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Public service wage bill and economic growth

Evidence from South Africa

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Towards Inclusive Economic Development in Southern Africa

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ABSTRACT

This study employs an autoregressive distributed lag model to investigate the long-run and short-run economic growth impacts of the public service wage bill in South Africa. The annual time series data used ranges from 1983 to 2019 obtained from the South African Reserve Bank online dataset. The study also controls for other government expenditure items, and gross fixed capital formation. It does not find a negative relationship between wage bill expenditure and economic growth, as is widely assumed. However, the impact of the wage bill even though positive, is significantly small compared to government expenditure on health, social protection, education and investment, indicating a possibility of a crowding-out effect. This is the case in both the short and long run. Recommendations are made for structural reforms aimed at improving spending efficiency and effectively managing the wage bill to ensure that public services are delivered in a fiscally sustainable and cost-effective fashion.

Keywords: ARDL, gross domestic product, South Africa.

1 INTRODUCTION

As part of its approach to escape current economic hardships, the South African government has proposed a three-year expenditure ceiling on the public service wage bill. During this period, the government will implement a zero-based budgeting methodology, cutting down on non-interest expenditure whilst major efforts will be placed on maximizing revenue (MTBPS, 2020). The intention is to reduce non-interest expenditure by 4.6% of GDP over the next medium term expenditure framework At present, wages paid to public servants take about 14% of South Africa's GDP, 37% of national revenue, amongst the highest portion in the world. Furthermore, the public sector wage bill accounts for ZAR 629 billion of the national budget, which is 34.8% of consolidated national expenditure. Statistics South Africa reported that the wage bill had increased by 10.3% since 2009, notably higher than the rate of inflation. This is despite the dwindling economic growth, largely resulting from high public debt, poor revenue collection and poor composition of national expenditure.

The travel restrictions implemented to curb the spread of the corona virus have only accelerated an on-going gloomy economic condition, leaving a large deficit and high gross debt as countries solicit additional loans to mitigate the health and social effects of the pandemic. The government debt-to-GDP ratio is expected to rise to 87.3% in 2023/24 at 62.20%. Before the eruption of the covid-19, the South African economy was already experiencing a downfall of -1.4% in the last quarter of 2019, a continuation of decade-old underperformance recorded since the global financial crises of 2007/8. The downfall reached 7.0% in 2020 due to restricted economic activity. The public sector wage bill on the other side has risen along with the unemployment rate, indicating a possibility of more resources being concentrated on fewer segments of the work force. It is against this background that the South African government has sought to revise downwards its annual expenditure on public servants' wages towards 2023, aiming to save about ZAR 160 billion as part of the Economic Reconstruction and Recovery Plan.

Countries facing fiscal challenges consider, as part of amicable remedies, cutting government expenditure or increasing revenue through tax increase. The success of either of these policy directions is subjected to heated and on-going debate in academic corridors. However, the notable point of divergence in the empirical literature is on which of these available fiscal alternatives can bail an economy out of hardships and deliver sustainable growth. A pool of existing literature suggests that an increase in spending boosts the economy (Ram 1986; Alexiou 2007; Aschauer 1990; Knoop 1999, Castro and Fernandez 2011), whilst another pool finds an adverse relationship (Cameron 1982; Grier and Tullock 1989; Ghura 1995; Saunders 1985; Gould 1983; Carlstrom and Gokhale 1991). However, it can be noted that different findings in one way or the other are influenced by a large number of factors, such as the period being studied, models and techniques employed as well as choice of variables. On the choice of variables, some studies have looked into national expenditure components hoping to provide wisdom and guidance to this debate. On this, Alesina and Perotti (1997) decompose government expenditure and find that fiscal adjustments that rely on spending cuts on transfers and government wage bill are expansionary and have better chances of being successful. Similarly, Gupta et al (2002) find that countries where a major part of spending is concentrated on wages register relatively lower growth on output than those that allocate major portions to non-wage goods and services. Bernperoglu (2013) finds wage cuts to be less destructive when implemented to reduce deficit than employment cut. Similar findings are observed in Lamo (2016). The common denominator in these findings is the assumption of reverse causality following from a negative correlation between wage bill expenditure and economic growth.

The purpose of the study is to establish the short-run and long-run impacts of public wage bill expenditure on economic growth in South Africa using an autoregressive distributed lag model as suggested by Pesaran et al (2001). The study further recommends reasonable and amicable expenditure adjustments that will be within the consolidated fiscal framework and ensure reciprocal returns into the economy. This is achieved by looking to some of the expenditure components where

the national budget can be largely concentrated to ensure growth in the economy, such as expenditure on health, education, social protection and gross capital formation.

The rest of the study is organized as follows: section is a literature review, reflecting on theories of wage efficiency and economic growth as well as recent findings from empirical enquiry; section 3 analyses noted trends on public wages and economic growth in South Africa; section 4 breaks down the economic and econometric model adopted, as well as diagnostic tests employed; section 5 covers is data issues and subsequent analysis; whilst the last section provides conclusion and recommendations.

2 LITERATURE RIVIEW

2.1 Economic growth theories

Evolution in economic growth theory has seen a three-staged path of development, namely, classical economic growth models, neoclassical economic growth models and the new economic growth models. The "fathers" of classical growth models include Adam Smith and David Ricardo. In his *The wealth of nations (1*776), Smith provides a theoretical account of growth in the economy. His model maintains that the division of labour is a source of wealth growth. According to this assertion, the growth rate is determined by the size of productive labour and productivity of labour, with the latter influenced by technological pro*g*ress. Smith provides a production function with factors affecting productivity and growth, which are labour, capital and land:

$$Y = f(L, N, K) \quad (1)$$

Where *N* denotes land, *K* is capital and *L* labour.

Accounting for the dynamics of wages in relation to labour, Smith asserts that wages are likely to rise so long as employers compete with each other for limited supplies of labour, whereas they will fall should labourers bid against each other for limited opportunities. David Ricardo modifies the growth accounting model by imposing diminishing returns on land. As a result of limited supply of land, rent is likely to increase as demand increases, thereby cutting profits, whilst workers demand higher wages. Classical economic models offered bases from where major empirical enquiries and policy formulation would depart.

The development in economic growth debates saw a rise in neoclassical economic growth models. Amongst the drivers of this school of thought we can include Robert Solow and Nicholas Kaldor. After the Harod-Domar model, attributing economic growth to higher savings and low capital-output ratio, Robert Solow (1956) developed a model with labour and capital as main variables responsible for production. According to his model, the scale of income does not change, whilst marginal productivity of capital or labour diminishes over time. His model can be demonstrated in a Cobb-Douglas production function:

$$Y = AK^{\alpha}L^{1-\alpha} \quad (2)$$

Where a change in output comes as a result of a change in the amount of capital and labour, such that:

$$\Delta Y = f(\Delta L, \Delta AK) \quad (3)$$

In light of the above, the national economic growth rate is:

$$G = \frac{\Delta Y}{Y} = \alpha\frac{\Delta K}{K} + (1-\alpha)\frac{\Delta L}{L} \quad (4)$$

where $\Delta L$is an increase in labour volume, α is an output elasticity of capital and (1- α) is represents labour yield share. This model has served as a foundation for economic growth models that have emerged post-Solow. Nicholas Kaldor (1957) develops from a dynamic approach of Harrold and demonstrates mutual interactions between the rate of change of income and of capital in an economic

growth accounting system. The model is based on aggregate income, capital, wages, profit and investment. His model demonstrates how constancy in the capital/output ratio, share of profit and in the rate of profit are consequences of endogenous forces operating in the capitalist system. Like most models departing from Keynesian school of thought, his holds the full employment condition and maintains that economic growth comes as a result of an interactive process between savings, investment and technical progress.

In addition to the developments in economic growth debate, there are new economic growth theories developed by the likes of Lucas and Barro. The central idea to this school of thought is that endogenous technological progress is a main driver of economic growth other than external factors. This is shown in Barro (1990) where an endogenous growth model with an optimizing household is constructed. The baseline model is similar to the neoclassical growth model, except that technological progress is treated as an endogenous variable. The economic growth rate in this case is given by:

$$\frac{\Delta Y}{Y} = \frac{\Delta K}{K} = \frac{\Delta C}{C} = \frac{\alpha A n^{1-\alpha} - p - \delta}{Y} \quad (5)$$

Where *C* is consumption per person, *p* is constant rate of time preference and is greater than zero, *Y* is output per worker, *A* is constant net marginal product of capital and –δ is marginal utility.

-δ > 0, so that the marginal utility has a constant elasticity – δ.

Recent empirical literature has sought to validate the endogeneity of technical progress in growth accounting models.

2.2 Wage efficiency models

Theories of wage efficiency at least acknowledge that higher wages induce more working effort. However, there are two theories of the mechanisms by which this possible. One relies on the notion that employers pay high wages in order to eliminate a possibility of shirking, whilst the other regards high wages as an employee motivation. On this, Leibenstain (1957) develops a model for less developed countries in which worker's health and productivity depends on real wages paid. Solow (1957) follows suit and formulates a model in which increased wages increase morale and directly affect productivity through work effort. Similarly, Bulow and Summers (1986) develop a model of dual labour markets that shows that employers might find it optimal to pay more wages to their employees to elicit more work effort. By increasing wages, firms are actually increasing the cost of job loss and encourage workers to make more effort. Shapiro and Stiglitz (1984) provide a detailed account of the wage efficiency hypothesis. According to this model, workers have no incentives to shirk, for they know the cost of unemployment is very high. Wages in this case serve to allocate labour and provide incentive for employee efforts conditional on employment. The worker has a choice to exert more effort or shirk, such that the utility function of wage and effort is as:

$$u(w, e) = w - e \quad (6)$$

Where e is effort and is 0 or a constant; $e > 0$ since a worker must decide to put more effort or shirk; and w is wage at any given level. The worker's objective function is:

$$\max E\left[\int_0^{\infty} u\big(w(t), e(t)\big)\exp(-rt)\vartheta t\right] \quad (7)$$

where *r* is the intertemporal discount rate.

Firms are justified in offering higher wages to employees for as long as increased productivity is guaranteed.

Dickens (1986) provides another basis for higher wages. His model is similar to the wage efficiency model but states that firms may pay higher wages to avoid a threat of collective bargaining. Most government employees are unionized, which explains the high public sector wage bill. In many capitalist economies the right of worker's unions is often restricted, giving less brokering powers to

workers. It can be argued that this is done to minimize the bargaining power which often leads to wage increases.

Efficiency wage theories provide different reasons as to why firms opt to pay workers high wages. These reasons include an aim to minimize chances of collective bargaining; to motivate and encourage worker moral; and to attract higher quality pool of applicants. On the supply side, workers exert a lot of effort, thereby improving productivity, fearing that if they shirk the result is job loss. These models can also be used to explain wage differential across industries. Many firms and governments have relied to some of these models in determining a market clearing wage, especially in OECD countries, whilst in many countries, South Africa included, public sector wages are largely and notably influenced by political dynamics and union demands.

2.3 Empirical literature: Public wage expenditure and economic growth

Governments whose public service wage bill is relatively high are often faced with two options in trying to contain a further increase: cut wages or reduce the number of public servants. However, these options come with heavy consequences. A wage cut means less income for workers and less consumption and saving by consumers; reducing the number of public servants means job losses and thus more unemployment and poverty. Lamo et al (2016) find that when fiscal consolidation is implemented during economic distress, contractionary effects from employment cuts are more damaging than those from public wage cuts. Government job cuts are associated with the highest output losses and the least impact on deficit reductions, whilst wage cuts are found to be a less destructive way of cutting the budget (Bernperoglu, 2013).

In this case, the major question that has attracted interest for empirical analysis is what happens to economic growth when governments opt for expenditure consolidation on the public wage bill. Generally, there is division in the empirical literature on the government expenditure-growth nexus. A notable number of studies have disaggregated government expenditure to precisely measure the impact of each component on economic growth and output. This is important, because governments do not allocate equal portions of the budget to all expenditure components, depending on the size of government. Alesina and Perotti (1997) finds fiscal adjustments that rely on spending cuts on transfers and government wage bill to be expansionary, having better chances of success. Similarly, Gupta et al (2002) finds that countries where spending is concentrated on wages to register lower growth than those who allocate higher shares to capital and non-wage goods and services. Trost et al (2015) observe similar findings for Slovenia. Where higher wage expenditure is accompanied with cuts in non-wage spending, crucial spending for economic growth and poverty reduction, such as public infrastructure or social protection can be crowded out, and intended fiscal balance compromised (IMF, 2015). Eckardt et al (2014) find that a 1 percentage point increase in public wage bill, as a share of GDP, increases the fiscal deficit by half a percent. Similar findings are observed in Cahuc et al 2012 and Hernández de Cos 2012).

The reviewed theoretical and empirical models have served as a foundation and baseline to fiscal adjustments aimed at improving economic growth for many countries. Whilst wisdom from empirical literature reveals a positive relationship between high wages and economic growth, there have been few studies investigating the relationship between expenditure on the public sector wage bill and economic growth (Alesina and Perotti, 1997; Trost et all, 2015). We study the long-run and short-run impacts of public wage bill expenditure on economic growth using the autoregressive distributed model.

3 TREND ANALYSIS

3.1 Public sector wage bill expenditure

South Africa is amongst the countries with growing expenditure on public wages whilst productivity and the economy remain steady with no significant growth. This is highlighted as one of the reasons the government has undertaken to impose a ceiling on public wage expenditure, aiming to reduce total employee compensation by at least ZAR 160 billion at least by 2023. The South African government pays salaries to about 1.2 million civil servants in total, costing the nation one third of the national budget. According to Stats SA 2019 the total number of people employed in the formal non-agricultural sector was 10.2 million in 2019, 18000 more than in the fourth quarter of 2018. Adding to this, it is reported in Quarterly Employment Statistics (2019) that the average monthly earnings in the formal non-agricultural sector were ZAR 22500 in the fourth quarter of 2019, which is a 0.6% increase from the third quarter of 2019. Figure 1 shows the trend in public sector employee compensation since 1983 using annual time series data obtained from the Stats SA data set. However, such an increase has been more rapid from 2006 through the 2008/9 period of global financial crises to the present.

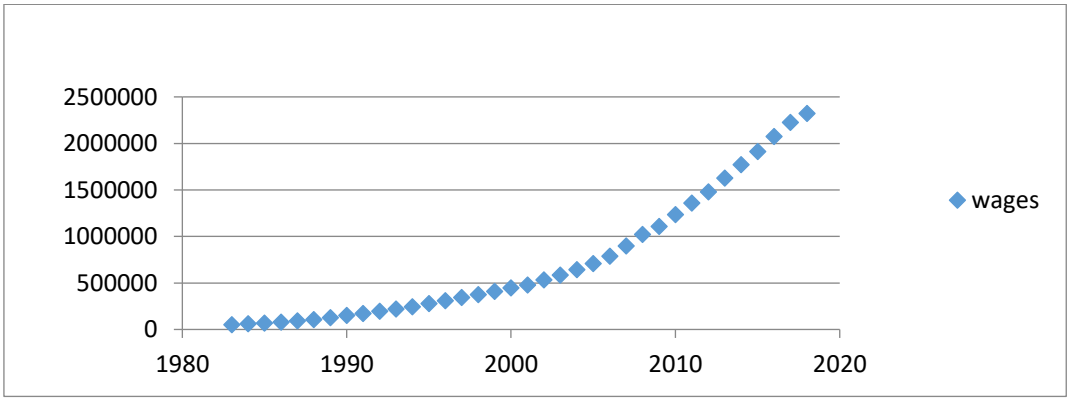

Figure 1. Public sector wage bill (in millions)
Source: Data from SARB online statistical query

In the 1990s, the South African labour force was largely made up of unskilled and semi-skilled workers, with skilled labour only a small minority. This was regarded as expensive by the government, for the cost of employment was relatively high. Post-transition the government rolled out a rightsizing project aimed at reducing the size of the public service workforce, particularly the unskilled workers. This was also done to cut the excessive costs associated with employing unskilled workers. This exercise resulted in an increase in the unemployment rate from 16.5% in 1995 to 26.7% in 2000 (Statistics SA 2015) This sparked political pressure from various facets of society, especially the unions. As a reaction, the government had to absorb most of the workers through an extended public works programme aimed at curbing further increase in the rate of unemployment. Adding to this were government's strategic measures to improve the standard of living for previously disadvantaged racial groupings and to eliminate the wage gap inherited from the apartheid era, as set out in the Reconstruction and Development Programme. This is the major reason for the rapid increase in public wage expenditure. However, even though that expenditure has been significantly rising, the unemployment rate remains high and increasing. This could mean more money is spent on comparatively few employees.

3.2 Composition of national spending

The public sector wage bill accounted for ZAR 694 billion in 2018/19, about 41.9% of total government expenses (Stats S.A, 2019). As Other expenditure items included 21.3% on the purchase of goods and services and 13.6% on social benefits. Other items accounted for the remaining 23.2%.

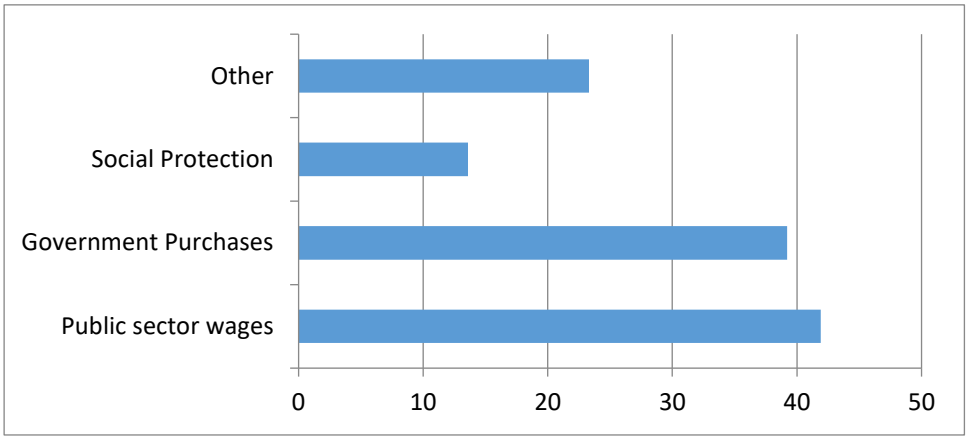

Figure 2: Composition of national spending (as a percentage of GDP)
Source: Data from Statistics South Africa.

What can be easily deduced from the available statistics is that public investment has been crowded out by either public wage expenditure or consumption expenditure. This is partly why the government will need to improve the composition of national expenditure through curbing non-interest expenditure in of attempt to stabilize national debt.

3.3 Annual GDP growth

South African annual GDP growth has maintained an overall steady outlook, with a severe decline of -2.1% in 1992, and -1.5% in 2009 during the global financial crisis. The highest significant growth in annual GDP recorded is 5.6% in 2006, as well as 4.3% and 4.2% in 1996 and 2000 respectively (World Bank national accounts data). The Thabo Mbeki administration obtained this by relaxing labour laws, cutting interest rates and raising government spending. Despite growing government expenditure on economic and social activities, there has been a gradual fall in economic growth since 2011, mostly resulting from a consistent fall in government services, mining and agricultural production. Problems experienced from the state-owned enterprises (SOEs) the mounting debt-to-GDP ratio and relatively high public wage expenditure were singled as major driers of the noted decline (Mboweni 2020). A further illustration is seen in Figure 3. The figure shows annual GDP per capita growth from 1990 to present. Statistics SA (2020) reports a further fall in GDP as countries implement lockdown regulations to curb the spread of corona virus. Some of the factors that have largely contributed to pre-2020 economic underperformance include poor performance from transport, government services, communication, forestry and fishing, as well as trade, catering and accommodation. The Eskom load-shedding which has been implemented in the recent past may be a major contributing factor to some of the challenges faced by these sectors. The largest power utility in South Africa, Eskom, undertook to implement planned blackouts in an attempt to ration power provision because of its inability to meet demand.

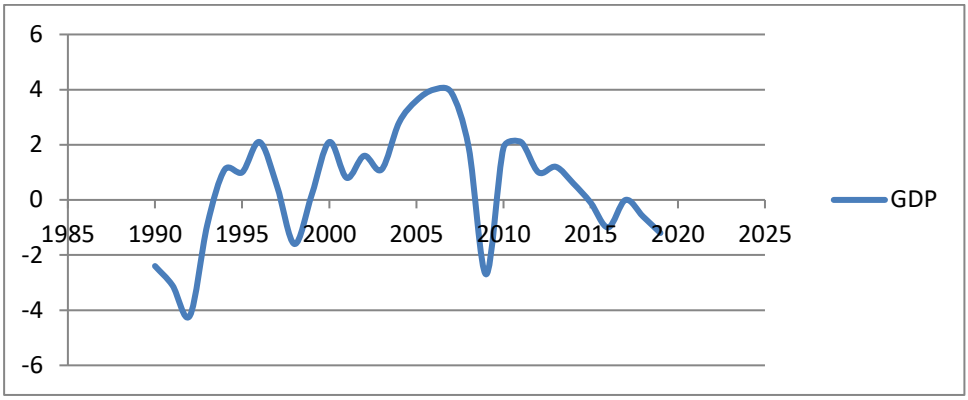

Figure 3: Annual GDP per capita growth
Source: Data from SARB online statistical query.

The state of the SOEs, which has largely contributed to high and recurring increase in debts, is one indication that the growing expenditure on the public wage bill has not translated to improved government services and subsequently productivity. This leads policy makers to three basic questions: Has the growing wage expenditure increase been justified in terms of services and productivity? How will the proposed expenditure ceilings on the public wage bill affect economic growth? And what measures can be employed to contain the mounting expenditure increase on the public wage bill?

It is against this background that a study responding to these questions must be conducted, with the aim of providing guidance to a new policy framework that should turn things around.

4 METHODOLOGY

4.1 Economic model

A number of classical theories accounting for increased productivity and economic growth have largely focused on mutual interaction on labour and capital dynamics, treating variables responsible for these dynamics as constants in the economic growth accounting framework. These variables include wages, profit, technical progress and healthcare provisions. There has only been a handful of studies dedicated to study the impact of these variables into economic growth.

In closing this gap, we modify a Kaldorian model of economic growth to include some of the various variables revealed by empirical literature to be significantly impacting productivity and economic growth, such as government expenditure on health, housing, and the public service wage bill.

$$Y_t = W_t + P_t; I_t \equiv S_t = K_{t+1} - K_t \quad (8)$$

where Y_t is national income over time t , W_t is wages, P_t is profit is I_t investment and S_t is savings.

From the above, wages are a difference between income and profits:

$$W_t = Y_t - P_t \quad (9)$$

$$S_t = \alpha P_t + \beta(Y_t - P_t), \text{where} 1 > \alpha > \beta \geq 0. \quad (10)$$

Where α and β show contributions of wages and profits to national savings.

$$I_t = K_{t+1} - K_t = (Y_t - Y_{t-1})\left(\alpha' + \beta' \frac{P_{t-1}}{K_{t-1}}\right) + \beta'(P_t - \frac{P_{t-1}}{K_{t-1}}) \quad (11)$$

where $\alpha' > 0, \beta' > 0$. Rearranging Equation 9 and 11, so that:

$\alpha^i = \alpha - \beta$ and $\beta' = \beta$

For the present study, we modify the models to include aggregate expenditure variables that affect economic growth: government expenditure on health and housing:

$Y_t = G_i + W_t + P_i$, where $G_i = G_1 \dots \dots \dots G_i$ (12)

4.2 Unit root test

Before estimating the ARDL and NARDL model, we test for stationarity of time series, using the Augmented Dicker-Fuller ADF test and Philipp Peron (PP) test. The unit root tests are performed at level and at first difference, where necessary, using Schwartz selection criteria and 1 lag with only an intercept. Traditionally, the augmented Dicker-Fuller test takes the form of the following regressions:

$$\Delta Y_t = \alpha + \beta X_{t-1} + \sum_{t=1}^{n} \beta_i \Delta X_{t-1} + \varepsilon_t \quad (13)$$

where α is an intercept and a trend. The null hypothesis for the unit root test is:

H_0 : β = 0, against an alternative hypothesis

H_1 : β < 0

If the test statistics is less than the critical value, we reject the null hypothesis, meaning there is no unit root in the series.

We supplement the ADF test by the PP test on the time series data. The advantage in using a PP test is that it is more robust and correct for serial correlation and heteroscedasticity that may exist in the disturbance. The PP test tests the null hypothesis that the time series is integrated of order 1,

H_0: P = 1

The PP test is given below:

$$\Delta Y_t = \alpha + py_{t-1} + \varepsilon_t \quad (14)$$

where ΔY is the first difference operator

4.3. Autoregressive distributed lag methodology

We adopt the ARDL of Pesaran et al (2014) to estimate short-run and long-run relationships, as well as the dynamic interaction of variables. The model is chosen because of its obvious advantages in investigating the long-run and short run co-integration between variables. The baseline ARDL model is given by:

$$\Delta logGDP = a_0 + \sum_{t=1}^{n} \alpha_{1i} \Delta \log W + \sum_{t=1}^{n} \alpha_{2i} \Delta logEi_{t-1} + \sum_{t=1}^{n} \alpha_{3i} + \Delta logI_{t-1} + \sum_{t=1}^{n} \alpha_{4i} + \Delta \beta_1 logGDP_{t-1} + \beta_1 \log W_{t-1} + \beta_2 \log E_{t-1} + \beta_3 \log I_{t-1} + \varepsilon_t \quad (15)$$

Where:Δ denotes the first difference; α_0 denotes a drift component; $\varepsilon_t$denotes a white noise residual; β_1 to β_3 denote long-run coefficients; α_1 to α_3 represent short-run dynamics of the model; and E_i represents the incorporated government expenditure components.

To establish the presence of a long-run association between variables, the bounds test is used. The bounds test is based on the F-test, which is used to test the hypothesis of the presence of co-integration, against nonexistence of co-integration in the variables (Pesaran, et al 2001). If the F-statistics fall below the lower critical value I(0), we reject the null; but if the F-statistics is above the upper critical value I(1) we fail to reject the null, indicating the presence of a long-run relationship. The bounds test tests if:

$$H_0 = \beta_1 = \beta_2 = \beta_3 \quad (16)$$

There is no co integration among the variables.

$$H_1 \neq \beta_1 \neq \beta_2 \neq \beta_3 \quad (17)$$

There is co-integration among variables.

In the presence of long-run co-integration amongst variables, we move to estimate the ARDL model for long-run coefficients, as well as short-run parameters, by estimating an error correction model associated with long-run coefficients. The ARDL based unrestricted error correction model is given by:

$$\Delta logGDP = a_0 + \sum_{t=1}^{n} \alpha_{1i}\ \Delta \log W_{t-1} + \sum_{t=1}^{n} \alpha_{2i}\ \Delta logEi_{t-1} + \sum_{t=1}^{n} \alpha_{3i}\ \ \Delta logI_{t-1} + \sum_{t=1}^{n} \alpha_{4i}\ + \sum_{t=1}^{n} + \sum_{t=1}^{n} \alpha_{5i}\ \Delta logGDP_{t-1} + \beta_1 ect_{t-1} + \varepsilon_t \quad (18)$$

Where β represents the speed of adjustment to equilibrium, which is expected to be negative and significant (-1 to 0).

4.3 Diagnostic tests

We use Lagrange Multiplier (LM) test statistics for all performed diagnostic tests in all regressions. In determining if all the standard errors of the variables are constant we use Breusch-Pagan. The test is used to test for coefficients for heteroscedasticity. The aim of the test is to determine if the conditional variance of the dependent variable (Y_t) given the independent variables (X_t) does not change with time *t.* We depart from an OLS assumption that:

$$H_0: E(u|X) = \emptyset^2 \quad (19)$$

To test this we allow for the following regression:

$$\widehat{\mu =}\ \ \beta_0 + \beta_1 x + v \quad (20)$$

The test is distributed at $nX^2$with k degrees of freedom. We assume heteroscedasticity if the test has a p-value below 0.05.

We use the Breusch-Godfrey test to test for the existence of serial correlation amongst the error terms. The test takes the following form:

$$\widehat{\mu t =}\ \ e_t - p_1 x\, e_{t-1} - \ldots - p_p e_{t-1} \quad (21)$$

The test assumes that μ_t is normally distributed. In this case we test the null hypothesis of:

$H_0: p > 0$ against the alternative hypothesis of:

$H_1: p > 0$

We test formality form in the estimated model using the Ramsey test. The test establishes if the non-linear combinations of the independent variables $(\beta x)^2$, $(\beta x)^3$ ... ... $(\beta x)^k$ have any power in explaining the dependent variable y. The test is given by:

$$y = \ \alpha x + \mu_1 y^2 \ldots \ldots + \mu_{k-1} y^k + \ \varepsilon \quad (22)$$

The null hypothesis is that all the coefficients of μ are equal to 0.

Lastly, we employ the Jarque-Bera test to test if the data is normally distributed. In this test the statistics has asymptotic chi-square distribution with two degrees of freedom. The test is denoted by:

$$JB = \frac{n}{6}\left(S^2 + \frac{K^2}{4}\right) \quad (23)$$

where *S* is the sample size, *K* is the sample excess kurtosis, and *n* is non-missing values in the data sample. We test whether the data is from a normal distribution:

$H_0: x \sim N(.)$

$H_1: x \neq N(.)$

4.4. Stability test

We test for a possibility of structural instability in the model using cumulative sum (CUSUM) and cumulative sum of squares (CUSUM) test. For the CUSUM test we test the statistics for each period t, under the null hypothesis that the statistics are drawn from a CUSUM distribution (t – k):

$$CUSUM_t = \sum_{i=k}^{t} W_{i+1,i} \quad (25)$$

where k is the number of parameters.

The null hypothesis:H_0 : W_m must be inside the corridor [$-L_m$, L_m]. We reject the null hypothesis if W_m cut either $-L_m$ or L_m

The null hypothesis is rejected at 5% significance level if CUSUM is below the 2.5 percentile or above the 97.5 percentile of the CUSUM distribution. In testing for random movements in the studied period, we use the CUSUM of squares as suggested by Brown et al (1975). The test uses the sum of recursive residuals which takes the following quantity:

$$S_m = \frac{\sum_{i=k+1}^{t} W_t^2}{\sum_{i=k+1}^{t} W_t^2} = \frac{S_m}{S_T} \quad (26)$$

Under the null hypothesis that S_m follows the Beta distribution, with mean E(S_m) = [$\frac{(m-K)}{(T-K)}$], which is expected to be within the corridor ±C +[$\frac{(m-K)}{(T-K)}$]. From this, *C* represents Kolmogorov Smirnov statistics. The null hypothesis of stability is rejected should S_m cross the corridors at a time where *t* = *m*. *m* represents the breakpoint, whilst *T* represents the total period.

5 EMPIRICAL ANALYSIS

For empirical analysis, we use time series data consisting of employee compensation, GDP, government expenditure on health, housing, education, social protection, public safety and order, as well gross capital formation all obtainable from South African Reserve Bank (SARB) online data set ranging from 1983 to 2019). All the variables are adjusted for inflation. Further description of the time series variables is shown in Table 1. We test for possible stochastic trends in the time series variables using PP and ADF tests. The tests are done at level and at first difference with only the intercept. We further test for serial correlation, heteroscedasticity, function form, normal distribution and model stability. Lastly we move to estimate the ARDL model.

Table 1: Description of time series

Code	Variables	Abbreviation
KBP6000	Compensation of employees	Logrwages
KBP6270	Gross Domestic Product	logrGDP
KBP4374	Consolidated Government expenditure on Health	Logrhealth
KBP4376	Consolidated Government expenditure on housing	logrhousng
KBP4373	Consolidated Government expenditure on Education	logrEducation
KBP4372	Public safety and order	logrPublic_s
KBP1053J	Gross capital formation: Investment	logrInv
KBP4375	Social protection	logrsoc

Table 2 represents descriptive statistics for all the variables. The series comprises 37 observations. As mentioned previously, we move to test for stationarity amongst the time series variables using the ADF and PP tests. The results are presented in Table 3.

Table 2: Descriptive statistics

Variables	GDP	wages	Investment	health	hsng	Public & order	Social protection
Mean	6.419373	3.536252	4.971972	4.898715	4.478323	4.839334	4.909669
Median	6.396342	3.757504	4.986266	4.832473	4.353225	4.827723	4.903527
Maximum	6.655668	4.059181	5.188115	5.287165	4.846471	5.191102	5.360665
Minimum	6.182334	2.637598	4.746840	4.572944	4.175145	4.321896	4.373084
Std. Dev	0.172449	0.520214	0.136921	0.235704	0.232594	0.281659	0.333203
Skewness	0.095351	-0.460852	-0.206624	0.338845	0.518731	-0.24026	-0.238882
Kurtosis	1.906687	1.600137	1.650846	1.669471	1.565081	1.802048	1.651571
Jarque-Ber	3.957021	4.330780	3.069442	3.437257	4.833620	2.568411	3.155050
Probability	0.138275	0.114705	0.215516	0.179312	0.089206	0.276870	0.206486
Sum	237.5168	130.8413	183.9630	183.9630	165.6980	179.0554	181.6577
Sum sq. Dev	1.070593	130.8413	0.674907	2.000034	1.947607	2.855943	3.996875

Using ADF and PP tests, we find that all the examined variables are stationary at first difference except for expenditure on wages which is stationary at level. It is important to highlight that the critical values of the F-statistics computed in Pesaran et al (2001) depart from the assumption that the variables are either I(0) or I(1), but may not be I(2). In light of the above, all the obtained results meet the conditions required for the application of the ARDL model. Results are given in Table 3.

Table 3: Unit root test results

Time series	ADF		PP	
Variables	Level	1st difference	Level	1st difference
GDP	-0.24	-3.54**	-0.28	-3.58**
Wages	-3.26**	-1.04	-3.26***	-1.04
Investment	-1.36	-3.93***	1.25	-4.00***
Health	0.51	-5.56***	0.50	-5.57***
Housing	-0.47	-6.84***	-0.41	-6.79***
Education	-0.48	-5.80***	-0.48	-0.58***
Public safety and order	-1.45	-3.19**	-2.49	-5.39***
Social protection	-1.15	-7.68***	-0.95	-8.29***

*Note: ***, **, * represents 1%, 5% and 10% respectively.*

Having established the order of integration in the considered series, we move to check for co-integration using the bounds testing procedure. The results are shown in Table 4.

Table 4: Co-integration test ARDL model

Level of significance	I(0)	I(1)	Decision
10%	2.37	3.2	Co-integrated
5%	2.79	3.67	Co-integrated
2.5%	3.15	4.08	Co-integrated
1%	3.65	4.66	Co-integrated

Note: Calculated F-statistics is 5.52

The results show evidence of a long-run relationship amongst variables, with calculated F-statistics (5.52) falling above the upper bound I(1), thereby guaranteeing co-integration at all levels of significance. These results are sufficient for the application of the standard ARDL. Tables 5(a) and 5(b) shows long-run and short-run coefficients obtained from estimating equation 15 and 18 respectively. The model is estimated using Akaike information criterion (AIC), with three lags for the independent variable and three lags for regressors.

Table 5(a): Long-run estimates (ARDL model)

Variables	Coefficients	Probability
Wages	0.09	0.005***
Investment	0.17	0.002***
Health	0.19	0.042**
Housing	0.00	0.880
Education	0.18	0.070**
Public safety and order	-0.20	0.058**
Social protection	0.24	0.000***

*Note: ***, **, * represents 1%, 5% and 10% respectively.*

We find positive and significant long-run estimates for most of our expenditure variables except for government expenditure on housing as well as public safety and order, which are either negative or not statistically significant. Particularly, we find a positive long-run relationship between public wage expenditure and economic growth against the widely assumed negative relationship. However, the impact of wage expenditure is significantly small in relation to economic growth compared to education, health, investment and social protection expenditures, indicating a possibility of a crowding out effect, as described in IMF (2015). There it is observed that, where higher wage expenditure is accompanied by cuts in non-wage spending, crucial spending for economic growth and poverty reduction such as public infrastructure or social protection can be crowded out, and intended fiscal balance compromised. In our case, GDP is likely to grow by 0.09% with every 1% additional to the wage bill. One major contributing factor to this small impact could be the steady, slow growth in government services as a percentage of GDP since the dawn of the democratic era. Government services have not registered significant growth in relation to GDP in South Africa, whilst education, investment in infrastructural development and social protection has positively impacted the country's economy through innovative invention, employment creation and poverty reduction. Consistent with our

findings, Gupta et al (2002) asses the growth effects of fiscal adjustments in a sample of low income countries and find that countries that allocate a major share of overall spending to wages register lower growth than those that allocate higher shares to capital and non-wage goods and services

The short-run estimates of the ARDL model are presented in Table 5(b). All the estimates are statistically significant. Similarly, we obtain positive estimates for most of our expenditure variables except for housing expenditure, which is negative but statistically significant.

Table 5(b): Short run estimates

Variables	Coefficient	Probability
Wages	0.02	0.001***
Investment	0.24	0.000***
Health	-0.04	0.086**
Housing	-0.05	0.000***
Education	0.68	0.000***
Public safety and order	0.12	0.002***
Social protection	0.14	0.000**
ContEq(-1)	-1.82	0.000***

*Note: ***, **, * represent 1%, 5% and 10% respectively.*

The results show a 0.2% increase in GDP with a 1% increase in wage expenditure. However, this impact is smaller than education, investment, social protection, and public safety and order expenditure. For example, a 1% increase in education and investment expenditures leads to a 0.68% and 0.24% increase in GDP respectively. It is important to highlight that there is great deal of literature in developed and developing countries that has observed a negative relationship between wage expenditure and economic growth. Eckardt et al (2014) find that a 1 percentage point increase in the public wage bill, as a share of GDP, increases the fiscal deficit by half a percent. Furthermore, they show that expansions on public wage expenditure are associated with deteriorating fiscal positions. This negative relationship is also observed in (Cahuc et al 2012 and Hernández de Cos et al 2012).

In light of these findings, it would follow that an effective management of the wage bill is needed. This can be achieved by linking the public wage bill to the country's fiscal objectives, to ensure sustainability. The wage determination decision is taken independent of the fiscal framework, the sustainability of which is often ignored or neglected. Secondly, efforts should be dedicated to improving the productivity of public servants to ensure efficiency in service deliveries.

To conclude the standard ARDL estimation, we conducted diagnostic tests and a stability analysis in our regressions. The results are shown in Table 6.

Table 6: Diagnostic test (ARDL)

Tests	Probability
Homoscedasticity	0.81
Serial correlation	0.12
Function form	0.84
Normality	0.32
CUSUM	Stable
CUSUM of sqrs	Stable

*Note: ***, **, * represents 1%, 5% and 10% respectively.*

We do not have a problem of heteroscedasticity and serial correlation in our regression. Residuals are normally distributed and function form is correct. Results from CUSUM and CUSUM of squares test confirm stability of the model.

6 CONCLUSION

The study employed ARDL to investigate the impact of the South African public service wage bill on economic growth. The study is motivated by current debate and government's call to impose a ceiling on growing public wage expenditure. By so doing, the government intends to contain mounting expenditure and bring about fiscal balance and stability. This study is important for South Africa, where government serves as a major employer and where rising wages have always been justified as a means to address race-wage gaps existing as a legacy of apartheid.

We do not find a negative relationship between wage expenditure and economic growth as it is widely assumed. However, the impact of the wage bill on economic growth is small compared to health, education, investment, public safety and order, as well as social protection. This is the case in both the short-run and the long run. This calls for an urgent need to improve the composition and efficiency of government spending. Resource allocation should match the government's fiscal objectives. Secondly, an effective management system for the wage bill is needed to ensure long-run sustainability. Linking the wage bill to the fiscal framework will ensure on-going monitoring and management. Lastly, efforts should be dedicated to improving the productivity of civil servants to ensure efficient service delivery.

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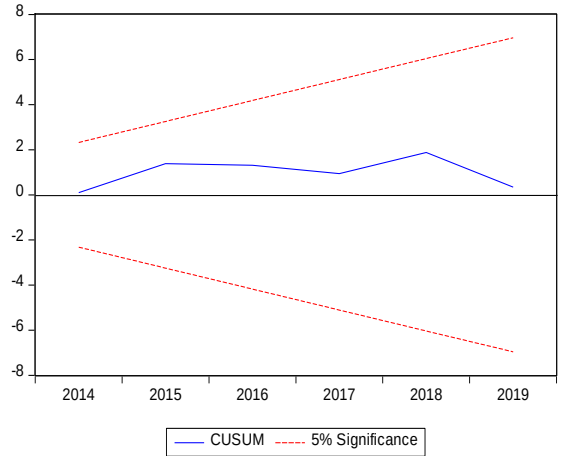
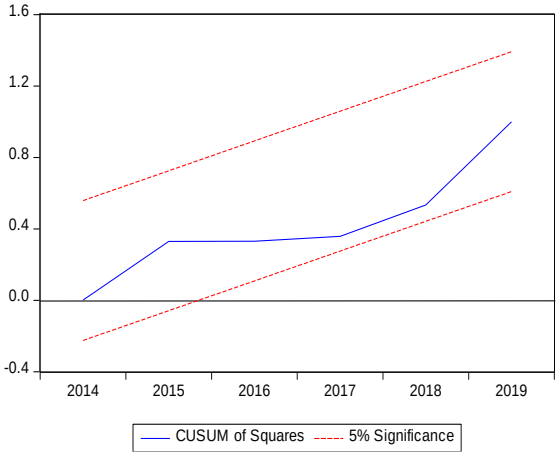
APPENDIX



Cusum test



Cusum of squares test

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