North West	-7% South Africa
-7% KwaZulu-Natal	-3% South Africa	-12% North West
-9% Free State	-4% Free State	-13% Limpopo
-13% North West	-11% KwaZulu-Natal	-13% Northern Cape
-20% Limpopo	-23% Limpopo	-14% Free State

Note: percentage calculations are (2016-2012*)/2012* where 2012* is the 2012 number less the change in the number of schools between 2012 and 2016).
Source: Persal Nov-2012 and Nov-2016 (DBE, 2017: p.21).

26 This assumes there is one Principal, one Deputy Principal and one HOD per school. This is likely to be a true assumption for Principals and Deputies but less so for HODs since there is often more than one HOD per school.

Table 9. Number of employed HODs, deputy principals, and principals by province and national for 2012 and 2016

	# HODs employed			# Deputy Principals employed			# Principals employed			# Schools				# HODs employed	# Deputy Principals employed	# Principals employed
Province	2012	2016	% Change	2012	2016	% Change	2012	2016	% Change	2012	2016	% Change	# Fewer schools	% Change after accounting for fewer schools		
Eastern Cape	5 886	5 447	-7%	1 354	1 297	-4%	5 243	4 964	-5%	5558	5469	-2%	-89	-6%	3%	-4%
Free State	2 685	2 309	-14%	852	689	-19%	1 224	936	-24%	1351	1214	-10%	-137	-9%	-4%	-14%
Gauteng	8 672	8 826	2%	2 564	2 647	3%	2 156	2 069	-4%	2045	2083	2%	38	1%	2%	-6%
KwaZulu-Natal	11 286	10 420	-8%	2 642	2 293	-13%	5 581	5 350	-4%	5955	5895	-1%	-60	-7%	-11%	-3%
Limpopo	6 091	4 809	-21%	1 563	1 146	-27%	3 509	2 996	-15%	3935	3867	-2%	-68	-20%	-23%	-13%
Mpumalanga	4 047	4 139	2%	1 109	1 172	6%	1 789	1 598	-11%	1807	1725	-5%	-82	4%	14%	-6%
Northern Cape	1 035	986	-5%	298	318	7%	581	490	-16%	560	545	-3%	-15	-3%	12%	-13%
North West	2 988	2 508	-16%	899	769	-14%	1 697	1 381	-19%	1591	1471	-8%	-120	-13%	-1%	-12%
Western Cape	4 086	3 947	-3%	1 333	1 327	0%	1 534	1 439	-6%	1453	1450	0%	-3	-3%	0%	-6%
South Africa	46 776	43 391	-7%	12 614	11 658	-8%	23 314	21 223	-9%	24255	23719	-2%	-536	-6%	-3%	-7%
Source	PERSAL Nov'12 Nov'16			PERSAL Nov'12 Nov'16			PERSAL Nov'12 Nov'16			School Realities 2012 & 2016				Subtracting # fewer schools from 2012 estimates for the comparison		

Note: Persal Nov-2012 and Nov-2016 from DBE (2017: p.22).

5.2. Increases in class sizes 2011 to 2016

There are at least two reasons why one might expect class sizes to rise given the evidence presented in this paper. (1) Given that increases in enrolments have not been met with an increase in the number of teachers hired, one would expect class sizes to rise. Between 2012 and 2016 there were -2% fewer schools (Table 9) and -2% fewer teachers (Table 8), yet enrolments have been increasing over this same period by 3% (Table 8). Further analysis (Gustafsson, 2018) shows that this is coming from enrolment increases due to a birth spike, and therefore the increases are currently concentrated in primary schools, at least up until 2017.[27] (2) Secondly, even if there was not a spike in enrolments, one might expect an increase in class sizes as provinces implement hiring freezes (and deliberately leave vacant posts 'open') to cope with the increasing fiscal pressures driven by the rise in teacher wages.

There are two methods of looking at class sizes, an indirect approach and a direct approach. The indirect approach uses official data on total learner enrolment and the total number of teachers and calculates a Learner:Educator (LE) ratio. In contrast, the direct approach uses direct observation to do headcounts of the total number of children physically present in a classroom during an observation day as part of a nationally representative survey of schools. Figure 14 below reports the LE ratio as calculated by Gustafsson (2020: p.31) using official DBE data. It shows that while there was an initial decline in LE ratios in the country from 2003 to about 2011, LE ratios have been rising from 2011 to 2016. Note that these figures represent the theoretical minimum class-size and do not represent actual class sizes due to subject choice, the actual utilization of teachers, teacher absenteeism etc.

Figure 17. Learner: Educator ratio trend using official aggregates (Gustafsson 2020, forthcoming)
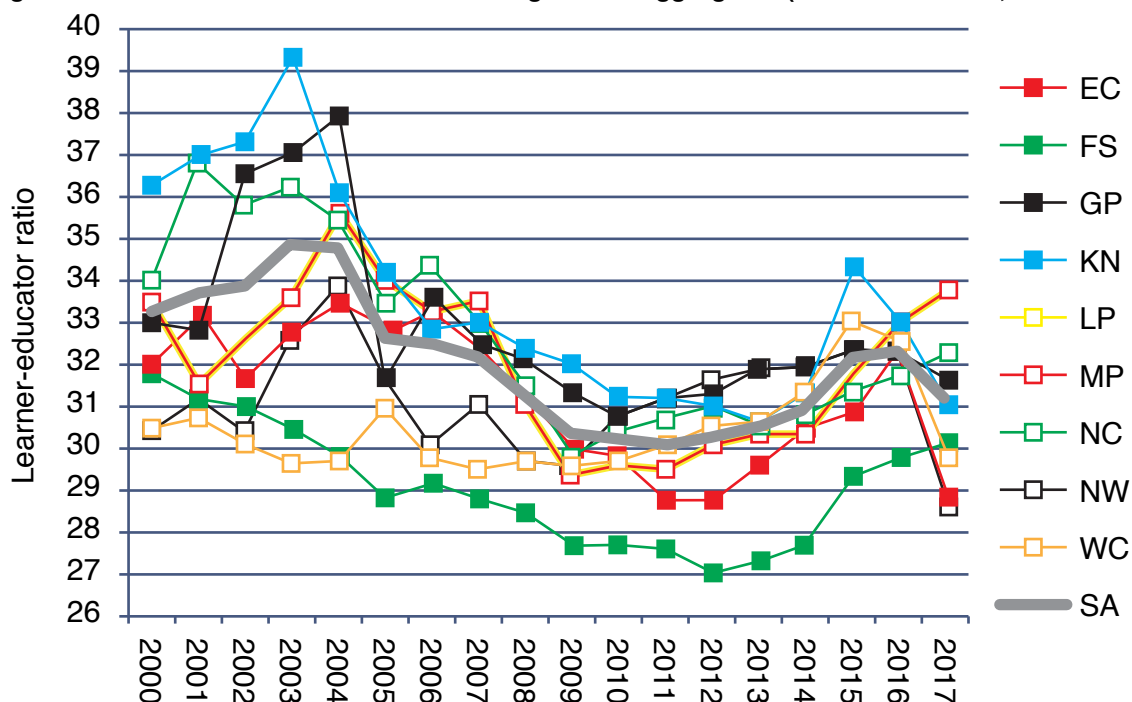
Note: Graph from Gustafsson (2020, forthcoming). Ratios are calculated from total educators and total learners (Grade R-12) appearing in the official statistical releases of the Department of Basic Education, titled School Realities and Education Statistics South Africa.

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27   2018 is the first year that the 'birth spike cohort' entered high school (Grade 8).

The second method of looking at class sizes involves direct observation. South Africa participates in a number of cross-national surveys (notably TIMSS, PIRLS and SACMEQ), and also conducts periodic surveys of a large sample of all schools (School Monitoring Survey 2011, 2017). During these surveys enumerators are often asked to do a headcount of learners in selected classrooms and report that number. This provides an estimate of realized or 'actual' class sizes after taking account of the various factors that increase class sizes. Table 10 below reports on four independent measures of class sizes across five grades (3, 4, 5, 6 and 9). These are sourced from the microdata from TIMSS (2011, 2015), TIMSS-Numeracy (2015), SACMEQ (2013), PIRLS (2011 and 2016) and the School Monitoring Survey (2017). Focusing on the median (p50) estimates in Table 10, it is interesting to note that they are relatively stable around 40 learners per class over the period 2011 to 2017. The best inter-temporal comparisons are derived from the same study over time. This is possible for TIMSS (2011 and 2015) and PIRLS (2011 and 2016). Both studies show increases in class sizes at the median, from 43 to 44 in Grade 9 (TIMSS) and from 38 to 43 in Grade 4 (PIRLS). The PIRLS study seems to show quite clearly that there have been large increases in class sizes in primary schools specifically, as one might expect given the birth spike that affected only primary schools over this period. At least as far as the PIRLS Grade 4 data between 2011 and 2016 is representative of primary schools. We have no reason to believe otherwise. Other studies looking at primary school grades (TIMSS-N 2015 Grade 5; and SMS 2017 Grade 3) report median class sizes of 40 in Grade 3 and 5, lower than the 43 reported by PIRLS, yet still larger than the 38 figure from PIRLS 2011.

Table10. Independent estimates of realized South African class sizes 2011-2017

Study	Grade	Year	Sample		Class sizes						Reference – variable name in microdata
			Schools	Learners	p10	p25	p50	p75	p90	Mean	
TIMSS	9	2011	285	11969	28	35	43	57	74	47,4	BTBG12
		2015	292	12514	28	35	44	53	71	46,3	BTBG12
TIMSS-N	5	2015	297	10932	24	32	40	45	54	39,1	ATBG12A
PIRLS	4	2011	341	15744	25	33	38	46	59	40,2	ATBG12A
	4	2016	293	12810	28	35	43	54	67	45	ATBR01A
SACMEQ	6	2013	297	7117	26	32	39	46	54	39,7	xclsize; yclsize; wclsize
SMS	3	2017			27	34	40	47	55	41,1	EFQ18

In sum, one could conclude from the evidence presented in Figure 17 and Table 10 that class sizes have been increasing in South Africa over the period 2011 to 2016, and that the magnitude of the increase depends on the study used to determine class size. The PIRLS study shows that average class sizes at the Grade 4 level have increased by about 13% (from 40 to 45) between 2011 and 2016. Yet this masks that the largest increases were found in the poorest schools. Among the poorest 60% of learners, class sizes experienced by the average Grade 4 learner increased from 41 to 48 learners per class between 2011 and 2016 (own calculations)[28]. For the richest 10% of Grade 4 learners, class sizes increased from 33 to 35 learners per class over the same period.

28 This is calculated using the Grade 4 class size variable in prePIRLS 2011 (ATBG12A) and PIRLS Literacy 2016 (ATBR01A). It is worth noting that for these variables there are 27.5% missing values in 2011 and 23.5% missing values in 2016 which could bias these estimates. To calculate the class sizes experienced by the poorest 60% of learners we create a school-based average wealth index by running a Principal Component Analysis (PCA) on eight asset variables: 'A computer or tablet', 'A Study desk/table for your use', 'Your own room', 'Internet connection', 'Your own mobile phone', 'A gaming system (e.g. PlayStation, Wii, Xbox)', 'Books of your very own (do not count your school books)', and 'Daily newspaper'. (Variables: ASBG05A ASBG05B ASBG05C ASBG05D ASBG05E ASBG05F ASBG05G ASBG05H) These asset questions are common between both waves of PIRLS.

Analysis and Discussion

The above analysis has presented publicly available data for the period 2008 to 2018 on: (a) overall educational expenditures, (b) teacher salaries, (c) the Consumer Price Index, (d) collective bargaining wage agreements, and (e) learner enrolments. Combining these different data elements, we have created a Basic Education Price Index (BEPI) that tracks the cost of the real inputs in education over the period 2008-2018. Discounting educational expenditures using BEPI and then dividing by the total number of learners in the system we showed that nationally real current per-learner expenditure declined by -2.3% over the period 2009 to 2018 with much larger declines seen in the Free State (-13%), Limpopo (-13%) and the North West (-11%). We then showed that these are also the provinces that experienced the largest declines in the number of educators employed, and especially the number of principals, deputy principals and HODs employed.

It is uncanny how similar the declines are in per-learner spending between 2009 and 2018 to the declines in the number of principals employed between 2012 and 2016 (the years for which we have PERSAL data). In the Free State per-learner spending declined by -13%, principal posts declined by -14%. In Limpopo per-learner spending declined by -13%, principal posts declined by -13%. In the North West per-learner spending declined by -11%, principal posts declined by -12%.

Before presenting the significance of the work it is helpful to summarize the main findings of the preceding analysis:

1. **Fiscal squeeze:** Provinces are clearly facing a 'fiscal squeeze' where increases in teacher salaries have outpaced increases in budget allocations to education. This is most pronounced in the Free State, Limpopo and the North West but even nationally there has been a decline of -2.3% in real current per learner spending between 2009 and 2018.

2. **Coping using hiring freezes:** Provinces seem to be 'coping' with this squeeze by implementing hiring freezes and leaving vacant posts unfilled. Unsurprisingly these hiring freezes are largest where the real per-learner declines are greatest. Importantly, hiring freezes are disproportionately affecting school management posts rather than regular teaching posts, although there has been a decline in the latter as well.

3. **Historical overestimation of spending on education:** Any historical analysis that uses CPI to discount educational expenditures overestimates the real spending on education. In South Africa a traditional approach of using CPI as the discount rate leads one to conclude that 'real' aggregate educational expenditures have increased by 42% between 2008 and 2018, when in fact they have only increased by 8% when using the correct discount rate. Furthermore, when comparing 2009 and 2018 using CPI-discounted figures the aggregate increase was 30% when in actual fact it was only 3% when using the correct discount rate. This is primarily because the vast majority of additional educational spending over this period has simply been on paying existing teachers more, rather than hiring more teachers or buying more non-personnel resources.

4. **Per-learner figures vs aggregate figures:** Much of the existing literature and government reporting is at the aggregate level. Yet the meaningful unit of analysis is the child – how much is available to the average child in South Africa? While this may not matter if a population is stable over time, a situation of rising births (as in South Africa) means that resources are being spread over a larger number of children than before. This makes a considerable difference in one's conclusion. Between 2009 and 2018 real expenditure on education rose by 3% when looking at the aggregate level and fell by -2.3% when looking at the per-learner level (both using real cost drivers). While there was slightly more money (+3%) being spent on education in 2018 compared to 2009 when looking in the aggregate, for the average child there was slightly less money being spent on them in 2018 compared to 2009.

5. **Significant inter-provincial variation in spending per child:** It is clear that some provinces spend more public money per child than others, despite alleged equal funding per child in the national funding formulas. For example, Gauteng spent R2,500 more per child per year compared to KwaZulu-Natal or Limpopo (R20,037 in Gauteng compared to R17,563 in KwaZulu-Natal and R17,503 in Limpopo in 2018).

In this section, we present the significance of the work and a possible way forward. In reviewing the above data and findings it is important to note that the argument presented here is not a normative one in favor of (or opposing) real increases in teacher wages. The decision of whether teacher pay should be higher or lower than other professions (or whether wage increases should be higher or lower than CPI) is a political decision. If government had made a deliberate policy choice to raise real teacher wages over this period and allocated additional resources to do so, that is a political decision well within their purview to make. Furthermore, if government had made a deliberate policy choice to raise real teacher wages by more than increases in educational expenditures, and also stated that it was willing to accept the trade-offs of rising class sizes and fewer personnel, that is also a political decision well within their purview to make. Yet that is not the case here. When government concluded their collective bargaining agreements for teacher wages over this period, there was neither an explicit commitment that there would be the necessary increases in overall education expenditures to pay for the increases, nor an explicit acknowledgement of the likely negative consequences of agreeing to large wage increases without agreeing to similarly large increases in education budget allocations. Instead there was a growing disconnect between formal policy choices (as reflected in government plans, speeches etc.), budget allocations and wage agreements.

A crude summary of the South African situation might be that firstly, when government is talking about its aspirations and plans it explains that it wants teachers to be well-paid and well-regarded. Then, secondly, when it is time for the actual budgeting process, government tempers that enthusiasm when it realizes there are limits to government spending and competing budget

priorities. Thirdly, when in bargaining council negotiations with organized labour, acquiesces to the demands of teacher unions (because it needs their political support in upcoming elections) despite those increases being higher than what were budgeted for in existing budgets. Repeat this process for three election cycles and the outcome is more or less what we have in South Africa in 2020. Part of the disconnect is explained by the fact that the government department's responsible for negotiating public sector pay (Department of Public Sector Administration, the Department of Basic Education) have consistently agreed to wage increases that are out of sync with the funds then made available to them from National Treasury.

Where this disconnect becomes most visible is at the provincial level when provincial treasuries are stuck between a rock and a hard place; the rock being the nationally determined teacher wage rate, and the hard-place being the actual budget they have available to pay teachers. In order to make their budgets balance (and to do so in a politically palatable manner), they implement hiring freezes. Vacancies arising from natural attrition (retirement, leaving the profession, or death) are not filled. This has the cumulative impact of saving money but comes at the cost of undermining the proper functioning of schools on the ground. The data presented above illustrated that in the four-year period 2012 to 2016 there were 2,091 fewer principals, 956 fewer deputy principals and 3,385 fewer HODs employed in the country, despite there being only 536 fewer schools. In Limpopo only 77% of schools have a principal post in the school (presumably 23% have acting principals). Researchers have highlighted this exodus and pointed to its likely deleterious consequences. Wills (2019: p.311) makes this explicit in her recent review of School Leadership and Management (SLM) in South Africa:

> *"School Management Team (SMT) posts are considerably more expensive than teacher posts and there is a strong temptation for provinces to 'save' by not filling SMT vacancies or just appointing individuals in an 'acting' role at little additional cost. In recent years, in particular, the number of SMT members that schools of a given size should have has been compromised through a combination of increased budgetary pressures, weak planning by provinces, a wave of retirements and pre-retirement exits of managers which has left vacancies that are not being filled (Gustafsson, 2016a; Wills, 2015). This situation is also aggravated by temporary hiring freezes imposed on provinces. … The decline in SMT positions poses a threat to school functionality, sustained learning and realising national plans to harness the potential of school leadership as a lever for educational improvements (National Planning Commission 2011, p. 40). Taylor's (2011) analyses suggest that the presence of a principal at school for example is linked to higher learning. The converse is likely to be equally true. The decline in HoDs – a critical middle-management position that is typically more connected to the day-to-day practices of teachers than that of principals – is a key area to monitor. HoDs play a crucial accountability and monitoring function in managing teacher's curriculum coverage (Naidoo and Petersen, 2016) – the very dimension of SLM that is identified as being most connected to learning in schools. Not appointing HoDs may be a cost-saving measure in the short-run; however, this not only leaves a management and instructional leadership vacuum in schools but may compromise teacher effort (and general levels of satisfaction) as it undermines the promotion and related incentive system (Deloitte, 2013: p. 61). The prospect of an HoD promotion is a key node in the teacher incentive system where HoD salaries are on average 35% higher than that of a teacher" (Wills, 2019: p.311).*

What is clear from the above is that the proverbial collective bargaining chickens are now coming home to roost. In the long run, it is simply not possible to ignore the consequences of agreeing

to collective wage bargaining demands that go beyond governments ability to pay for them. In the absence of taking on more debt to pay for the disconnect, the inevitable outcome will be to implement widespread hiring freezes at the expense of overall teaching and learning, and with the consequence of rising class sizes. A large part of the explanation comes down to government's inability to refuse large wage increase demands by teacher unions, particularly before elections. This is something that the majority teacher union SADTU is well aware of. In the editorial of their quarterly newsletter for October 2009 they state that "The double-digit annual salary increment, which should be paid by the end of October, also calls for a celebration as few sectors managed to clinch a double-digit increment in the middle of a recession" (SADTU, 2009: p.1). This might not be a problem if there was sufficient additional funding to cover these large increases, yet the analysis above clearly indicates that there was not.

It should also be emphasized that when additional budget is made available to Basic Education, it is a policy choice about whether that should be allocated to (a) paying existing teachers more, (b) hiring more teachers), or (c) increasing non-personnel spending. Given the analysis presented above it is clear that the South African government has consistently chosen to pay teachers more, rather than hire more teachers. Furthermore, in the presence of budget cuts the choice has always been to allow hiring freezes rather than limit the ongoing increases in teacher wages. One could argue that with the rising number of children entering the schooling system following the birth spike in 2005, more teachers needed to be hired to ensure class sizes did not rise. Yet, additional budget allocations were channeled towards increasing existing teachers' salaries rather than hiring more teachers. Unsurprisingly, class sizes have increased.

Conclusion

In this paper we have made the following three assertions: (1) Using CPI to discount educational expenditures for inter-temporal comparison purposes is incorrect and misleading, primarily because teacher salaries make up 80% of the education price basket, (2) the Basic Education Price Index (BEPI) is a more accurate discount rate since it is comprised of the real cost drivers of education in South Africa, (3) Using BEPI to discount educational expenditures over the 2008-2018 period shows that after an initial rise in real per-learner expenditure between 2008 and 2009, there has been a -2.3% decline between 2009 and 2018 in real terms when using cost drivers. In the Free State, Limpopo and the North West the decline was six times as large.

We presented evidence to show that the cause of the decline is that increases in teacher salaries have not been met with concomitant increases in education budgets. The government has agreed to higher wages and benefits without budgeting for those increases, and in the process undermined the education system. This has led to a host of unintended consequences. Provincial departments experiencing salary increases that have outpaced their budget increases have attempted to deal with the subsequent fiscal squeeze by implementing hiring freezes and allowing class sizes to rise. Payroll data shows that even after accounting for a small decline in the number of schools, there are -7% fewer principals employed in 2016 compared to 2012 (Table 9). In the three most severely affected provinces the declines in employed Principals, Deputy Principals and HODs range from -13% to -23% when comparing 2012 and 2016.

In this paper, we have not attempted to explain the needed reforms to the teacher incentive system in South Africa (see Gustafsson, 2012), or whether these increases in teacher pay and benefits have been accompanied by similar increases in teacher productivity and/or the recruitment of higher achieving students into the teaching profession.

The main contribution of the paper, to both the research literature on South African education, and also to policymakers, is to help explain the conundrum of the co-existence of widespread hiring freezes and the alleged rising per-learner spending on education (using CPI as a deflator). The answer to this conundrum is that CPI is the wrong deflator. When using the correct deflator (BEPI) there is a logical explanation behind both increases in class sizes and the implementation

of hiring freezes. The federal nature of South Africa provides further corroborating evidence. Provincial disaggregation of spending trends and hiring freezes shows quite clearly that those provinces experiencing the largest declines in real per learner spending are also the ones who have the highest number of vacancies. This is not a coincidence. For those researchers who are unconvinced that BEPI is the correct discount rate, and instead believe that real education expenditures have been increasing monotonically for the last decade, we ask the following question: If real educational expenditures per learner have been rising over this period, why is it that provinces are implementing hiring freezes?

Finally, we would encourage government officials from the National Treasury and the Department of Basic Education to take account of the dynamics presented in this paper when entering wage negotiation agreements with teacher unions. While many of the choices made in such negotiations are necessarily political, it is fair to ask government to acknowledge the trade-offs and costs in their decisions and to make those trade-offs and decisions public.

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Appendix A

Raw EPRE Figures

Table 11. Raw Provincial Expenditure on Education: Total expenditure including compensation of employees and capital accumulation (Millions of Rands)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	17524	21164	22577	24170	25185	26779	26958	28426	30967	32808	35359
FS	6713	7846	8461	9259	10057	10558	10968	11307	11834	12891	14159
GP	16688	20051	22251	24596	26732	29209	31636	36297	39410	41414	45712
KN	22992	26231	28747	32810	34557	37156	39289	42888	45663	48316	50984
LP	14697	17865	20202	20313	21008	22648	24419	25118	26826	29020	30835
MP	9361	10931	11598	12565	13864	14653	15675	17098	17809	19535	20973
NC	2853	3103	3419	3974	4126	4490	4709	5101	5512	6006	6555
NW	7179	8391	9102	9882	10393	11679	12078	13110	14086	15072	16262
WC	9192	10613	11956	12793	13654	15111	16589	17637	19301	20567	22150
SA	107198	126194	138313	150362	159577	172284	182322	196983	211408	225629	242989

Notes: 1. Figures are taken directly from EPRE files.

Table 12. Raw Provincial Expenditure on Education: Compensation of employees (R millions)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	13755	17112	18857	19782	20482	21413	22103	22632	23872	25883	27445
FS	5345	6094	6782	7271	7844	8414	8762	9181	9699	10229	11054
GP	12685	15278	17355	18514	20030	21813	23734	25982	28660	31428	34130
KN	18038	20864	22609	26207	27558	29930	32038	34527	37608	40061	42811
LP	11854	14170	15908	16647	17555	18710	19798	20722	21744	23183	24642
MP	7365	8416	9252	10119	10912	11619	12406	13212	14247	15505	16683
NC	2227	2494	2721	2885	3110	3438	3647	3911	4289	4609	5013
NW	5656	6502	7083	7645	8296	9006	9474	9921	10616	11587	12643
WC	7090	8215	9193	9733	10463	11273	12132	14887	16269	17524	18766
SA	84015	99146	109761	118804	126249	135616	144095	154975	167004	180010	193187

Notes: 1. Figures are taken directly from EPRE files.

Table 13. Raw Provincial Expenditure on Education: Capital accumulation (Millions of Rands)

Province					Year						
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	944	868	407	987	1036	1335	1043	1016	1765	1540	1550
FS	333	438	156	415	488	338	386	613	316	654	667
GP	637	870	727	1379	1387	1044	1011	2151	2549	1787	1500
KN	1228	1407	1921	2120	2580	2379	2022	2441	2218	1957	1786
LP	723	987	1074	1237	572	1137	1328	1088	815	1259	1035
MP	390	328	422	637	646	696	780	978	704	918	1096
NC	259	103	109	297	259	340	335	360	432	462	361
NW	240	312	243	546	308	676	610	908	1010	1063	1020
WC	207	324	452	648	571	737	1212	1121	1012	958	1166
SA	4240	5637	5512	8266	7846	8682	8727	10676	10820	10599	10180

Notes: 1. Figures are taken directly from EPRE files.

Table 14. Raw Provincial Expenditure on Education: Current expenditure (Total less capital, Millions of Rands)

Province	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	16580	20296	22170	23183	24150	25444	25915	27410	29202	31268	33810
FS	6380	7408	8305	8845	9569	10220	10583	10694	11518	12237	13492
GP	16051	19181	21524	23217	25345	28165	30626	34146	36861	39627	44212
KN	21763	24824	26826	30690	31977	34777	37267	40447	43445	46359	49198
LP	14696	16878	19128	19076	20436	21511	23091	24030	26011	27761	29799
MP	8971	10603	11176	11927	13218	13957	14895	16121	17106	18617	19878
NC	2594	3000	3310	3677	3867	4150	4374	4741	5080	5545	6195
NW	6938	8078	8859	9336	10085	11003	11468	12202	13077	14008	15242
WC	8985	10290	11503	12145	13082	14374	15376	16516	18289	19609	20983
SA	102958	120557	132801	142096	151730	163602	173595	186307	200588	215030	232809

Notes: 1. Figures are taken directly from EPRE files.

Ensuring Comparability: Adjusting for Programme 5 and Workbooks

Before it is possible to discount figures using the BEPI, it is important to ensure that all EPRE files are in fact comparable and include the same components across provinces and over the period analysed. In 2015 there was a national policy change which meant that Further Education and Training (FET) expenditures, which were previously financed through provinces (and were therefore included in the EPRE reports), would now be financed through national government. This policy change is known as Programme 5. The removal of FET expenditure is appropriate in our case since our scope only includes public ordinary schools. In EPRE files, figures were adjusted to account for Programme 5, but only as far back as 2011/12. We therefore manually removed Programme 5 for 2008/09 and 2010/11.[29]

A second issue that arises is the introduction of the DBE Workbooks, which were only reflected in spending beginning in 2014. The tables below include national expenditure on Workbooks from Estimates of National Expenditure (ENE) publications. They provide total and current expenditure table with Programme 5 and Workbooks accounted for. The resulting tables of nominal expenditure can then be compared across years.

a. Programme 5 Adjustment

The tables below provide the proportional differences in expenditure in 2011/12 with and without Programme 5. The adjusted figures are the figures without Programme 5, which best represent public spending on basic education. The adjusted figures are given in the 2015/16 EPRE reports. The unadjusted figures are the figures with Programme 5, given in the earlier 2014/15 EPRE reports. Programme 5 affected expenditure on employees and total expenditure, but not capital accumulation. The latter is therefore not shown here. The proportional differences given here are applied to the raw expenditure figures provided in Appendix A above. The resultant comparable nominal figures are given in subsection 'c' below.

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29   We adjusted the earlier years (2008/09 - 2010/11) by comparing the proportional difference between 2011/12 figures before and after the adjustment was done by provinces. The latest adjusted 2011/12 figures are available in the 2014/15 EPRE reports, while the latest unadjusted figures are available in the 2013/14 reports. After finding the proportional difference in expenditure for 2011/12 including and excluding Programme 5, we applied this proportional adjustment to the 2008/09 - 2010/11 expenditure figures, for each province independently.

Table 15. Adjusted and Unadjusted Total Expenditure, 2011/12 (R Millions)

Province	2011/2012		
	Adjusted: EPRE 2015/2016	Unadjusted: EPRE 2014/2015	Proportional difference
EC	24170	25174	0,96
FS	9259	9715	0,95
GP	24596	26120	0,94
KN	32810	33799	0,97
LP	20313	21161	0,96
MP	12565	13024	0,96
NC	3974	4078	0,97
NW	9882	10148	0,97
WC	12793	13361	0,96
All SA	150362	156581	0,96

Table 16. Adjusted and Unadjusted COE, 2011/12 (R Millions)

Province	2011/2012		
	Adjusted: EPRE 2015/2016	Unadjusted: EPRE 2014/2015	Proportional difference
EC	19782	20344	0,97
FS	7271	7529	0,97
GP	18514	19370	0,96
KN	26207	26639	0,98
LP	16647	17291	0,96
MP	10119	10235	0,99
NC	2885	2951	0,98
NW	7645	7781	0,98
WC	9733	9998	0,97
All SA	118804	122140	0,97

b. Workbooks

Workbooks are financed nationally to lower procurement costs and are therefore not reflected in EPRE files and must be added in to total expenditure estimates. Workbook expenditure is given in National Budget Review reports, available on the treasury website. Although workbooks are mentioned as early as 2011, they are only implemented and reflected in spending in 2015. Table 15 provides the yearly national expenditure on workbooks.

Table 17. Raw National Expenditure on Workbooks, R million

Year	Expenditure
2015/16	954
2016/17	1009
2017/18	4801
2018/19	4958

c. Comparable Nominal Expenditure

The tables below combine raw EPRE figures from Appendix A with the Programme 5 adjustment in subsection 'a' above. Workbooks, as described in subsection 'b' above, are also included. These tables provide comparable nominal expenditure figures.

Table 18. Nominal Expenditure on Education: Total expenditure (Millions of Rands)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	16825	20320	21676	24170	25185	26779	26958	28426	30967	32808	35359
FS	6398	7479	8065	9259	10057	10558	10968	11307	11834	12891	14159
GP	15714	18881	20952	24596	26732	29209	31636	36297	39410	41414	45712
KN	22319	25463	27905	32810	34557	37156	39289	42888	45663	48316	50984
LP	14108	17149	19393	20313	21008	22648	24419	25118	26826	29020	30835
MP	9031	10546	11189	12565	13864	14653	15675	17098	17809	19535	20973
NC	2780	3024	3332	3974	4126	4490	4709	5101	5512	6006	6555
NW	6991	8171	8864	9882	10393	11679	12078	13110	14086	15072	16262
WC	8802	10162	11448	12793	13654	15111	16589	17637	19301	20567	22150
W.Books	.	.	.	.	.	.	.	954	1009	4801	4958
SA	102941	121183	132820	150362	159577	172284	182322	197937	212417	230430	247947

Notes: 1. Provincial figures are raw EPRE figures adjusted for Programme 5. 2. W.Books refers to learner workbooks which are nationally financed.

Table 19. Nominal Expenditure on Education: Compensation of employees (Millions of Rands)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	13375	16640	18336	19782	20482	21413	22103	22632	23872	25883	27445
FS	5162	5886	6550	7271	7844	8414	8762	9181	9699	10229	11054
GP	12124	14603	16588	18514	20030	21813	23734	25982	28660	31428	34130
KN	17745	20526	22242	26207	27558	29930	32038	34527	37608	40061	42811
LP	11412	13642	15316	16647	17555	18710	19798	20722	21744	23183	24642
MP	7281	8321	9147	10119	10912	11619	12406	13212	14247	15505	16683
NC	2177	2438	2660	2885	3110	3438	3647	3911	4289	4609	5013
NW	5557	6388	6959	7645	8296	9006	9474	9921	10616	11587	12643
WC	6902	7997	8950	9733	10463	11273	12132	14887	16269	17524	18766
SA	81720	96438	106763	118804	126249	135616	144095	154975	167004	180010	193187

Notes: 1. Provincial figures are raw EPRE figures adjusted for Programme 5.

Table 20. Nominal Expenditure on Education: Capital accumulation (Millions of Rands)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	944	868	407	987	1036	1335	1043	1016	1765	1540	1550
FS	333	438	156	415	488	338	386	613	316	654	667
GP	637	870	727	1379	1387	1044	1011	2151	2549	1787	1500
KN	1228	1407	1921	2120	2580	2379	2022	2441	2218	1957	1786
LP	723	987	1074	1237	572	1137	1328	1088	815	1259	1035
MP	390	328	422	637	646	696	780	978	704	918	1096
NC	259	103	109	297	259	340	335	360	432	462	361
NW	240	312	243	546	308	676	610	908	1010	1063	1020
WC	207	324	452	648	571	737	1212	1121	1012	958	1166
SA	4240	5637	5512	8266	7846	8682	8727	10676	10820	10599	10180

Notes: 1. Provincial figures are raw EPRE figures adjusted for Programme 5.

Table 21. Nominal Expenditure on Education: Current expenditure (Millions of Rands)

Province	Year										
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	15881	19452	21269	23183	24150	25444	25915	27410	29202	31268	33810
FS	6066	7041	7908	8845	9569	10220	10583	10694	11518	12237	13492
GP	15077	18010	20226	23217	25345	28165	30626	34146	36861	39627	44212
KN	21090	24056	25984	30690	31977	34777	37267	40447	43445	46359	49198
LP	14107	16162	18319	19076	20436	21511	23091	24030	26011	27761	29799
MP	8641	10217	10767	11927	13218	13957	14895	16121	17106	18617	19878
NC	2521	2921	3222	3677	3867	4150	4374	4741	5080	5545	6195
NW	6750	7858	8621	9336	10085	11003	11468	12202	13077	14008	15242
WC	8595	9839	10995	12145	13082	14374	15376	16516	18289	19609	20983
W.Books	.	.	.	.	.	.	.	954	1009	4801	4958
SA	98701	115546	127308	142096	151730	163602	173595	187261	201597	219831	237767

Notes: 1. Provincial figures are raw EPRE figures adjusted for Programme 5. 2. W.Books refers to learner workbooks which are nationally financed.

EPRE Figures Adjusted for CPI Inflation

Table 22. CPI-Deflated Expenditure on Education: Total expenditure (Millions of Rands, 2018 Rands)

	Year										
Province	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
EC	28517	32308	33051	35115	34630	34823	33023	33308	34133	34337	35359
FS	10845	11891	12297	13452	13828	13729	13436	13249	13044	13491	14159
GP	26636	30020	31947	35733	36757	37983	38754	42530	43440	43344	45712
KN	37829	40485	42548	47667	47516	48316	48129	50253	50332	50568	50984
LP	23912	27266	29569	29512	28887	29451	29914	29432	29569	30373	30835
MP	15307	16767	17060	18254	19063	19054	19202	20035	19630	20445	20973
NC	4712	4808	5080	5773	5673	5838	5769	5977	6075	6286	6555
NW	11849	12991	13515	14357	14290	15188	14795	15361	15527	15774	16262
WC	14919	16158	17455	18587	18774	19650	20321	20666	21275	21525	22150
W.Books	.	.	.	.	.	.	.	1118	1112	5025	4958
SA	174482	192677	202517	218451	219418	224031	223344	231930	234137	241169	247947

Notes: 1. Provincial figures are comparable nominal EPRE figures adjusted for CPI inflation. W.Books refers to learner workbooks which are nationally financed.

Table 23. CPI-Deflated Expenditure on Education: Compensation of employees (Millions of Rands, 2018 Rands)

	Year										
Province	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	22671	26456	27959	28740	28162	27844	27076	26519	26313	27090	27445
FS	8749	9358	9987	10564	10786	10942	10733	10758	10691	10706	11054
GP	20550	23218	25292	26897	27541	28364	29074	30444	31591	32893	34130
KN	30078	32635	33914	38074	37892	38920	39246	40457	41454	41928	42811
LP	19343	21691	23352	24186	24138	24330	24252	24280	23967	24263	24642
MP	12342	13229	13947	14701	15003	15109	15198	15480	15704	16227	16683
NC	3690	3877	4056	4192	4277	4471	4468	4583	4728	4824	5013
NW	9420	10157	10611	11107	11407	11711	11606	11624	11702	12127	12643
WC	11698	12715	13646	14141	14386	14659	14862	17444	17932	18341	18766
SA	138513	153334	162788	172602	173592	176350	176516	181590	184080	188398	193187

Notes: 1. Provincial figures are comparable nominal EPRE figures adjusted for CPI inflation.

Table 24. CPI-Deflated Expenditure on Education: Capital accumulation (Millions of Rands, 2018 Rands)

	Year										
Province	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	1600	1380	621	1434	1424	1737	1278	1190	1945	1612	1550
FS	564	696	238	603	671	439	472	719	349	684	667
GP	1080	1383	1108	2003	1907	1358	1238	2520	2810	1870	1500
KN	2082	2237	2929	3080	3548	3094	2477	2860	2445	2049	1786
LP	723	1569	1638	1798	787	1478	1627	1275	899	1318	1035
MP	661	522	644	926	888	905	956	1146	776	961	1096
NC	439	163	166	432	356	442	411	422	476	483	361
NW	408	497	370	793	423	879	747	1064	1113	1113	1020
WC	351	515	690	941	786	958	1485	1314	1115	1003	1166
SA	7186	8963	8404	12009	10789	11290	10691	12509	11927	11093	10180

Notes: 1. Provincial figures are comparable nominal EPRE figures adjusted for CPI inflation.

Table 25. CPI-Deflated Expenditure on Education: Current expenditure (Millions of Rands, 2018 Rands)

						Year					
Province	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
EC	26917	30928	32430	33681	33206	33086	31746	32118	32188	32725	33810
FS	10281	11194	12058	12850	13158	13290	12964	12531	12695	12807	13492
GP	25555	28636	30839	33731	34850	36625	37516	40010	40630	41474	44212
KN	35747	38248	39619	44587	43968	45223	45652	47393	47887	48519	49198
LP	23911	25697	27931	27714	28100	27972	28287	28157	28670	29055	29799
MP	14646	16245	16417	17328	18175	18149	18246	18889	18855	19484	19878
NC	4273	4644	4913	5341	5317	5397	5358	5555	5599	5803	6195
NW	11441	12495	13145	13564	13867	14308	14048	14297	14414	14661	15242
WC	14568	15643	16765	17645	17988	18692	18836	19353	20160	20523	20983
	.	.	.	.	.	.	.	1118	1112	5025	4958
SA	167295	183714	194114	206442	208629	212742	212653	219421	222211	230076	237767

Notes: 1. Provincial figures are comparable nominal EPRE figures adjusted for CPI inflation. W.Books refers to learner workbooks which are nationally financed.

School Enrolments

Table 26. All Enrolments GrR to Gr12: Public schools (Thousands)

Province	Year											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018*
EC	2127	2032	2003	1910	1896	1882	1889	1895	1899	1743	1789	32506
FS	584	642	639	641	646	650	656	666	672	684	685	-5224
GP	1972	1720	1778	1814	1859	1900	1944	1999	2049	2262	2220	13195
KN	2809	2773	2744	2782	2813	2799	2831	2811	2808	2818	2837	36021
LP	1490	1672	1661	1646	1665	1662	1666	1695	1707	1718	1720	17453
MP	1098	1016	1014	1022	1028	1026	1034	1052	1046	1077	1072	-304
NC	272	265	266	271	274	279	285	287	287	290	296	3811
NW	862	764	746	751	760	773	784	797	811	807	824	6158
WC	1007	943	960	970	992	1005	1027	1046	1063	1091	1104	-5814
SA	12221	11829	11810	11808	11933	11976	12117	12248	12342	12490	12547	97802

Notes: *Values are additional students present in the published DBE enrolment report (School Realities, 2018) compared to the average of 2017 and 2019 enrolment figures from the same report. 1. Enrolment numbers are taken from governmental School Realities reports (DBE, 2008-2018)..

Appendix E

Per-pupil expenditure, full set of results

Figure 19. Total per-learner expenditure deflated using BEPI-Persal

Province	Year											2018 adjusted
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	
EC	18433	20118	19672	20019	19647	20035	18653	18455	18498	20191	19914	20130
FS	21773	23428	22952	22847	23023	22872	21844	20884	19982	20221	20551	20504
GP	20442	22082	21424	21450	21272	21647	21269	22339	21820	19639	21666	20717
KN	18279	18472	18487	18660	18171	18688	18141	18765	18443	18389	18380	18201
LP	18145	20639	21228	19528	18662	19182	19167	18230	17828	18121	18579	18110
MP	19485	20873	20064	19457	19951	20108	19815	19989	19307	19463	20439	19564
NC	23589	22969	22743	23159	22258	22617	21608	21901	21750	22190	22491	22464
NW	20381	21503	21597	20811	20219	21269	20135	20223	19692	20025	19819	19873
WC	20952	21677	21684	20860	20364	21157	21121	20732	20588	20211	20431	19964
Workbooks	-	-	-	-	-	-	-	96	93	412	405	398
SA	19356	20612	20444	20147	19780	20252	19670	19879	19521	19788	20273	19917

Figure 20. Total per-learner expenditure, deflated using BEPI-GG

Province	Year											2018 adjusted
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	
EC	19048	20986	19719	20238	19911	19953	18753	18421	18716	20126	19914	20130
FS	22500	24440	23007	23097	23332	22778	21961	20846	20217	20156	20551	20504
GP	21125	23035	21476	21685	21558	21558	21383	22298	22077	19575	21666	20717
KN	18890	19270	18532	18865	18415	18611	18238	18731	18660	18330	18380	18201
LP	18751	21530	21279	19742	18913	19103	19270	18197	18037	18062	18579	18110
MP	20135	21775	20112	19670	20219	20025	19921	19952	19534	19401	20439	19564
NC	24377	23960	22798	23413	22557	22524	21724	21861	22005	22119	22491	22464
NW	21061	22432	21649	21039	20491	21181	20243	20186	19924	19961	19819	19873
WC	21652	22612	21736	21089	20638	21070	21235	20694	20830	20146	20431	19964
Workbooks	0	0	0	0	0	0	0	96	94	411	405	398
SA	20003	21502	20493	20368	20045	20168	19776	19842	19750	19725	20273	19917

Figure 21. Current per-learner expenditure, deflated using BEPI-Persal

Province	Year											2018 adjusted
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	
EC	17320	19190	19264	19197	18839	19034	17937	17800	17444	19244	19041	19248
FS	20547	21978	22462	21818	21906	22138	21082	19756	19448	19196	19583	19538
GP	19525	20990	20641	20243	20168	20871	20596	21021	20408	18792	20955	20037
KN	17196	17389	17180	17450	16814	17489	17212	17701	17547	17644	17737	17563
LP	18062	19382	20013	18335	18154	18217	18130	17445	17285	17335	17955	17503
MP	18559	20152	19269	18465	19021	19151	18834	18851	18544	18549	19371	18542
NC	21295	22110	21954	21422	20861	20905	20075	20360	20044	20485	21254	21228
NW	19591	20608	20963	19657	19621	20036	19123	18826	18280	18613	18575	18626
WC	20367	20912	20786	19799	19512	20124	19583	19419	19508	19270	19355	18913
Workbooks								96	93	412	405	398
SA	18475	19583	19557	19035	18807	19229	18734	18811	18526	18879	19441	19099

Figure 22. Current per-learner expenditure, deflated using BEPI-GG

Province	Year											2018 adjusted
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	
EC	17882	19995	19308	19401	19086	18954	18027	17761	17646	19182	19041	19248
FS	21214	22901	22514	22051	22193	22045	21189	19713	19673	19134	19583	19538
GP	20158	21871	20688	20459	20432	20783	20699	20975	20645	18731	20955	20037
KN	17754	18120	17219	17636	17034	17416	17299	17663	17751	17588	17737	17563
LP	18648	20196	20058	18530	18392	18141	18221	17407	17486	17279	17955	17503
MP	19162	20998	19313	18662	19270	19071	18929	18810	18759	18489	19371	18542
NC	21986	23038	22004	21650	21134	20817	20176	20316	20277	20419	21254	21228
NW	20227	21473	21011	19866	19878	19952	19220	18785	18492	18553	18575	18626
WC	21028	21790	20833	20010	19767	20039	19682	19377	19734	19208	19355	18913
Workbooks	-	-	-	-	-	-	-	96	94	411	405	398
SA	19075	20405	19602	19238	19053	19149	18828	18770	18741	18818	19441	19099

Trends in current expenditure per learner when discounting figures using CPI only

The graph below is a replica of Figure 13 in the paper, however instead of discounting using BEPI all figures are discounted using CPI inflation. It is clear that when discounting using CPI it seems as if real expenditure is rising over time in all provinces. This illustrates clearly why CPI is the wrong deflator for educational expenditures. For those advocating for CPI as the correct measure, one needs to ask why, if the real resources available in education where increasing over time, would there be such a clear hiring freeze across most provinces in the country?

Figure F1: Current expenditure per learner deflated with CPI only (2018 Rands)

Current Expenditure Per learner (CPI-Deflated)
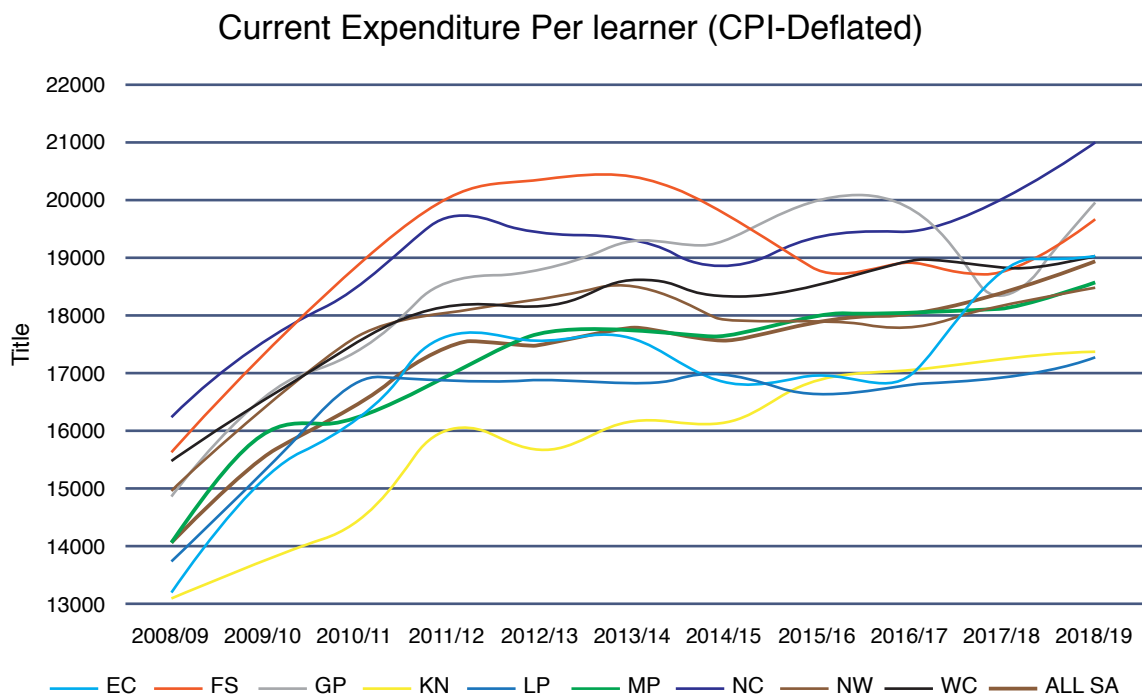
# The effect of increasing inflation in non-personnel expenditure

It is not clear whether, and to what extent, inflation in non-personnel expenditure has outstripped CPI. Although it has a much lower weighting in the BEPI than wages, it could nevertheless have a large effect on per-pupil expenditure. Anecdotal evidence from provincial officials suggests that price increases in major non-personnel items such as books and stationery have increased faster than CPI. Here, we look at the effect of a 1% increase in non-personnel expenditure above CPI. The choice of 1% is arbitrary and does not reflect estimates of any true level of non-personnel inflation. The analysis here is therefore wholly theoretical. We provide BEPI-Persal values (Table G1), as well as trends in total current expenditure (Figure G1) and per-learner current expenditure (Figure G2). In all cases we compare current expenditure deflated with BEPI-Persal and using adjusted 2018 enrolment values with and without a 1% increase in non-personnel spending above inflation.

Table G1: BEPI-Persal calculated with CPI+1% inflation in non-personnel costs

	Year									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CPI	6,6%	4,3%	5,0%	5,7%	5,7%	6,2%	4,5%	6,3%	5,3%	4,7%
CPI +1%	7,6%	5,3%	6,0%	6,7%	6,7%	7,2%	5,5%	7,3%	6,3%	5,7%
BEPI-Persal	49,9	55,1	63,2	67,6	71	76,5	81,3	88,2	93,2	100
BEPI-Persal with CPI+1%	49,2	54,4	62,5	66,9	70,5	76	80,9	87,9	93,1	100
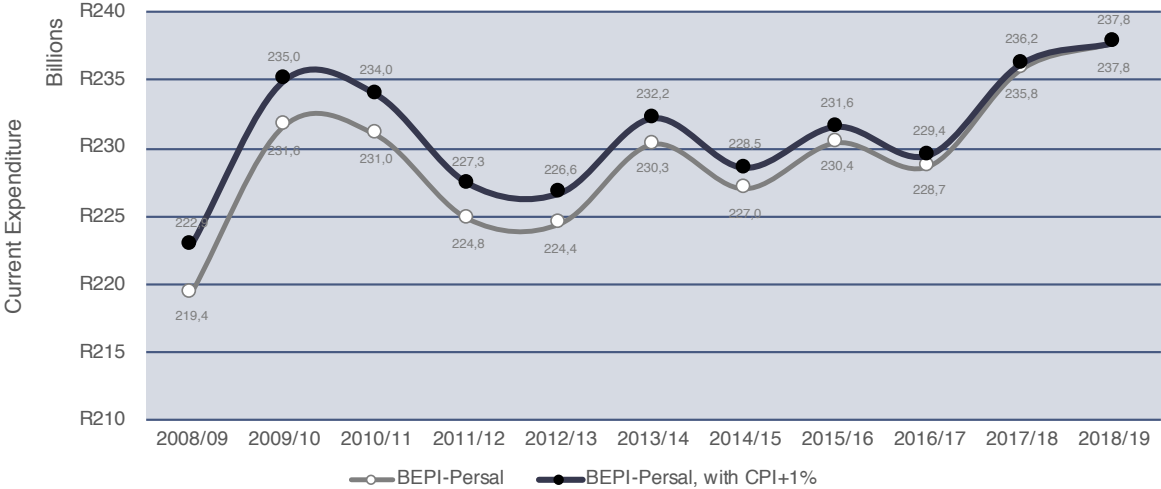
When just looking at Table G1, BEPI-Persal does not appear to change substantially with 1% additional inflation in non-personnel spending. The inflation index changes by less than 1.0 unit in any given year. Figure G1 begins to display the extent of changes, although they are still somewhat obscured at this level. In the figure, the 2018 values are equal by design, since both indexes use 2018 Rand values as the base year. The original BEPI-Persal index is slightly steeper, indicating greater increases in expenditure over time. The additional 1% increase above CPI for non-personnel expenses has eroded the increase in current expenditure from 8% to 7%, a difference of R18-billion.

In the last figure, Figure G2 below, the 2018 values are again the same, for the same reason. The original BEPI-Persal estimate lies below the CPI+1% line, and the trend line is flatter, indicating that per-learner expenditure is decreasing less than in the case with CPI+1%. The final table confirms this: Overall, the -2.3% decrease in per-learner expenditure we saw previously is -3.6% with a 1% increase in CPI for non-personnel spending. Previously, we estimated that this would require R8.7 billion (R6 billion) to keep total (current) spending the same as in 2010. With a 1% increase above inflation of non-personnel spending, we would have needed R12.1 billion (R9.5 billion). Thus, an increase in non-personnel costs of 1% above inflation would require an additional R3.4 billion to make up for the decrease in per-pupil funding (40% of the initial requirement).

Figure G2: Per-Learner current expenditure deflated using BEPI-Persal, calculated with CPI+1% inflation for non-personnel costs
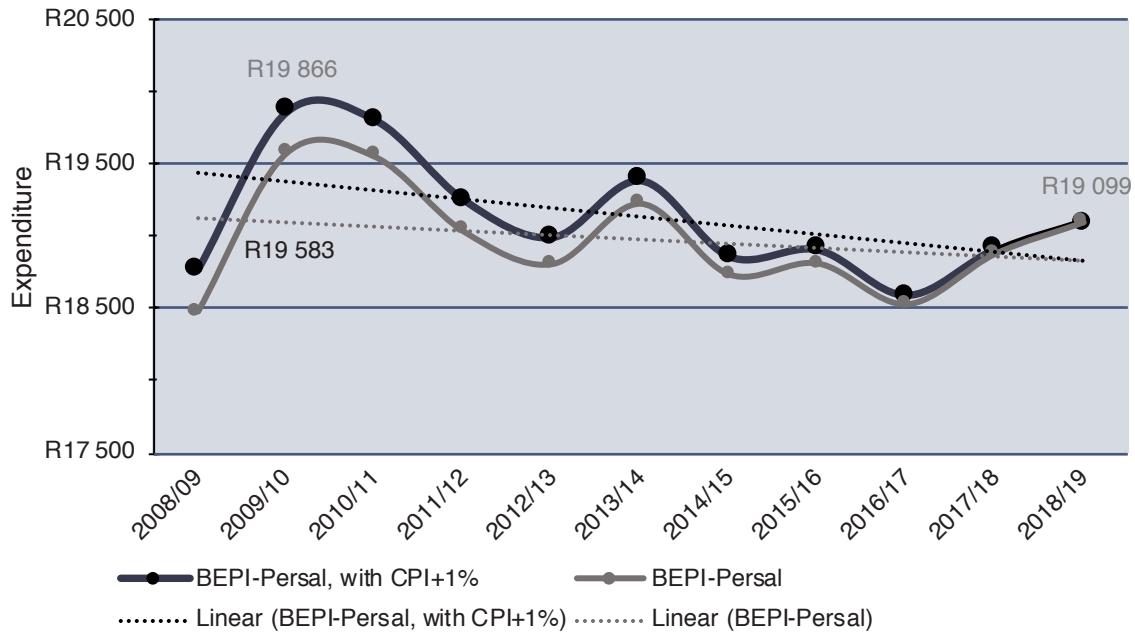
Table G2. Provincial per-Learner expenditure deflated using BEPI-Persal, calculated with CPI+1% inflation for non-personnel costs

Province	From 2009 to 2018	From 2009 to 2018, CPI+1%
Eastern Cape	-0,1%	-1,4%
Free State	-13,0%	-14,1%
Gauteng	-2,9%	-4,2%
KwaZulu-Natal	2,2%	0,9%
Limpopo	-12,5%	-13,7%
Mpumalanga	-3,8%	-5,0%
Northern Cape	-3,3%	-4,5%
North West	-11,1%	-12,3%
Western Cape	-9,0%	-10,2%
South Africa	-2,3%	-3,6%

Again, it is not clear whether, and to what extent, non-personnel costs have increased above CPI inflation, but this discussion indicates the substantial consequences of such an increase. While we have estimated that the education system needed an additional R8.7 billion in 2018 to keep pace with per-learner expenditure seen in 2010, this may be a vast underestimate depending on cost inflation of non-personnel goods.