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The Relationship between Components of Budgetary Expenditure and Economic Growth in the Free State Province using Disaggregated Data

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Abstract: Government direct bulk of the fiscal allocation to social expenditures (health, education and social development) and current expenditure, yet economic activity is pervasively low relative to the faster growth in government expenditures in the Free State province. Some pertinent questions in the policy circle are: why does the growing government expenditure fail to support economic growth? Does social expenditures enhance economic growth? This paper seek to answer these questions by empirically assessing the relationship between major budgetary allocations and economic growth over the period 1994Q – 2016Q4. We employ the autoregressive distributed model (ARDL) to establish the long-run relationship and the Toda-Yamamoto non-Granger causality method to find the causative links among variables in a multivariate model. Evidence shows a long-run relationship between population per capita, government expenditures on education, health, current, transfers and subsidies and economic growth, but social and capital expenditures are not cointegrated with economic growth. In the long-run, economic growth Granger-causes government expenditures on health, social development and population per capita, while education expenditure and economic growth Granger-causes each other in both long-run and short-run. We find a bi-directional causality between education expenditure and population per capita, but a one-way causal flow from population per capita to economic growth. Further causality analysis indicates that economic growth Granger-causes capital, transfers and subsidies expenditures in both the short and long run, and vice-versa. Also, economic growth Granger-causes population per capita, and population per capita Granger-causes current, transfers and subsidies, in the short-run. Our analysis affirm that social expenditures influences economic growth, with education expenditures playing a more significant role. On the policy front, there is a need to raise public expenditures on social development programmes and provision of durable capital assets, which entails attracting foreign aid and external funding to support long-term growth.

JEL Classification: C32, E12, H55, O47, E62, O11

Keywords: Free State Province. Economic growth, Government expenditure, ARDL, Toda-Yamamoto non-Granger causality test

1. INTRODUCTION

The complex relationship between government expenditure and aggregate income is longstanding issue in the public finance and economic literature with a large body of empirical studies to unearth the dynamics of the underlying relationship. Up till now, neither the economic theory nor empirical evidence reported provides clear-cut conclusion on exact theory underpinning the government expenditure–economic growth (national income) nexus. In the literature, two main theories on government expenditure-economic growth nexus are Wagner’s Law (WL, hereafter) and Keynesian theory with opposing views². The ambiguity in the empirical

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² For example, studies testing the validity of the Wagner’s and Keynesian theories in the burgeoning literature for both the developed and developing countries are mostly yield mix results on the government expenditure-economic growth nexus. Some studies found evidence supporting Wagner’s Law (see, e.g., [Ram, 1986](#); [Ashan et al. 1992](#); [Oxley, 1994](#); [Hsieh and Lai, 1994](#); [Iyare and Lorde, 2004](#); [Akitoby, 2006](#); [Kalam and Aziz, 2009](#); [Narayan, 2008](#); [Loizides and Vamvoukas, 2005](#); [Kumar, 2009](#); [Islam, 2001](#); [Atasoy, 2016](#); [Costomitis, 1996](#); [Lamartina and Zaghini, 2010](#); [Sideris, 2007](#); [Durevall and Henrekson, 2011](#)), whereas, for example, [Landau \(1986\)](#), [Zammanian et al.](#)

literature has been attributed to different type of econometric model used, sample period, type of data (timeseries, cross-sectional or pooled time-series), model specification (bi-variate or multivariate), pre-test for unit root, presence of linear/nonlinear causative process, omitted variable bias, measures to account for variables, to mention a few (see, e.g. [Peacock and Scott, 2000](#), [Rao, 1989](#); [Oxley, 1994](#); [Shelton, 2007](#); [Herenkson, 1993](#); [Islam, 2001](#); [Christie, 2012](#); [Paleologou, 2015](#); [Ashan et al. 1992](#); [Holmes and Hutton, 1990](#); [Karagianni, 2009](#)).

On one hand, Wagner's law posit that an expansion in economic growth causes government expenditure rise, implying that the latter is in an endogenous factor in economic growth implying that government expenditure plays a passive role in the economy (Wagnerian approach). On this basis, public finance studies viewed government expenditure as a behavioural variable, same as private consumption (see, e.g. [Ashan et al. 1992, 1996](#); [Peacock Wise-Mann, 1961](#); [Goffman, 1968](#); [Musgrave, 1969](#); [Gupta, 1967](#); [Bird, 1971](#); [Mann, 1980](#)). On the other hand, the Keynesian proposition consider government expenditure as an exogeneous policy instrument intended to stimulate growth—a standard practice followed in macroeconometric models. From Keynesian viewpoint, government expenditure is an important fiscal policy instrument that play an active role in stimulating economic activity level. Based on the Wagner's view, causation runs from economic growth to government expenditure, while causality running in the opposite direction is consistent with the Keynesian conjecture. As a result of these divergent theories, the precise knowledge on the linear or non-linear causative link between government expenditure (and its components) and economic growth is an important to formulate and implement an effective policy (see, e.g. [Sigh and Sahni, 1984](#); [Loizides and Vamvoukas, 2005](#); [Holmes and Hutton, 1993](#)).

But, the endogenous literature argued that the exact effect of government expenditure on economic growth should be assessed by focusing on components of government expenditure, rather than using aggregate data since disaggregated government expenditure data will show differentiated effects of government expenditures on growth, and also produce a conclusive inference on productive or unproductive expenditures (see, e.g. [Barro, 1990](#); [Barro and Sala-Martin, 1992](#); [Barro and Sala-i-Martin, 1995](#); [Easterly and Rebelo, 1993](#)). In the endogenous theory, it has been noted that expenditures may differ in their outcome in the long run because certain government expenditures such as education and infrastructural services are expected to yield income in the longer run while others such as defence will not yield any additional income in the long run ([Babatunde, 2011](#)). Indeed, [Dritsakis and Adamopoulos \(2004\)](#) maintain that the growing expansion of fiscal activities can be associated with increase in demand for certain public goods such as social services, for example, education, health care and welfare, which has high income elasticity.

Against this backdrop, this present study builds on the recent empirical analysis by [Omshoro-Jones \(2015, 2016\)](#), who assessed the underlying relationship between government expenditure and economic growth in the Free State province (FS, hereafter) using provincial data, at aggregated level. Specifically, [Omshoro-Jones \(2015\)](#) investigated the relationship between government expenditure on the flagship public employment programme (expanded public works programme, EPWP) and economic growth in the FS province during the period 2005Q1-2013Q4, and finds no evidence for long-run relationship and causative link between

(2012); [Paleologou \(2015\)](#); [Holmes and Hutton \(1990\)](#); [Govindaraju et al. \(2011\)](#); [Omoke \(2009\)](#); [Babatunde \(2011\)](#)-all reported results confirming Keynesian theory. Others inferred a bi-directional (feedback effect) causality (see, e.g. [Singh et al. 1984](#); [Cheng, 1997](#); [Halicioglu, 2003](#); [Grenade and Wright, 2014](#); [Huang, 2006](#); [Narayan et al.2008](#); [Tasseven \(2011\)](#), and some studies found no evidence for both theories (neutrality effect), for example, [Huang \(2006\)](#), [Dogan et al. \(2006\)](#), [Sinha et al. \(2007\)](#); [Kesavarajah \(2012\)](#) among others. All these studies, mostly focused on aggregate data

variables in a multi-variate framework, in which unemployment rate and labour force participation rate were added as control variables, deploying the maximum likelihood Juselius-Johansen cointegration (1990) and Engle-Granger (1987) causality tests. In a follow-up study, Omoshoro-Jones (2016) examined the government expenditure–economic growth nexus for the FS province over the period 2001Q1 to 2014Q4 applying the ARDL-bound testing approach and Toda-Yamamoto non-Granger causality test in both bi-variate and multivariate frameworks, adding population as a third variable. Evidence from the five tested versions of the Wagner's law shows a bi-directional causality between government expenditure and economic growth, with a long-run income elasticity ranging from 0.99 to 1.2%, while variables are cointegrated in the long-run. Same evidence for a bi-directional causality between government expenditure and economic growth, with a long-run relationship was reported for South Africa by Ziramba (2008) and Odhiambo (2015), but test the validity of Wagner's view using aggregate data based on Gupta (1967) interpretation of Wagner's law.

This present paper contributes to the growing empirical literature investigating the relationship between components of government expenditure and economic growth surveyed in the next section. In this study, we empirically examine the relationship between major budgetary allocations and economic growth over the period 1994Q – 2016Q4 employing the novel ARDL-bound testing approach proposed by Pesaran et al. (2001) to establish the long-run relationship and the Toda-Yamamoto non-Granger causality method developed by Toda et al. (1995) to find the causative links among variables in a multivariate model.

This type of analysis is crucial for sub-national government such as the FS Province, first, given the challenging macroeconomic and socioeconomic conditions impeding a vibrant economic activity level in the domestic economy. Second, as a result of weak economic growth and ongoing fiscal adjustment (consolidation process) which requires, *inter alia* prudent fiscal management, curb wasteful expenditure, reduce the public sector size owed to growing wage bill, improve service delivery, as such the provincial government is faced with tough choices of implementing additional fiscal restraint, for example, which component of public expenditure should be cut? Health? Education? Infrastructure? The answer to these questions is not based on an *a priori* judgement but an empirical issue, and also contingent on the contribution of major budgetary allocations to economic growth. Third, since the provincial government bulk of its fiscal resources to social expenditures (health, education and social development) and current expenditure, still economic activity remains pervasively low relative to the faster growth in government expenditures in the FS province. Some pertinent questions in the policy circle are: Why does the growing government expenditure fail to support economic growth? Does social expenditures enhance economic growth? The answer to these policy-relevant questions is the main objective of this study.

Our paper is related to the burgeoning empirical literature attempting to explain the dynamic association between government expenditure and economic growth in sub-Saharan African countries, for example, in cross-sectional studies (Ansari et al.1997; Olurankinse and Alimi, 2014; Oteng-Abaiye, 2011) and country-specific studies (Menyah and Wolde-Rufael, 2013) for Ethiopia; Tsauri and Odhiambo (2013) for Zimbabwe; Thabane and Lebina (2011) for Lesotho; Mutuku and Kimani (2011) for Kenya; Kamasa et al. (2015) for Ghana. Much fewer studies have also focused on South Africa, see, e.g., Chang et al. (2004); Akitoby et al. (2006); Ziramba (2008); Alm and Embaye (2010); Menyah and Wolde-Rufael (2012) and Odhiambo (2015). Nevertheless, most of these studies testing the validity of the Wagner's Law used aggregate

expenditure, and annual data³. To the best of our knowledge, this is the first attempt to empirically analyse the relationship between the components of government expenditures and economic growth at provincial level, and also using disaggregated provincial government expenditure data in South Africa.

The remainder of the paper is organized as follows. Next section provides theories underpinning the government expenditure-economic growth nexus. The survey of related empirical studies is presented in [Section 2](#). [Section 3](#) presents some stylized facts on the trend of components of provincial government expenditures and economic growth in the FS province. [Section 4](#) presents the framework for empirical analysis and model specification. [Section 5](#) gives the analysis of the empirical results, and [Section 6](#) concludes and discusses the policy implication of findings.

1.1. Theoretical Background

In the theoretical literature, the nature of the possible relationship can be articulated based on theoretical conjectures proposed by Wagner's Law (1883, WL hereafter), Keynesian theory (1963) and the endogenous growth theory. While Keynesian and endogenous growth postulations emphasize the active role of government in the economy through expansionary fiscal policy to stimulate economic growth, nonetheless, WL suggested that role of government expenditure in the economy is passive.

Adolph Wagner was the first scholar to recognise, and empirically assess the relationship between public expenditure and national income⁴, and note that government expenditure tends to grow relatively faster than national income. This led to the popular Wagner's law of "increasing expansion of public and state activities", which posits that as real income increases, there is a long-run tendency for the share of public expenditure to increase relative to national income (Wagner, 1883). In other words, during the process of economic development, an increase in economic activity reflected in economic growth leads to a rise in government activity relative to private economic activity, resulting in considerable rise in public expenditure (see, e.g. Peacock Wise-Mann, 1961; Bird, 1971; Oxley, 1994).

Wagner posited three main rationales why government expenditure will grow faster than economic growth over time. First, as a country industrializes, government activity is substituted for private activity, requiring an increase in the administrative and protective functions of the state. Population growth, urbanization and the growing degree of complexity of legal relationships and communications will also create the need for public sector expansion. Second, several public services are income elastic (greater than unity), for example, education, cultural activities, health services and welfare expenditures. That is, as income increases, aggregate demand for public goods rises. Third, satisfying the growing technological needs of the population would require a scale of investment not likely to be undertaken by the private sector. Government participation is then necessary to finance these large-scale projects.

According to Atkinson and Stiglitz (1980) and Henrekson (1990), Wagner's Law has become a widely accepted stylized fact in public finance, where government expenditure (and its

³ These studies pre-test the timeseries data, identify for long-run relationships using cointegration tests such as Johansen (1995), Johansen-Juselius (1990), the traditional Engle-Granger 2-step procedure (1987), Gregory-Hansen (1996) structural break technique, and Pedroni cointegration test, and determine the causative process among variables in the short-run by employing, e.g., the Engle-Granger causality test, error correction model; Hutton-Holmes (1993); Baek-Brock (1990) non-linear causality test, Toda-Yamamoto (1995) non-granger causality test.

⁴ In this paper, government expenditure is interchangeably referred to as public spending/expenditure, while economic growth is referred to as national income due to the differing references in the extensive international literature.

components) are considered as a behavioural variable, playing a passive role in the economy. In the empirical sense, government expenditure (or its components) is treated as an endogenous factor in economic growth—an inevitable outcome of economic growth, with causality running from income to government expenditure. This theoretical notion finds supports in subsequent studies by [Bird \(1971\)](#), [Ram \(1992\)](#) and [Henrekson \(1993\)](#), among others. In general, these studies conclude that WL suggest a long-run equilibrium relationship between public spending and national income, especially in the developed countries, where the role of the public sector tends to grow in relative importance as per capita income increases.

On the contrary, [Keynes \(1936\)](#) asserts that public expenditure is an effective counter-cyclical policy tool to stimulate economic growth, for example, during economic recession. Thus, government plays an active role in the economy, and its expenditure becomes a key policy instrument with an innate stabilizing function via multiplier effect. In principle, the Keynesian theory perceives government expenditure as an exogenous policy instrument to promote economic growth through an expansionary fiscal policy in the short run, with causation from government expenditure to national income (economic growth) without feedback in the opposite direction. This theoretical idea holds true, for instance, high government expenditure is a useful during an economic recession (upswing) when government embarks on an expansionary (restrictive) monetary policy stance, which in turn, could raise aggregate production, demand for labour supply and job creation, and supporting economic growth via multiplier effect. In addition, an increase in aggregate demand relative to an increase in per capita income that positively affect productivity and employment growth will induce positive impact on output growth (economic activity). In fact, [Rodrik, \(1998\)](#) empirically showed that government expenditure tends to grow rapidly due to the need to mitigate the severe effects of idiosyncratic shocks pervading a domestic economy such as war and natural disaster.

However, the endogenous growth literature stressed the importance of government activity (policy) on economic growth, with main focus on the effectiveness of components of government expenditure as a productive or unproductive public spending depending on the impact of components of government expenditure on the long-term growth (see, e.g. [Barro and Sala-Martin, 1992](#); [Easterly and Rebelo, 1993](#)). Indeed, [Barro and Sala-i-Martin \(1995\)](#) maintains that the effectiveness of government expenditures as productive or unproductive is an empirical issue that cannot be defined as *a priori*.

Some studies in the endogenous theory have reported a positive effect of components of government expenditures on growth. For example, [Barro \(1990, 1991\)](#) and [Romer \(1990\)](#) empirically show that public expenditure on education as a component of human capital has a positive effect on economic growth in the long-run in their built endogenous growth models. More importantly, the endogenous growth theory recognizes human capital as a key determinant of economic growth since an increase in human capital stock of individuals improves productivity, which in turn, raises economic growth ([Narayan et al. 2006](#)). In reference to [Romer \(1990\)](#), the creation of new designs/ideas that underlie technological progress is a direct function of human capital reflected knowledge (education) accumulation. Therefore, public investment on human capital (education) that enhances research and development will raise physical capital, which in turn, stimulates economic growth indirectly. Indeed,

it is widely accepted in the literature that education generates positive externalities / spillover that foster social and economic development, for example, [Hansson and Henrekson \(1994\)](#) found a significant positive effect on growth from educational spending. Based on conventional wisdom, at the macro level, an economy with large proportion of educated labour force will be able to harness technological gain to improve productivity, innovation, business and entrepreneurial opportunities which indirectly increase economic growth. At the micro level,

education provides better income-earning prospects and access into the labour market – in particular those demanding highly skilled labour, as well as deepens individual's knowledge to make informed decisions/choices, in effect promote a cohesive and stable society. Evidently, education plays a crucial role not only for innovation but also in determining long-term growth.

On the other hand, it also been proven that public spending on health is a 'productive' expenditure that induce a positive effect on long-term growth (Barro, 1990). Hence, public investment in capital infrastructure, such as hospitals that provides an accessible adequate health care services will improve life expectancy and produce a healthy working labour force, which in turn, increase labour supply as production expands to support high economic growth. In support of this conjecture, Barro and Sala-I-Martin (1995) found that government expenditure in education, health, and other services could contribute indirectly toward raising the marginal productivity of private sectors via their contribution on human capital accumulation, implying that government expenditure on health and education can lead to greater productivity and national output.

2. LITERATURE REVIEW

Empirically, ample evidence have shown that government expenditure (and its sub-components) can have either a positive, negative or neutral effect on economic growth. For instance, Landau (1983) found a negative relationship between public consumption expenditures share in GDP and GDP growth rate per real capita based on data for 1961- 1976 from 96 countries. In another study, using a pooled cross-section regression model, Landau (1986) found government consumption expenditure (excluding military and educational expenditures) has negative effect on economic growth, but capital expenditure has a neutral effect on economic growth, while population growth rate negatively affect per capita GDP growth.

On the contrary, Barro (1989a) reported a negative relationship between government consumption expenditure (as a share in GDP) and economic growth, and, a weak link between the latter and government investment. In a subsequent study, Barro (1989b) reported a negative relationship between economic growth and investment proportions of public consumption expenditures per capita but a positive relationship between public investment expenditures and growth in dataset for 72 countries over the period of 1960-1985. In addition, Barro (1991) found a negative relationship between public expenditure and real per capita GDP (proxy for economic growth) when the human capital is accounted for, in a sample of 98 countries during the period 1960–1985 using regression analysis. Alike, Fosler and Henrekson (2001) affirms that high government expenditure negatively affects growth in a panel study over a period of 26 years, and Henrikson (1994) concludes that government transfer payments and government consumption expenditures are both negatively related to total factor productivity and economic growth, while government investment expenditure does not have any impact on total factor productivity.

Nevertheless, in a production function framework, Ram (1986a) finds a positive impact of total government expenditure on growth in a sample of 115 countries over the period 1960-1980, asserting a positive externality effect and higher factor productivity in the government sector than the productivity in the rest of the economy. Grier and Tullock (1987) used pooled cross-section regression with data for 115 countries including 24 OECD countries in the post-World War II period), and finds a significantly negative relationship between the growth rate of real GDP and government consumption's share of GDP. Aschauer (1989) reported same finding confirming the positive relationship between public investment and output growth. Nevertheless, Komendi and Meguire (1985) found no evidence of significant relationship between the average growth rate of real GDP and government expenditures in a sample of 47 countries over a 20 year period after the World War.

But, the findings of these earlier studies, particularly [Landau \(1986\)](#) and [Ram \(1986a\)](#) have been criticised by [Rao \(1989\)](#) premised on the inability of these authors to account omitted variables problem, biased standard error, nature and direction of causal flow in the applied econometric modelling approach resulting in erroneous inference on significance test, parameter nuisance and spurious regression. Thus, it is a widespread approach in the contemporary studies assessing the government expenditures-economic growth nexus, to test for long-run relation, and intertemporal causative link in the short-run underlining the government expenditures-economic growth nexus using variety of sophisticated econometric techniques.

Surveying recent studies, beginning with cross-sectional studies on developed countries; [Kolluri \(2000\)](#) deployed the Engle-Granger (EG, hereafter) cointegration test and an error correction model (ECM, hereafter) to uncover long-run and short run dynamic relationship between economic growth and total government expenditure, government consumption and transfer expenditures in the G7 countries over the period 1960-1993, and finds a positive and statistically significant long-run income elasticities greater than unity for all the components of government expenditures consistent with Wagner's view, except for government consumption in the US. By implication, public expenditures tends to grow faster than national income in the G7 countries.

[Devlin and Hansen \(2001\)](#) found a bi-directional causal flow between health expenditure and national income in a sample of 20 OECD countries. [Magazzino \(2012a\)](#) added budget deficit as a third endogenous variable, and finds concrete evidence supporting Wagner's view as economic growth Granger causes sub-categories of public spending in 27 European countries during the period 1970 to 2009 using the EG and Johansen-Juselieus (JJ, hereafter) cointegration methods, providing concrete support for the evidence reported by [Magazzino \(2012b\)](#), who assess the link between economic growth and wide array of components of public spending (which includes public expenditures on: general public services, defence, public order and safety, economic affairs, environmental protection, housing and community amenities, health, recreation, culture and religion, education, and social protection) in the Euro area over the period 1990-2010. Obtained results shows a long-run relationship between economic growth and public spending on defence, housing and community amenities as well as recreations, culture and religion), whereas, the deduced inference on the direction of causality was mixed, without any evidence supporting Keynesian view⁵.

[Afxentiou and Serletis \(1996\)](#) examine the convergence between sub-components of government expenditure in the European Union during the period 1961 to 1991 in a Barro-type regression of a modified production function approach, and also deploying the EG cointegration and Granger causality techniques. Their results failed to corroborate Wagner's view based on the evidence of no long-run relationships, and a bi-directional causal flow between the sub-categories of government expenditures and economic growth. They also note that except in a few cases, there is no evidence of convergence between government consumption, transfers, subsidies and their aggregates (all measured in real per capita).

[Alexiou \(2009\)](#) consider the relationship between national income and components of government expenditure in seven transition economies in the South Eastern Europe during the period 1995-2005 using a pooled cross-sectional analysis (with fixed effect) within the production function framework, and finds that disaggregated expenditures on: capital formation, development assistance, private investment and trade-openness all have positive and significant effect on economic growth, however, population growth has no significant economic impact on the latter.

[Khan et al. \(2015\)](#) analysed the impact of social expenditures (education, health and social welfare) and economic growth in Australia and New Zealand over the period 1980 to 2012⁶.

⁵[Magazzino \(2012b\)](#) reported Granger causality tests supporting Wagner's Law for five countries (Austria, Germany, the Netherlands, Portugal, and Spain); bi-directional causality is confirmed in five cases (Cyprus, France, Greece, Ireland, and Slovenia), and no causality (neutrality) is found in 7 countries (Belgium, Estonia, Finland, Italy, Luxembourg, Malta, and Slovakia).

⁶ This author deployed the JJ cointegration test and ECM framework to test for long-run relationship and short-run dynamics.

Their results shows that social expenditures positively affect economic growth in both countries, but variables are not integrated. The ECM results suggest a unidirectional causality running from economic growth to health expenditure, and social expenditure to economic growth in Australia, as well as a one-way causality running from education expenditure to economic growth, health expenditure to education expenditure, economic growth to health expenditure, and education expenditure to budget deficit. This finding generally affirm that social welfare expenditures Granger causes economic growth in the European countries.

On cross-sectional studies focusing on developing countries, for example, Abdullah *et al.* (2007) deployed a fully modified ordinary least square (FMOLS) regression method, to study the long-run relationship between fiscal policy variables and economic growth for 13 Asian countries⁷, and found a positive and statistically significant impact of health and education expenditure, total government expenditure on real per capita GDP, whereas, defence expenditure, distortionary taxation, budget balance and population growth has a significant negative impact on real per capita GDP (measuring economic growth).

Using pooled data for 43 developing countries spanning 1970 to 2009, Deverajan *et al.* (1993) considered wide range of government expenditures and their impact on real per capital GDP⁸. Their findings indicates a statistically significant negative between relationship between capital expenditure and per capita GDP, while current expenditure has positive and statistically significant effect. At disaggregated level, public expenditures on health and education have an insignificant adversely affect economic growth. The authors concludes that seemingly productive expenditures such as capital, transport and communication, health, and education can have a negative or an insignificant relationship with economic growth. In other words, productive expenditures can become unproductive when in excess. The result of Deverajan *et al.* (1993) contradicts the findings of, for example, Easterly and Rebelo (1993) and Aschauer (1989). Easterly and Rebelo (1993) finds that public investment in transport and communications in developing countries leads to higher economic growth in a cross-country study. While, with a particular focus on the United States (US) during the 1949-1985, Aschauer (1989) reported that public investment spending on 'core infrastructure' (i.e. streets, highways, airports, mass transit, and other public capital) tends to raise private-sector productivity, implying that government expenditure public infrastructure is needed to stimulate economic growth.

In panel dataset for 30 developing countries spanning 1970 to 1989, Bose *et al.* (2007) analyse the impact of government expenditures on economic concentrating on disaggregated public expenditures, and finds that capital expenditure have a significantly positive effect on economic growth, while current expenditure exert an insignificant effect. At disaggregated level, both government investment and total expenditures on education have a sizeable positive influence on economic growth, when budget constraint and omitted variables are accounted for.

Lastly, Baum and Lin (1993) also examined the impact of three different types of government expenditures (defense, welfare, and education) on per capita GDP using cross-section data from developed and developing countries over the period 1975-1985. Their result shows aggregate government expenditures on education and defense expenditures has positive effects on economic growth, but welfare expenditures has an insignificant negative effect on economic growth.

On the country-specific studies; the results of Liu *et al.* (2008) is consistent with Keynesian view for the United States based on their analysis of the association between public expenditure and economic growth using both aggregate and disaggregate data (which includes: national defence, human resource expenditure, physical resources expenditure, net interest payment and other expenditure) for the United States. They conclude that the US government need to increase its investment on human resource expenditure to enhance economic growth.

Yilgor (2012) inferred a unidirectional causality running from total government expenditures, and disaggregated expenditures on current, transfer total expenditures to economic growth for

⁷ These countries include: China, Hong Kong, Korea, Japan, Indonesia, Malaysia, Philippines, Singapore, Thailand, Bangladesh, India, Pakistan, and Sri Lanka.

⁸ These authors used a simple ordinary least squares regression (OLS) model.

Turkey⁹ consistent with Keynesian view, but found no causal relationship between investment expenditures and economic growth. [Kunu and Hopglu \(2015a\)](#) considered the relationship of five components of government expenditures (i.e. current, capital, health, education and defense) and economic growth in Turkey, and obtained results only confirm long-run relationship between current expenditure and real GDP with causal flow from the latter to the former in both the long-run and short-run indicating that public spending on education, health, defense and public investment are not appropriate tools for stability policies¹⁰. In a follow-up study, the findings of [Kunu and Basar \(2015\)](#), confirmed the inference from previous studies on Turkey¹¹, their results provide evidence for cointegration among variables studied, with a positive and statistically significant relationship from expenditures on health, education, public investment and real GDP in the long-run, and also finds that government expenditures on health, public investment and current Granger causes real GDP in both the long run and short run without any causal flow in the opposite direction.

[Singh and Sahni \(1984\)](#) found mixed causal relations using aggregate and disaggregated forms of public expenditure for India over 1950-1981 period, with the relationship at the aggregate level being bidirectional. [Asgar \(2011\)](#) empirically analyse the effect of government spending in social sectors (i.e human capital – education and health, law and order, subsidies, economic and community services) on real GDP (per capita income) during the period 1974-2008 in Pakistan using a vector autoregressive model (VECM), and the obtained results indicate a positive relationship between government expenditure on human capital, economic and community services and economic growth.

[Bojanic \(2013\)](#) tested the validity of Wagner's theory in Bolivia over the period 1940-2010 by estimating nine functional forms of the WL. The applied Engle-Granger (1987) cointegration test confirmed the long-run equilibrium relations between sub-categories of government expenditures and income, while the result of the error correction model suggest a bidirectional causality between income and government expenditures (i.e. infrastructure, health and defence) but a unidirectional causality from education expenditures to income) in six of the estimated models.

Focusing on the Czech Republic, [Szarowska \(2011\)](#) explored the relationships between real GDP, total expenditures and array of disaggregated expenditures (which includes: general public services, defence, public order and safety, economic affairs, environmental protection, housing and community services, health, recreation, education and social protection) using annual data over 1995-2008. The results of the deployed Johansen cointegration test proved the existence of long-run relationship between GDP and total government expenditures and expenditures on public order and safety spending, and economic affairs spending, but found no long-run relations between health and education expenditures and economic growth. In addition, in the long-run, total government spending including expenditures on general public services, defense, economic affairs and education spending adversely affect growth (real GDP), while social protection is positive but weakly correlated to economic growth.

[Gurgul, Lach and Mestel \(2012\)](#) used both linear and nonlinear Granger causality tests to explore short run causative link between real GDP, total public expenditure and largest budgetary expenditures in Poland¹². They found a one-way causality running from public expenditures on health care and social security to real GDP growth, consistent with Keynes view, but no causal link between economic growth and public expenditures on administrative and security. This authors concludes that a rise in growth rate of health care or education and science expenditures can be linearly transmitted to the economic growth rate.

On the emerging market region, [Narayan and Smyth \(2004\)](#) examine the relationship between human capital and real income within a cointegration and causality using data for China

⁹ This author applied a VAR model and Granger causality test on annual data over the period of 1980-2010.

¹⁰ Authors applied Engle-Granger Causality Test and Johansen-Juselius Cointegration Test, with sample period 1990-2012.

¹¹ These authors employed the ARDL-bound testing approach for cointegration test and the ARDL-causality test to study short-run linkages among variables, using annual data for 1970-2012

¹² The linear and nonlinear causality tests used are the proposed augmented VAR-based modified WALD test proposed by [Toda and Yamamoto \(1995\)](#) and [Diks and Panchenko \(2006\)](#) respectively.

from 1960 to 1999. They test for cointegration employing both Johansen and Juselius (1990) and Gregory and Hansen (1996) methods. Their results shows that human capital and real income are cointegrated, and human capital Granger causes real income (i.e. a one-way effect) in the long-run, but there is a unidirectional causality running from real income to human capital, in the short run.

In a different study, [Narayan et al. \(2006\)](#) applied the ARDL-bound testing cointegration and error-correction model to test the causal relationship between real investment and tertiary education (measured as higher education enrolments and higher education graduates) and real national income in China using annual data over the period 1952–1999, and deduced that real income, real investment and tertiary education are cointegrated in the long-run when real investment is the dependent variable, but this equilibrium relations is inexistence if tertiary education or real income are treated as dependent variable. Further analysis reveals that, when real investment is the dependent variable there is unidirectional causality from real income to real investment, and also from real income to enrolments in higher education but there is no causal flow between enrolments in higher education and real investment, in the short run, whereas, where graduates is used as a proxy for tertiary education, causality runs interactively through the error-correction term from real income and tertiary education to real investment in the long-run but a bi-directional causality is noted between real income and tertiary education graduates.

On similar studies in the MENA region, [Alshahrani and Alsadiq \(2014\)](#) studied the effect of total government expenditures (and its components, which includes expenditures on housing, education, defense, health care, current and capital expenditures, and public investment, and private domestic investment) on economic growth in Saudi Arabia over the period 1969-2010¹³ within a modified two-sector production function framework proposed by [Ram \(1986a\)](#). They employed the and finds that capital, current, and total expenditures do not have a statistically significant effect on growth, but government expenditures on public investment, private domestic investment, education spending stimulate growth in the long-run, nonetheless, openness to trade and public spending on housing positively affect economic growth in the short-run.

[El-Mefleh and Shotar \(2008\)](#) deployed a VAR and Granger causality test to identify the determinants of economic growth among government expenditure, institutional settings, money supply, investment, inflation, education and the degree of economic openness, in Qatar over the period of 1984-2004. Findings from this study, indicates that government expenditure on education, investment, and monetary policy (general price level) shocks have moderate impact on economic growth, and limited evidence other variables influence growth.

[Mekdad, Dahmani and Louaj \(2014\)](#) investigate the effect of public spending on education on economic growth (per capita real GDP) in Algeria over the period 1974-2012 with the use of endogenous growth model which includes GDP, gross fixed capital infrastructure and labour force)¹⁴. The empirical results shows that government expenditures on education has a sizeable positive on economic growth, whereas, gross fixed capital infrastructure and labour force has a relatively lesser positive impact on growth.

[Al-shatti \(2014\)](#) examine the impact of components of public expenditure (i.e. current and capital expenditures on education, health, economic affair, housing and community services) and economic growth in Jordan over the period 1993 – 2013 employing the OLS regression method. The results of this study shows that current and capital expenditures on education, housing and community facilities had no effect on economic growth, but here is a statistically significant impact of the current expenditures on health, economic affairs, and housing and community facilities, as well as, of the capital expenditures on health and economic affairs on economic growth.

¹³These authors deployed the JJ cointegration test and a vector error correction model (VECM) procedure to test for long-run and short-run dynamics between variables respectively.

¹⁴ This author used JJ cointegration test and Granger causality test to determine long-run relations and short-run dynamics among variables.

In the literature, among sub-Saharan African countries, there is a rich empirical studies assessing the impact of government expenditures on economic growth using disaggregated data particularly in Nigeria. Reported findings in some of these studies provide strong support from Keynes view while others validates Wagner law.

On studies confirming Keynesian theory, amongst others, [Danladi \(2015\)](#) note a positively significant effect of recurrent expenditure on economic growth, but an insignificant positive effect of total capital expenditure on economic growth in the long-run. The causality test result indicates that total government expenditure, community and social services expenditures Granger causes real GDP in the short-run without any feedback effect, and a weak causality running from expenditure on administration to real GDP in Nigeria over the period 1980-2013, consistent with Keynesian theory¹⁵. [Sevitenyi \(2012\)](#) analysed the relationship and the direction of causality between government expenditure (and its components) and economic growth in Nigeria from 1961 to 2009; the deployed [Johanson \(1988\)](#) and [Juselius \(1990\)](#) cointegration test results affirmed a one-way causality running from total government expenditure to economic growth, supporting Keynesian theory, and at the disaggregate level Toda-Yamamoto (TY hereafter) non-Granger causality tests indicates that total capital expenditure including expenditures on administration, social and community services, economic services and transfers Granger causes real GDP in the short-run, with the exception of total recurrent expenditure. [Ighodaro \(2010\)](#) finds that economic growth and total government expenditure including its sub-component (i.e. public spending on community and social services, and general administrations) are cointegrated in the long-run, except when economic growth is treated as independent variable, while the Granger causality result mostly reveal a one-way causal flow from government expenditure (and its components) to real GDP in Nigeria during the period 1961-2007.¹⁶

On the contrary, [Ogbuagu and Ekpenyong \(2015\)](#) found government recurrent expenditure and capital expenditure and economic growth in Nigeria to be cointegrated in the long-run in the period spanning 1970-2014 using ARDL model which include net export and gross national savings (as a percentage of GDP) as endogenous variables. Other evidence indicate a positive (negative) long-run effect of recurrent (capital) expenditures on real GDP, while, the TY causality test reveals a unidirectional relationship running from GDP to government expenditure as predicted by Wagner theory. [Lawal et al. 2015](#)) used annual data of total government expenditure and gross domestic product from 1977 to 2012. The result of the [Johansson \(1988\)](#) and [Juselius \(1990\)](#) maximum likelihood failed to confirm cointegration between government expenditure and economic growth, however, TY causality test indicates that total government expenditure on agriculture, defence (security), transport and communication Granger causes GDP in Nigeria, in support of Wagner's law.

While, [Oyinlola and Akinnibosun \(2013\)](#) investigate the relationship between economic growth and disaggregated public expenditures (i.e. capital and re-current expenditures, public spending on administrative, community and social services and transfers) over the period 1970-2009, applying the Gregory-Hansen structural breaks cointegration test and the error correction model. Deduced inference from the specified models with control variables (government revenue and debt) confirmed Wagner's law in two out of five models in the long run. Specifically, long run elasticity results showed that economic growth does not translate to growth in recurrent expenditure, administrative and transfer expenditures, in contrast, economic growth leads to growth in capital expenditure and social and community service.

[Ibok \(2013\)](#) estimated six functional variants of Wagner's law in the Nigerian agricultural sector over the time period 1961 - 2012, analysing the association between agricultural capital expenditure (proxy for total public spending) and agriculture contributions to GDP (proxy for economic growth). In the specified models, agricultural population and budget deficit were included as endogenous variables. Obtained cointegration results confirmed a long run

¹⁵ This author make use of the Johansen cointegration and the Granger causality tests to determine long-run relationships and direction of causality among variables studied.

¹⁶ Author applied the Johansen cointegration and the Granger causality tests to establish long-run relationships and direction of causality among variables studied.

relationship between the sub-categories of agricultural capital expenditures and agricultural contribution to GDP, while the Granger causality test result affirms the validity of Wagner's law due to a one-way causal flow running from agricultural contribution to GDP to components of agricultural expenditures in the short-run.

Equally, [Ojong, Ekpo and Anthony \(2016\)](#) finds that total expenditures, capital and recurrent expenditures positively influence economic growth in Nigeria using OLS method with data covering the period from 1980 to 2012. By deploying the error correction model, [Chude and Chude \(2013\)](#) note that total government expenditure on education has a statistically significant positive effect on economic growth in Nigeria in the long run during the period 1977 to 2012. [Ogundipe \(2013\)](#) employed a two-sector production function framework akin to Ram (1986) to assess the impact of government recurrent and capital expenditures on economic growth during the period of 1970-2009, as well as the Johansen cointegration test and vector error correction model (VECM) to uncover the long-run and short-run relations among variables, and finds a statistically insignificant negative impact of the government expenditures on administration, economic services, and transfers on economic growth, but both education and health expenditures has a significantly positive impact on economic growth. Other results shows that a long-run equilibrium relationship between capital expenditure and economic growth, however, recurrent expenditure have no long-run relations with real output in Nigeria.

3. Stylised Facts: Government Expenditure and Economic Growth in Free State

The analysis in this section deals with the evolution of provincial government expenditure pattern on major budgetary allocations, with a special focus on social expenditures (education, health and social development) including current, capital and transfers expenditures. On the latter sub-category of public spending, current expenditures are payments for transactions within one year, whereas, capital expenditures are payments for non-financial assets used in production process for more than one year. Typically, current expenditure may include government expenses on administration such as wages, salaries, interest on loans, subsidies, transfers, and other expenses (i.e. consumption), maintenance, while expenses on capital assets is aimed at providing infrastructure facilities, such as roads, airport, education, telecommunication, electricity generation etc. are referred to as capital expenditure.

Government expenditure plays a crucial role in South Africa as stipulated in its *Constitution* – the country's universal legislative document. The disbursement of budgetary allocations usually followed a three-year expenditure period (i.e. Medium Term Expenditure Framework, MTEF) at the national and sub-national levels. The MTEF entails a planning period, where competing public spending based on the existing national government policies, for example, provision of service delivery, projects, public employment programmes, health care, education and infrastructures, are prioritised and monitored.

The prevailing socioeconomic dynamics in the Free State province necessitate a proactive intervention of the provincial government in its domestic economy via an expansionary fiscal policy to tackle the persistently high unemployment rate (32.6% in 2016), acute poverty and weak economic growth (0.6% in 2016). In the FS province, the government expenditure has increased substantially in absolute and relative terms during the past few decade. Audited financial data shows a rapid growth in total government expenditure from R7.4 billion in 2000/01 financial year to about R14.2 billion in 2005/06. This amount reached R20.9 billion by 2010/11 (growth of 48% from 2005), and grew by roughly 47% to R30.8 billion in 2016/17. By 2017/18, budgetary allocation stood at R35.6 billion growing by 14% from previous year.

It is worth noting that the faster growth rate of government expenditure during the reviewed period coincides with rising unemployment rate, poverty rate and low economic activity level attributed to weak output growth. For instance, FS experienced the highest unemployment rate of 34.7% in 2016 compared to 29.2% recorded in 2010. In the same period, labour absorption rate shrank from 40.9% (in 2010) to 40.2% in 2016, accompanied by a marginal growth in the labour force participation rate to 61.5% in 2016 from 58.4% in 2010 (Table 6 in the Appendix). Analysis of the labour market data generally confirmed the provincial government as the main source of formal employment¹⁷, indicative of limited private sector employment due to negligible private sector participation in the domestic economy.

As can be seen from Table 1, bulk of the budgetary allocation is channelled to social expenditure, namely education, health, and social development (EHS). Figure 1 depicts that expenditure on both education and health expenditures tend to grow at a faster rate than social development. Fiscal allocation to EHS rose steadily from 64% in 2001/02 financial year to about 85% in 2005/06, with the largest funding allocated to education (35-40%) while financial resources allocated to fund health care (22-24%) and social development (18 – 28%) is roughly half to one-third of expenditure on education.

Table 1: Components of FS government Expenditure as a share of total expenditure (%), 1999-2017

MTEF Year	Budgetary Allocations (% share) (per provincial departments) ^a			Expenditure on Social Services ^b (% share of Total)				Other Expenditure (% share of Total) ^b		
	Edu	Health	Soc.Dev	Edu	Health	Soc.Dev	Other function	Capital assets	Current	Transfers and Subsidies
1999/00	-	+	-	50	29	21	0	4	78	18
2000/01	40	24	-	50	29	21	0	6	76	18
2001/02	39	24	18	39	23	18	20	5	72	23
2002/03	36	23	22	37	22	22	19	4	68	27
2003/04	35	22	25	46	28	3	23	6	82	12
2004/05	34	22	27	45	29	3	23	4	85	10
2005/06	35	22	28	46	29	4	21	5	85	10
2006/07	43	28	4	43	28	4	25	9	79	12
2007/08	44	29	3	44	29	3	24	10	79	11
2008/09	42	28	3	42	28	3	27	12	75	13
2009/10	42	28	4	40	28	4	28	9	77	13
2010/11	40	29	3	40	29	3	28	6	77	16
2011/12	41	29	3	41	29	3	27	8	77	15
2012/13	41	30	3	41	30	3	26	10	77	14
2013/14	40	28	4	40	28	4	28	9	76	16
2014/15	41	29	3	40	29	3	27	6	81	13
2015/16	38	30	3	40	29	3	27	7	80	13
2016/17	38	29	4	39	29	4	28	3	85	12
2017/18	39	28	3	-	-	-	-	-	-	-

Sources: ^a Free State Provincial Treasury, In-Year-Monitoring (IYM) database

^b National Treasury, Provincial Budget Expenditure Review

Note: 1. FS = Free State Province; Edu = Education; Soc.Dev = Social Development

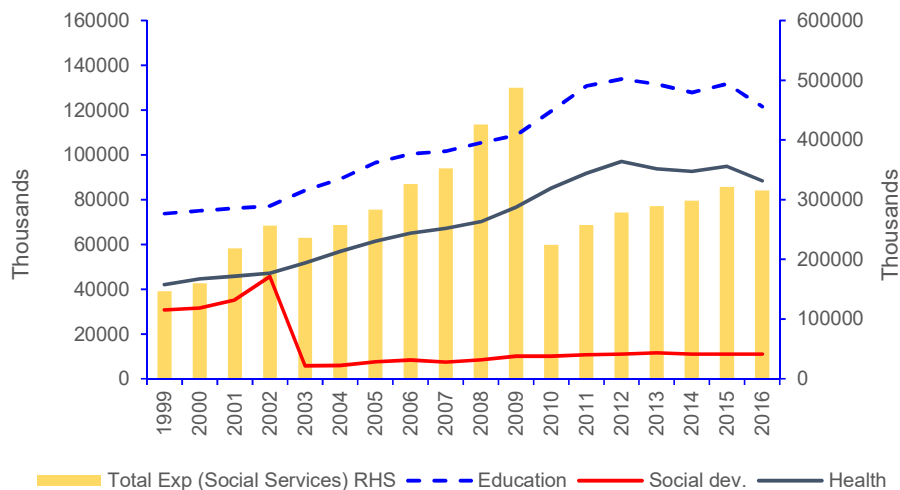
2. Total provincial expenditure on education, health and social development includes: compensation of employees (CoE), goods and services, capital assets and transfers and subsidies expenses.

3. Current expenditures include expenses on: CoE, goods and services, interest and rest on land asset; Transfers and Subsidies to: provinces and municipalities, higher institutions, departmental agencies, public corporation and private entities, non-profit organisations, and households, but excludes aid from foreign governments and international institutions; and Capital expenditures include payment on: building and fixed structures, machinery and equipments, heritage assets, biological assets.

¹⁷ See Quarterly Labour Force Survey (2017:Q4) published by Statistics South Africa (StatsSA)

More specifically, analysed audited financial data¹⁸ shows that total expenditure on social services increasing from R5.36billion in 1999 to about R13.2billion in 2007/08 period, with largest expenditure on health care (R2.7 billion), followed by education (1.58billion) and social development (1.16 billion) in 1999. By 2007/08 financial year, fiscal allocations to social services have doubled, with roughly R5.79 billion, 3.83billion and R426 million spent on education, health and social development respectively, while about R3.27 billion is spent on other socioeconomic challenges in the province as a result of the 2007/08 global economic recession. By 2016/17 financial year, combined fiscal allocation to education, health, social development stands at R11.8 billion, 8.65billion and 10.87 billion respectively, with 8.53bn expended on social services related projects. In the post-recession period (between 2011 and 2017), there is a notable growth in the allocation to social development which grew by 25%, compared to a muted growth in the provincial government expenditures on education (14%) and health (13%), in real terms.

Figure 1. Trend of FS Government Spending on Social Services, Real series: 1999 -2016



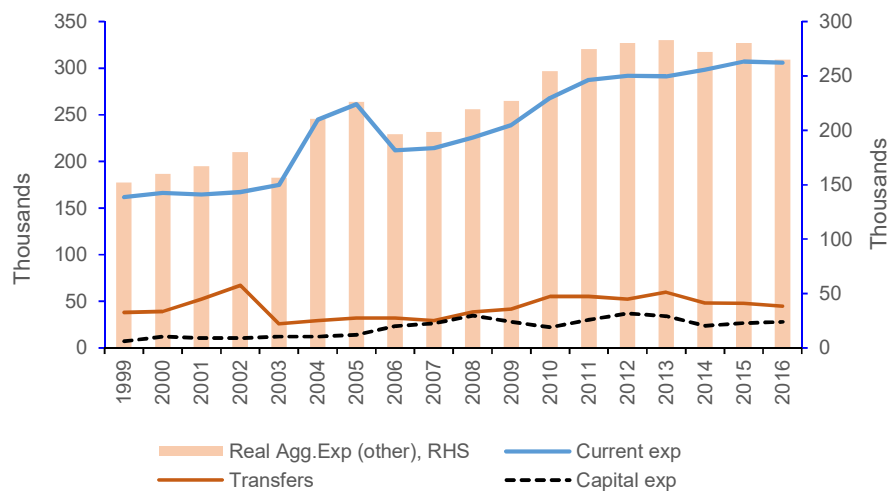
Data source: National Treasury, Provincial Budget Expenditure Review (own illustration)

On the other hand, expenses on capital assets, current and transfers expenditures is another important sub-category of provincial government expenditure that requires attention. Also, from Table 1, current expenditures usually absorb large chunk of fiscal allocation (about 75 – 85%), while spending on capital assets and transfers are marginal. Among these sub-components, the provincial government expenses on current expenditure grow more rapidly than both capital and transfers expenditures (Figure 2). Total expenditures on current, capital assets and transfers expenditure was R6.69billion in 1999, which doubled to R13.16billion in 2007/08, and R32.2 billion in 2016/17. During this period, current expenditure rose from R5.2billion in 1999 to R10.4 billion in 2007/08, and rose to R25.6 billion in 2016/17. Whereas, fiscal resources expended on capital assets was 1.23 billion in 1999, which grew to about R3.76billion in 2016/17, and expenditure on transfers increased from R230 million in 1999 to roughly 1.29 billion in 2007/08 financial year, but reduced markedly to R856 million in 2016/17. This sharp reduction in transfer expenditures can, partly be explain as a result of dwindling access to external funds (foreign

¹⁸ Audited data is available upon request. The financial data used for this analysis is extracted from the National Treasury Provincial financial database, mainly sourced from several *Provincial Budget Expenditure Review* (PBER) publications. This sourced data is benchmarked with the compiled audited financial data in the *In-Year-Monitoring* (IYM) database of the Free State Provincial Treasury (FSPT).

donors) in the province, deficient foreign investment, as well as, structural constraints in the South Africa domestic economy related to international investment downgrade.

Figure 2: Trend of FS Government Expenditure, Real series: 1999 - 2016



Data source: National Treasury, Provincial Budget Expenditure Review (own illustration)

On the economic front, it is worth noting that the economic growth trend in the FS province have been mixed in the since the 2000s. From [Table 6 \(in the Appendix\)](#), in 2002, the regional GDP was 4.9%, which is the highest growth recorded in the province, compared to the growth of 3.7% for South Africa. The re-integration of South Africa into the global economy leading to increased economic cooperation and trade ties, radical economic reforms reinforced with prudent fiscal management adopted by the democratic national government in the post-Apartheid era led to vibrant economic activities as productivity improves markedly, which culminate into steady growth of about 5% on average between 2005 – 2007, in contrast, growth in the province fell slightly to 4.2% in 2005, reaching 3.7% in 2007.

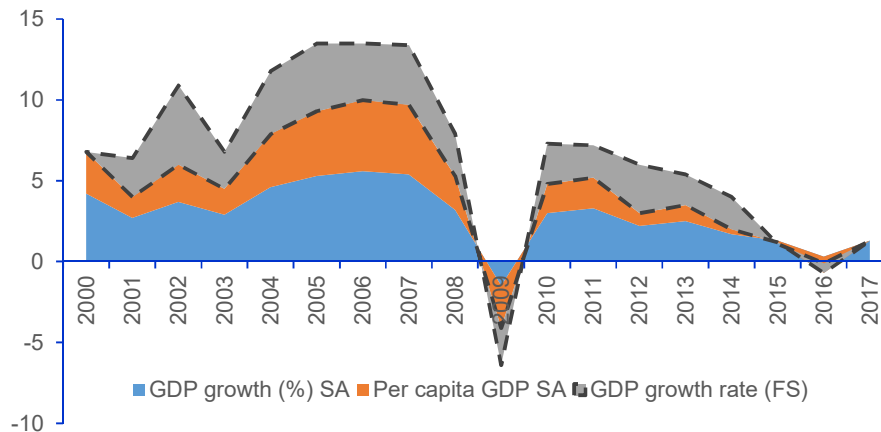
The impact of the 2007/8 global recession leads to sizeable decline in both regional and national economic activities, as provincial economic growth fell to -2.3%, but much pervasive decline of -1.5% in SA growth in 2009. However, the implementation of counter-fiscal measures shielded the domestic economy in the recessionary period, as a positive growth rate was recorded for South Africa and the province at 3% and 2.5% respectively. But, since 2011, there is a steady slump in economic activity level, for example, the national (provincial) economic growth fell sharply to 1.3% (-0.1%) in 2015. This observed decline in output, is attributable to myriad of structural domestic constraints such as: weak manufacturing growth, political uncertainties, electricity shortage (load shedding), investment downgrade (causing limited external financing and high cost of borrowing), sharp fall in global commodity prices (IMF, 2015) and the emergent severe drought since 2015. The cumulative effect of these domestic constraints resulted into technical recession in the country in 2016, causing the SA's growth fell to 0.3% and 0.6% in the FS province. ([Table 6 and Figure 3](#)).

Before closing this section, it is worth mentioning that our assessment provide some important insight: First, analysis of the disaggregated financial data accentuate the provincial government proactive effort to drive economic development mainly through education and health expenditures, but social development is poorly funded. This finding could partly explain unsuccessful effort of the provincial government to address the ever-increasing poverty and unemployment rates as budgetary allocation on social development is inadequate, for example, to support public employment programs ([see Omoshoro-Jones, 2014, 2015](#)).

Second, it is widely accepted in the existing literature, high public investment on capital assets boost economic growth, raise total factor productivity and a reducing effect on unemployment and poverty rates, particularly in developing countries ([see, e.g., Ascaheur,](#)

1989; Romer, 1990; World Bank, 1994; Chong and Calderón, 2001; Calderón and Servén, 2008; Estache and Fay, 2007; Estache and Garsous, 2013). Albeit, the government expenditure on capital asset since 2000, has been severely low. This deduction, partly shed some light on the low economic activity level and productivity growth in the province, and also, the rationale behind the ineffectiveness of an increasing provincial government expenditure to result into a tangible output and productivity growth. Thus, it is unsurprising that service delivery associated with physical infrastructure remains a significant challenge in the province. Lastly, it is crucial for the provincial government attract the much needed external financing to augment its fiscal resources, apart from the equitable share disbursed by the national government, and generated “own revenue” given the growing demand for durable public goods, lack of private investment and inaccessibility to external financing (i.e. foreign donor/aid) .

Figure 3: GDP growth rates (%), South Africa and Free State Province, 2000-2017



Data source: IMF (2018), World Bank (2018) and StatsSA(2018)

4. DATA, MODEL SPECIFICATION AND METHODOLOGY

4.1. Data

The financial data used in this study consists of six (6) components of budgetary allocation, which includes total provincial government expenditures on: education, health, social development, capital asset, current, and transfers and subsidies. Other key variables are: the regional gross domestic product (R-GDP measuring economic growth) and total population.

It is worth mentioning that the intergovernmental fiscal framework (IGFR) for disbursement of national revenue (as equitable shares) across the nine provinces and 294 municipalities in South Africa was fully established in 2000/2001 financial cycle resulting into the availability of limited historical financial data to undertake an econometric analysis. We circumvent common econometric problems in empirical modelling using small samples such as the loss of degrees of freedom, parameter nuisance and spurious regressions by using the linear interpolation technique to convert annual series (sample period 1999 to 2017) into quarterly data, generating a quarterly sample period 1999Q4 to 2016Q4. All nominal variables were deflated by the consumer price index (CPI, 2012=100) to obtain real variables. The real series of the GDP, CPI and the disaggregated provincial expenditure data were seasonally adjusted using ARIMA-X13 technique. Annual data on the R-GDP, CPI and population for the FS province were sourced from Statistics South Africa (Stats SA, at <http://www.statssa.gov.za>). Audited annual financial

data on the components of provincial government expenditures to be studied were retrieved from various issues of the Provincial Budget and Expenditure Review (PBER) publication by the National Treasury (NT, available at <http://www.treasury.gov.za/>), to ensure consistency, extracted data from NT is benchmarked against those reported in the *In-Year-Monitoring (IYM)* financial database of the Free State Provincial Treasury (FSPT, available at <http://www.dot.fs.gov.za/>). Statistical report on the correlation between key variables and descriptive statistics are provided in [Tables 8 and 9 in the Appendix](#).

4.2. *Model specification*

In this section, we attempt to resolve the ambiguity on the relationship between government expenditure (and its components) and economic growth in the extensive literature by investigating the relationship between government expenditure (and its components) and economic growth (national income) based on the opposing Wagnerian approach and Keynesian view. As discussed in section 1, the precise knowledge of the causal flow between government expenditure and economic growth enable policy makers to adopt and implement an effective policy since both Wagnerian and Keynesian propositions suggest an opposing intertemporal causal linkages in the short-run. While causation running from economic growth to government expenditures (and its component confirm Wagner's theory, but a causal flow from the latter to economic growth affirm the Keynesian theory.

As highlighted by [Oxley \(1994\)](#) and [Peacock and Scott \(2000\)](#), a central issue in testing Wagner's proposition is the choice of an appropriate model specification, thus we uncover the dynamic relationship between components of government spending and economic growth, accounting for the influence of population growth (i.e. demographic factor) in a progressive society as posited by Wagner's Law by specifying our empirical model based on the interpretation of [Goffman \(1968\)](#), who assumes that growth in per capita GDP causes in government expenditure rise at a faster rate relative to economic growth as an economy approaches a 'developmental or industrialisation phase'. In addition, we prefer the use of real government expenditure and real GDP (per capita) since the long-run elasticity of government expenditure with respect to GDP can be estimated, consistent with Wagner (1883) prediction of an income elasticity greater than unity ([Chow et al. 2002](#)).

As well, to ensure that our results is more reliable than those reported in prior studies, we add per capita population endogenously as a third variable in our theoretical model. The rationale behind this modelling approach are as follows: First, mainly to avoid the widespread econometric problems of specification bias ([Murthy, 1994; Paleologou, 2015](#))¹⁹, omitted-variable bias ([Ashan, et al. 1992; Shelton, 2007](#)) and wrong conclusion on the nature and direction of causality among variables inherent to bi-variate models (see, e.g., [Singh and Sahni, 1983; Loizides and Vamvoukas, 2004; Rao, 1989](#)).²⁰ Second, demographic factors (i.e. population growth rate) is considered as one of the main determinants of faster growth in government expenditure ([Alm and Embaye, 2011](#)). Based on convention wisdom, a growing population dominated by large proportion of young and elderly dependents will not only negatively affect output and productivity growth, but also raise social expenditure ([Garba et al. 2013](#)). In addition,

¹⁹ See [Murthy \(1994\)](#) for detail discussion on the importance of adding a third endogenous (control) variable in studies assessing Wagner's Law.

²⁰ Some studies have used different variables modelled endogenously as third variable, see, e.g., [Ashan et al. \(1992\)](#) included budget deficit and money stock variables; [Loizides et al. \(2004\)](#) added inflation into their computed multivariate models; [Halicioglu \(2003\)](#) used budget deficit to GDP ratio; Cheng, et al. (1997) added money supply; [Govindaraju et al. \(2011\)](#) used capital stock and labour and [Odhiambo \(2015\)](#) added unemployment rate.

Peacock and Wiseman (1961) asserts that population and taxes are vital exogenous variables that can significantly affect government expenditure²¹.

Third, the combined effect of a rapid population growth and urbanisation can lead to a permanent and sizeable increase government expenditure on social services due to an increase in aggregate demand for certain public goods such as health, education and social welfare (David and Velenchik, 1992). Fourth, Komendi and Meguire (1985) argued that population growth plays a major role in economic growth. High population growth, for example could have a negative impact on economic growth by influencing the dependency ratio, investment and saving behavior, and quality of human capital. Also, the composition of population has important implication on growth. A large working age population is deemed to accelerate growth, whereas population with many young and elderly dependents is considered as impediment (Grier et al. 1989). Lastly, in the theoretical endogenous growth model by Solow-Swan(1956), saving/investment and population growth rates are important determinants of economic growth (ceteris paribus) because a high population growth has a negative effect on economic growth simply because a higher fraction of saving in economies with high population growth has to go to keep the capital-labour ratio constant.

4.2.1. Empirical Framework

Following Goffman (1968) interpretation, the long-run relationship between components of government expenditures and economic growth is examined by formulating two theoretical models in a multivariate framework estimated as follows:

$$\text{Model 1: Wagner's Law: } GE_t = f(y / N_t, N / Y_t) \quad (1.1)$$

$$\text{Model 2: Keynesian theory: } (y / N_t) = f(GE_t, Y / N_t) \quad (1.2)$$

where GE_t is total government expenditure, (y / N_t) is per capital GDP and (N / Y_t) is population per capita, and t is the time period. Eq.1.1 and Eq.1.2 follows the Wagner's and Keynesian theories underpinning the government expenditure-economic growth nexus.

By incorporating the different sub-category of provincial government expenditures into the Eqs.1.1 and 1.2, take logs of both sides of the equations and also introduce the error terms to account for idiosyncratic factors (white noise), testable models to identify the relationship among variables can re-written as:

$$\ln EDU_t = \alpha_1 + \beta_1 \ln(y / N_t) + \pi_2 \ln(N / Y_t) + \varepsilon_{1t} \quad (1.3)$$

$$\ln HEA_t = \alpha_2 + \beta_2 \ln(y / N_t) + \pi_2 \ln(N / Y_t) + \varepsilon_{2t} \quad (1.4)$$

$$\ln SOC_t = \alpha_3 + \beta_3 \ln(y / N_t) + \pi_3 \ln(N / Y_t) + \varepsilon_{3t} \quad (1.5)$$

$$\ln CAPEX_t = \alpha_4 + \beta_4 \ln(y / N_t) + \pi_4 \ln(N / Y_t) + \varepsilon_{4t} \quad (1.6)$$

²¹ Few country-specific studies has also population variable in a multivariate set-up includes: Alexiou (2009) for South Eastern Europe countries; Bojanic et al. (2013) for Bolivia; Kalam et al. (2009) for Bangladesh; Permana et al. (2012) for Indonesia; Garba et al.(2013) for Nigeria, and Abdullah et al. (2007) for panel of Asian countries.

$$\ln CUREX_t = \alpha_5 + \beta_5 \ln(y / N_t) + \pi_5 \ln(N / Y_t) + \varepsilon_{5t} \quad (1.7)$$

$$\ln TRS_t = \alpha_6 + \beta_6 \ln(y / N_t) + \pi_6 \ln(N / Y_t) + \varepsilon_{6t} \quad (1.8)$$

where, EDU_t , HEA_t and SOC_t denotes real provincial government expenditure on education, health and social development; $CAPEX_t$ denotes of real expenditure on capital assets, $CUREX_t$ is real current expenditure and $TRNS_t$ is real transfers and subsidies expenditure, α_s, β_s, π_s are parameters to be estimated, ε_t is the serially uncorrelated random error terms and \ln is the natural logarithm.

Conversely, the Keynesian version of Eqs 1.3 to 1.8 is modelled as:

$$\ln(y / N_t) = \theta_1 + \ln \lambda_1 EDU_t + \ln \lambda_2 HEA_t + \ln \lambda_3 SOC_t + \lambda_4 \ln(N / Y_t) + \varepsilon_{7t} \quad (1.9)$$

$$\ln(y / N_t) = \theta_2 + \mu_1 \ln CAPEX_t + \mu_2 \ln CUREX_t + \mu_3 \ln TRS_t + \mu_4 \ln(N / Y_t) + \varepsilon_{8t} \quad (1.10)$$

Where, $\theta_s, \lambda_s, \mu_s$ are parameters to be estimated. It is imperative to note that, in Eq. 1.9 and 1.10, disaggregated government expenditure data are grouped into social expenditure (i.e. education, health and social development) and other expenses (capital, current, transfers and subsidies) mainly to obviate over (under) parametrisation and endogeneity problems in the specified models.

In the specified long-run models, we are guided by the theoretical notion that variables are cointegrated over a time period, indicative of a long-run relationship as predicted by WL (Ram, 1992; Henrekson, 1993). This presupposition is consistent with both the Keynesian principle and endogenous growth theories (Barro, 1991; Romer, 1996). But, empirical studies have shown that the existence of long-run relationship between government expenditure (and its components) and economic growth is insufficient to validate Wagner's theory, hence, the precise knowledge on the the nature and direction of causal flow between variables in the short run, determine the predominant theory underlying the relationship between government expenditures (and its components) and economic growth, as well as the effective fiscal policy to be adopted (Sigh et al. 1983; Holmes et al. 1990; Islam, 2001).

For instance, on the condition that are cointegrated validating a long-run relationship, in the short-run: a unidirectional causality running from per capita GDP to sub-components of total expenditures would confirm Wagner's view for FS province in Eqs. 1.3 to 1.8, whereas, a causal flow from per capita GDP to the disaggregated expenditure data, with any feedback in the opposite direction concretely affirms the Keynesian hypothesis in Eqs. 1.9 to 1.10. Nevertheless, an evidence of bi-directional causality between per capita GDP to the disaggregated expenditure data fails to support dominance of either the Wagner's or Keynesian view, but suggest a complex dynamic relation existing between economic growth (per capita GDP) and total government expenditures (or its components).

4.3. Empirical techniques

4.3.1. Establishing the Stationarity Properties of Variables

Prior to the 1990s, as noted in the introduction, many studies of Wagner's law used inappropriate estimation techniques when confronted with non-stationary time series data.²² Beginning with [Henrekson \(1993\)](#), [Oxley \(1994\)](#) and [Hondroyannis and Papapetrou \(1995\)](#) have tested Wagner's law employing the unit root and integration methodologies.

Moreover, macroeconomic time-series tends to contain unit roots usually dominated by stochastic trends ([Nelson and Plosser, 1982](#)), it imperative to ascertain the stationarity of a time series, thus the presence of a stochastic trend is determined by testing the presence of unit roots in time-series data. [Granger and Newbold \(1974\)](#) noted that the simulation that the F -statistic produced by a nonstationary time-series data do not follow the standard distribution. More importantly, the estimated regression coefficient will only reflect spurious correlation, which produces statistically significant results between series that contain a trend and otherwise random. Likewise, [Phillips \(1986\)](#) show that when the series are not stationary, the ordinary least squares (OLS) estimator is not consistent and the t and F statistics do not follow the known standard distributions. As a result of non-stationary series, the standard OLS regression method to become unsuitable since the usual t - and F -tests turn out to be meaningless while the significance of these tests are overstated leading to a spurious result ([Engle and Granger, 1987](#)). In most cases, non-stationary series become stationary after first differencing.

Both [Granger and Newbold \(1974\)](#) and [Phillips \(1986\)](#) have also proven that non-stationary time-series is would likely yield spurious conclusion in a linear causality tests. Thus, testing the stationarity properties of the time series to be used in our analysis, it is paramount to specify a parsimonious econometric model that produce robust results to draw accurate inference

We determine the stationarity properties of interested variables using the [Zivot and Andrews \(1992, ZA hereafter\)](#) structural break unit root test. The motivation behind this strategy are as follows: First, there is a possibility of structural breaks in the interested time series data to be used in our empirical analysis due to susceptibility of South Africa as small open economy integrated into the world economy via economic, trade and financial linkages; external shocks can be transmitted into the country from large economies (e.g. United States and China) with strong trade and financial ties. Intuitively, we suspect that global spillovers associated with the global economic recession of 2007 to 2009 and financial contagion of 2001 originating from the US that causes negative output growth, tight financial condition (high borrowing cost and limited access to external financing, exchange rate depreciation and sudden crash of the domestic stock markets, can manifest as structural breaks in the chosen macro-economic and financial variables. On this ground, carrying out a cointegration and causality tests without accounting for structural breaks in a time series data could yield wrong inference since there is a likelihood of significant variations (changes) in the relationship among macro-variables overtime.

Second, although several tests are useful to test for the presence of unit roots in time-series data as noted in the literature (see, e.g., [Dickey and Fuller, 1979, 1981](#); [Phillips and Perron, 1988](#); [Kwiatkowski et al. 1992](#)), nonetheless these unit root test are incapable of identifying structural break existing in the data. For instance, the conventional ADF test (like many other unit root tests) suffers from poor size and power properties especially in small samples ([Harris, 1995](#)). Further, the standard Augmented Dickey-Fuller (ADF) test does not accommodate

²² See, e.g. [Gupta \(1967; 1968\)](#), [Gandhi \(1971\)](#), [Ganti and Kolluri \(1979\)](#), [Mann \(1980\)](#), [Abizadeh and Gray \(1985\)](#), and [Ram \(1986a, 1986b\)](#).

structural breaks, and it is possible to wrongly reject the unit root hypothesis when time-series has structural breaks. Relatedly, Perron (1989) showed that failing to allow for an existing break, leads to a bias that reduces the ability to reject the unit root hypothesis, which is otherwise false. Several authors have proposed to overcome this problem by endogenously determining the breaks, for example, Zivot and Andrews (1992), Perron and Vogelsang (1992a), Barnejee et al. (1992)²³.

Based on the ADF test, Zivot and Andrews (1992, hereafter ZA) propose a procedure that allows for one structural break. They specify three models similar to (1.11) to (1.13) to test unit root with one structural break as follows:

$$\Delta x_t = \alpha_1 + \lambda_1 x_{t-1} + \kappa_{1t} + \theta_1 DU_t + \sum_{i=1}^m \omega_{1i} \Delta x_{t-i} + u_{1t} \quad (1.11)$$

$$\Delta x_t = \alpha_3 + \lambda_3 x_{t-1} + \kappa_{3t} + \theta_3 DU_t + \phi_3 DT_t + \sum_{i=1}^m \omega_{3i} \Delta x_{t-i} + u_{3t} \quad (1.12)$$

$$\Delta x_t = \alpha_2 + \lambda_2 x_{t-1} + \kappa_{2t} + \phi_2 DT_t + \sum_{i=1}^m \omega_{2i} \Delta x_{t-i} + u_{2t} \quad (1.13)$$

where x_t is a time series, Δ indicates the first difference of x_t , m is the number of lags variables to ensure stationarity of x_t such that the error terms u_t is white noise, and t is a time-trend, DU_t is a dummy variable for mean shift occurring at each possible break date (TB), and DT_t is a trend shift. These two variables are defined as:

$$DU_t = \begin{cases} 1 & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad DT_t = \begin{cases} t - TB & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases} \quad (1.14)$$

From Eq.1.11 to 1.15, similar to the traditional ADF test, the null hypothesis is $\lambda_1 = 0$ against the alternative hypothesis $\lambda_1 < 0$ ($i=1, 2, \text{ and } 3$). The date which corresponds with the least t value of the estimated parameter $\hat{\lambda}_i$ is chosen as the break data. A specified break date (TB) can be:

- An intercept break: $DU_t(TB) = 1(t \geq TB)$ (1.15)

Where, the value 0 for all dates prior to break, and 1 thereafter.

- Trend break: $DT_t(TB) = 1(t \geq TB) \cdot (t - TB + 1)$ (1.16)

Which takes the value 0 for all dates prior to the break, and is a break date re-based trend for all subsequent dates, and

- A one-time break dummy variable: $D_t(TB) = 1(t = TB)$ (1.17)

Which takes the value of 1 only on the break date and 0 otherwise.

Following Perron (1989), Perron and Vogelsang (1992a, 1992b), and Vogelsang and Perron (1998), we consider models for data with a one-time break, and specified ZA unit root test for

²³ See Perron (2006) for useful literature.

the Dickey-Fuller regression which correspond to different assumptions for the trend and break behaviour as follows:

Model 1: Trend data with intercept break:

$$\Delta x_t = \alpha_1 + \lambda_1 x_{t-1} + \kappa_t + \theta_1 DU_t(TB) + \phi_1 DT_t(TB) + \delta D_t(TB) + \sum_{i=1}^m \omega_{3t} \Delta x_{t-1} + \nu_{3t} \quad (1.18)$$

Model 2: Trend data with intercept and trend break:

$$\Delta x_t = \alpha_1 + \lambda_3 x_{t-1} + \kappa_t + \theta_1 DU_t(TB) + \phi_1 DT_t(TB) + \sum_{i=1}^m \omega_{3t} \Delta x_{t-1} + \nu_{3t} \quad (1.19)$$

Finally, the optimal number of lags is determined using the Akaike Information Criterion (AIC).

4.3.2. The ARDL-bound testing Approach

Next, we test whether variables are cointegrated in the long-run, i.e., exhibit a long-run relationship. In reference to [Engle and Granger \(1987\)](#) and [Toda and Phillips \(1993\)](#), ignoring the existence of cointegration in the series could lead to serious model misspecification. For our analysis, we employ the novel autoregressive distributed lag (ARDL) – bounds testing approach proposed by [Pesaran et al. \(2001\)](#). The ARDL – bounds test approach is preferred over other conventional cointegration tests models because of its several advantages:

First, the ARDL procedure yields a far more superior inference when using a finite sample or small sample data ([Narayan, 2005](#)) as is the case in this study, whereas, the traditional [EG \(1987\)](#) cointegration and the [JJ\(1988,1995\)](#) maximum likelihood tests typically suffers from small sample bias by failing to detect cointegration relationship ([Mah, 2000](#)). Second, the ARDL effectively deals with unit-root problems since the model is applicable irrespective of whether the underlying explanatory variables are integrated of order zero ($I(0)$ or one $I(1)$) ([Pesaran et al., 2001](#)), which remove the econometric burden of pre-testing data for unit-roots and establishing the order of integration of variables, a common procedure required when using the [JJ](#) cointegration test. Third, estimation is possible even when the explanatory variables are endogenous, and is sufficient to simultaneously correct for residual serial correlation ([Tang, 2004, 2005](#)), thereby avoiding the endogeneity problem and inability to test hypotheses on the estimated coefficients in the long run associated with the [EG](#) cointegration method. Similarly, the ARDL correct for serial correlation in residual is by allowing variables to have different optimal lags and include dummy variables that could account for any macroeconomic shocks or institutional differences ([Govindaraju and Rao, 2010:210](#)). This advantage is very crucial because according to [Rao \(1986:276\)](#) in the presence of contemporaneous variables, the inclusion of more lagged variables in a system, can cause the number of bi-directional relationships to drop quickly, in effect, reduce the ambiguous results supporting bi-directional causality. Fourth, the ARDL-bound testing approach have better statistical properties since it does not push the short-run dynamics into the residual term as in the [EG](#) cointegration method ([Pattichis, 1999](#)). Fifth, both the long-run and short-run parameters can be estimated simultaneously, however, the ARDL model is inapplicable when endogenous variable are $I(2)$ series.

In the light of our empirical aim, the ARDL – bounds testing approach is more suitable to use owing to small sample size of the selected variables, and the possibility of the inclusion of

dummy variables to account for structural breaks in the data ²⁴. We simultaneously examine both the long-run and short-run relationship as estimated in Eqs. 1.3 to 1.10 by employing the ARDL – bound testing approach based on the following unrestricted error-correction model (UECM):

ARDL Model 1 (for models testing Wagner's Law):

$$\begin{aligned} \Delta \ln Y_t = & \alpha_0 + \sum_{i=1}^l \alpha_1 \Delta Y_{t-i} + \sum_{i=2}^l \alpha_2 \Delta \ln X_{t-i} + \sum_{i=3}^l \alpha_3 \Delta \ln(N / Y_{t-i}) + \beta_1 \ln Y_{t-1} + \beta_2 \ln X_{t-2} \\ & + \beta_3 \ln(N / Y_{t-3}) + \mu_1 D1 + \mu_2 D2 + \mu_3 trend + \delta_1 ECT_{t-1} + \varepsilon_{1t} \end{aligned} \quad (1.20)$$

Where, Y denotes real disaggregated government expenditures (i.e. health, education, social development, capital assets, current, transfers and subsidies respectively) treated interchangeably as exogenous variables, X represent real GDP per capita and (N / Y) is population per capita as specified in the long-run models in Eqs. 1.3 to 1.8.

ARDL Model 2 (for Keynesian models):

$$\begin{aligned} \Delta \ln X_t = & \lambda_0 + \sum_{i=1}^l \lambda_1 \Delta X_{t-i} + \sum_{i=2}^l \lambda_2 \Delta \ln Y_{t-i} + \sum_{i=3}^l \lambda_3 \Delta \ln(N / Y_{t-i}) + \pi_1 \ln X_{t-1} + \pi_2 \ln Y_{t-2} \\ & + \pi_3 \ln(N / Y_{t-3}) + \mu_1 D1 + \mu_2 D2 + \mu_3 trend + \delta_2 ECT_{t-1} + \varepsilon_{2t} \end{aligned} \quad (1.21)$$

In Eq. 1.21, all notations are the same as those in Eq. 1.20, but the ARDL model is used for the specified long-run models in Eqs. 1.9 and 1.10, following the Keynesian proposition.

In equations 1.20 and 1.21, Δ is the first difference operator; α_0 and λ_0 are the constant; β_s and π_s are the long-run coefficients; $\alpha_1, \alpha_2, \alpha_3$ and π_1, π_2, π_3 represents short-run dynamics and ε_{1t} and ε_{2t} are the random variable that is white noise. Whereas, ECT_{t-1} is the lagged error-correction term obtained from the long-run equations and δ_s denotes the speed of adjustment.

It is worth mentioning that, although the error-correction term has been incorporated in all equations for explanatory purposes, however, only in estimated models where the null hypothesis of no cointegration is rejected will be estimated with an error-correction term (Narayan and Smyth 2006). Likewise, in contrast to the traditional Granger causality method, the ARDL model as an unrestricted error correction based-causality test (UECM) allows the inclusion of the lagged error-correction term derived from the long-run models, so that any long-run information lost through differencing is reintroduce in a statistically acceptable way (Menyah et al., 2012). The direction of causality in this case is determined by the F-statistic and the lagged error correction term.

In the above estimated equations, the evidence of a significant relationship in the first difference variables establish the direction of causality in the short-run, while a significant t -

²⁴ A large number of studies involving relatively small sample size have deployed the ARDL-bounds testing procedure. To mention a few, see Ziramba (2008), Menyah et al. (2012), Odhiambo (2015) for South Africa; Omoshoro-Jones (2016) for the FS province in South Africa; Babatunde (2011) for Nigeria; Narayan et al. (2006) for China; Atasoy and Gur (2016) for China; Huang (2006) for China and Taiwan; Amin (2011) for Bangladesh Pahlavani et al. (2011) for Iran; Menyah et al. (2013) for Ethiopia; Tsaurai et al. (2013) for Zimbabwe; Thabane et al. (2016) for Lesotho.

statistics on the ECT_{t-1} affirms the presence of long-run causality (Narayan et al. 2006). However, on the causative process, the results of the statistical testing can only be interpreted in a predictive but not in a deterministic sense. Simply put, the causality has to be interpreted in the Granger sense (Govindaraju et al. 2010:270).

Employing the bound-testing approach, cointegration is established among variables estimated in Eqs. 1.3 to 1.10, using the Wald F -statistic by restricting the estimated long-run coefficients to zero, while the asymptotic distributions of the test statistics are non-standard regardless of whether the variables are $I(0)$ or $I(1)$. Here, the test for the joint significance of the lagged values of the variables using the F -test where the null hypothesis of no integration defined as $[\beta_1 = \beta_2 = \beta_3 = 0 ; \pi_1 = \pi_2 = \pi_3 = 0]$ is tested against the alternative hypothesis of: $[\beta_1 \neq \beta_2 \neq \beta_3 \neq 0 ; \pi_1 \neq \pi_2 \neq \pi_3 \neq 0]$ and a t -test on the lagged level dependent variable (so that: $H_0 : \beta_1 = 0 ; H_0 : \pi_1 = 0$). The asymptotic distribution of the F -statistic is non-standard under the null and it was originally derived and tabulated in Pesaran et al. (2001) but modified by Narayan (2005) to accommodate small sample sizes. In the bound-testing approach, two sets of asymptotic critical values are provided – one when variables are $I(0)$ and the other for all variables that are $I(1)$. According to Pesaran et al. (2001), in testing for cointegration; if the computed F -statistic exceeds the upper critical bounds, gives a conclusive inference of a significant long-run relationship among variables without determining their order of integration. In this case, the null of no cointegration is rejected regardless of whether the series are $I(0)$ or $I(1)$. Alternatively, when the test statistic falls below the lower critical value, the null hypothesis is not rejected regardless of whether the series are $I(0)$ or $I(1)$. But, if the test statistic falls inside the lower and upper bounds, a conclusive inference cannot be made unless the order of integration of variables under consideration are known.

4.3.3. Toda-Yamamoto non-Granger Causality

According to Granger (1969; 1988), in a cointegrated system of two series expressed by error correction model representation, causality must run in at least one way. To test the robustness of our results we also carried out causality tests using the Toda and Yamamoto (1995, hereafter TY) version of Granger causality. This procedure has been found to be superior to ordinary Granger causality tests since it ignores any possible non-stationarity or cointegration between the series when testing for causality (Wolde-Rufael, 2005). In addition, the inference on causality based on the TY test is valid irrespective of whether a series is $I(0)$, $I(1)$ or $I(2)$, non-cointegrated or cointegrated of any arbitrary order, while the conventional Granger causality test is susceptible to erroneous inference (Ansari et al. 1997), and also suffers from nuisance parameter dependency asymptotically in some cases producing unreliable results (Babatunde, 2011).

Generally, the TY approach fits a standard vector auto-regression (VAR) model on levels of the variables (not on their first differences) which gives the long-run information often ignored in system that require first differencing and pre-whitening (Clark and Mirza, 2006). The approach employs a modified Wald test (MWALD) for restrictions on the parameters of the VAR (k) where k is the lag length of the system. In the TY method, the correct lag order, k is to artificially augmented, using a d_{\max} , which is the maximal order of integration of the series in the system,

and overfitting the VAR (k) model with the additional d_{\max} to obtain a new VAR order (p), such that $p = k + d$, while the coefficients of the last lagged d_{\max} vector are ignored (e.g., see Zapata and Rambaldi, 1997). This ensures that the usual t-statistics for Granger causality have standard asymptotic distributions. It has been proven that the modified Wald-statistic is valid regardless whether a series is $I(0)$, $I(1)$ or $I(2)$, non-cointegrated or cointegrated of an arbitrary order (see Toda and Yamamoto, 1995). The Wald-statistic is asymptotically distributed as a chi-square (χ^2), with degrees of freedom equal to the number of ‘zero restrictions’, irrespective of the integrated order [$I(0)$ or $I(1)$], non-cointegrated or cointegrated of an arbitrary order. To carry out the TY non-Granger causality test, we represent the disaggregated government expenditure–economic growth models estimated in Eqs. 1.8 to 1.10 in the following trivariate VAR systems using the SUR method (see, e.g. Rambaldi and Doran, 1996):

TY Model 1 (for all models testing Wagner’s Law):

$$\ln Y_t = \alpha_0 + \sum_{i=1}^k \alpha_{1i} \ln Y_{t-i} + \sum_{j=k+1}^{d_{\max}} \alpha_{2j} \ln Y_{t-j} + \sum_{i=1}^k \varphi_{1i} \ln X_{t-i} + \sum_{j=k+1}^{d_{\max}} \varphi_{2j} \ln X_{t-j} + \sum_{i=1}^k \theta_{1i} \ln(N / Y_{t-i}) + \sum_{j=k+1}^{d_{\max}} \theta_{2j} \ln(N / Y_{t-j}) + \varepsilon_{1t} \quad (1.22)$$

TY Model 2 (for all models testing Wagner’s Law):

$$\ln X_t = \lambda_0 + \sum_{i=1}^k \lambda_{1i} \ln X_{t-i} + \sum_{j=k+1}^{d_{\max}} \lambda_{2j} \ln X_{t-j} + \sum_{i=1}^k \varpi_{1i} \ln Y_{t-i} + \sum_{j=k+1}^{d_{\max}} \varpi_{2j} \ln Y_{t-j} + \sum_{i=1}^k \eta_{1i} \ln(N / Y_{t-i}) + \sum_{j=k+1}^{d_{\max}} \eta_{2j} \ln(N / Y_{t-j}) + \varepsilon_{2t} \quad (1.23)$$

Where the series are defined as Eqs. 1.20 and 1.21, with ε_{1t} and ε_{2t} are assumed to be white noise. From Eq. 1.22, $\ln X_t$ Granger causes $\ln Y_t$ if $\varphi_{1i} \neq 0 \forall_i$, similarly in Eq. 1.23, $\ln X_t$ Granger causes $\ln Y_t$ if $\varpi_{1i} \neq 0 \forall_i$. Here, the null hypothesis H_0 suggest a causal flow from the independent variables to the exogenous variable, whereas, the alternative hypothesis, H_1 indicates Granger causality running from the exogenous variable to the independent variables.

Note that, it is possible that the causal link between Y_t and X_t in the estimated UECM in Eqs. 1.22 and 1.23 could be attributed to a third variable in a multivariate set-up (see, e.g., Loizides et al. 2005; Ashan et al. 1992). In our case, from Eqs. 1.22 and 1.23, $\ln(N / Y_t)$ Granger causes $\ln Y_t$ with an interactive causative effect via $\ln X_t$ if $\theta_{1i} \neq 0 \forall_i$, likewise in Eq. 1.23, $\ln(N / Y_t)$ Granger causes $\ln X_t$ if $\eta_{1i} \neq 0 \forall_i$ with an interactive causative effect through $\ln Y_t$. Notably, an irrefutable support for Wagner’s law requires a unidirectional causality from real GDP per capita to components of government, but the Keynesian theory is validate by a

unidirectional causal flow the different components of government expenditures to GDP per capita. Here, the null hypothesis H_0 suggest causal flow from the independent variables to the exogenous variable, and the alternative hypothesis, H_1 indicates Granger causality running from the exogenous variable to the independent variables.

5. ANALYSIS OF EMPIRICAL RESULTS

5.1. Stationarity properties of Data

Even though it is possible to establish long-run relations among variables without pre-testing the order of integration, however the bounds-testing approach for cointegration will fail in the presence of $I(2)$ variables, in effect invalidating the asymptotic F - statistic and critical values provided by Pesaran et al. (2001) and Narayan (2005) (see, e.g. Ang, 2007). As stated earlier, to circumvent the implications of structural breaks the stationarity properties of, and cointegration among, key variables, we applied the ZA (1992) unit root test with one structural break, and the results are reported in Table 2. The unit root results shows that all variables are non-stationary in levels but after first differencing, suggesting that all variables integration order of one, $I(1)$ as the null hypothesis of the presence of unit-root cannot be rejected in levels of the series, but after first difference, the null hypothesis is rejected at the conventionally accepted critical values.

Table 2: Zivot and Andrews Unit Root Test with One Endogenous Structural Break

Variable	Intercept		Trend		Both	
	TB	t-statistic	TB	t-statistic	TB	t-statistic
$Ln(y / N)$	2004Q4	-3.220	2007Q4	-3.972	2008Q4	-4.109
$\Delta Ln(y / N)$	2001Q4	-5.159**	2002Q2	-8.230*	2001Q4	-5.572**
$LnEDU$	2015Q4	-2.364	2013Q1	-3.521	2013Q3	-3.357
$\Delta LnEDU$	2012Q4	-4.477**	2015Q2	-8.249*	2012Q4	-5.224**
$LnHEA$	2015Q2	-2.198	2012Q3	-3.547	2013Q1	-2.857
$\Delta LnHEA$	2013Q1	-9.558*	2002Q2	-8.454*	2013Q1	-9.526*
$LnSOC$	2003Q2	-8.602*	2005Q2	-4.844**	2003Q2	-8.455*
$\Delta LnSOC$	2004Q4	-14.256*	2003Q2	-4.670**	2004Q4	-15.413*
$LnCAP$	2015Q4	-2.355	2014Q1	-2.957	2013Q1	-2.941
$\Delta LnCAP$	2015Q4	-8.914*	2015Q2	-8.400*	2015Q4	-9.084*
$LnCUR$	2002Q3	-2.378	2014Q1	-2.957	2013Q1	-2.941
$\Delta LnCUR$	2015Q4	-8.915*	2015Q2	-8.400	2015Q4	-9.084*
$LnTRNSF$	2002Q4	5.313	2004Q1	-3.641	2002Q4	-4.873
$\Delta LnTRNSF$	2007Q4	-5.259**	2010Q2	-4.760**	2003Q4	-6.435*
$Ln(N / Y)$	2003Q4	-5.292	2006Q1	-4.318	2003Q4	-5.128
$\Delta Ln(N / Y)$	2010Q1	-9.113*	2002Q2	-7.812*	2010Q1	-8.957*

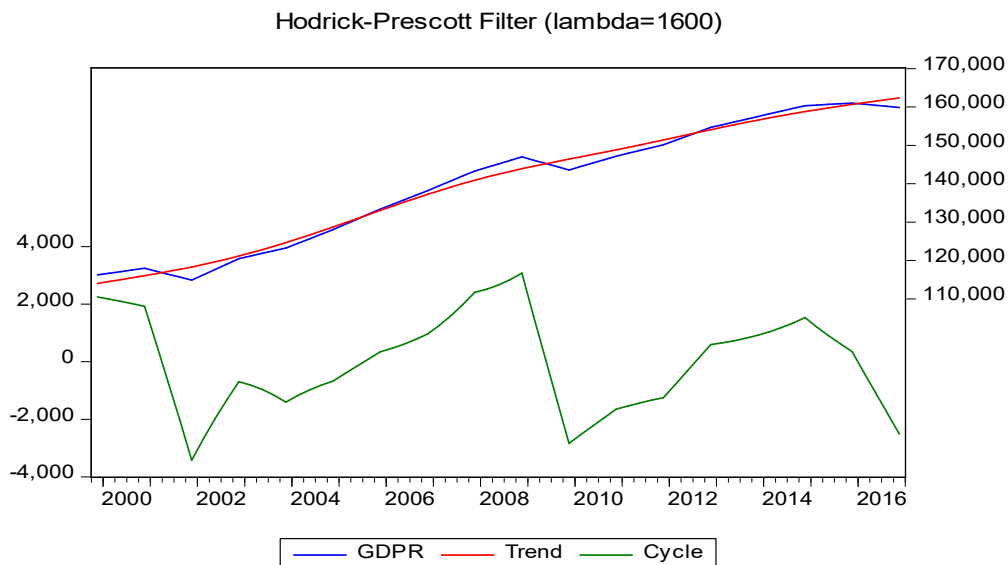
Note: *, **, *** denotes significance at 1%, 5% and 10%. Use Schwarz criterion, trend and intercept break. Minimise Dickey-Fuller t-statistic for break selection

5.2. Cointegration Test Result

Having confirmed the presence of structural break in the time series data, before estimating the ARDL models specified in Eqs. 1.3 to 1.10, the real GDP series is extracted from its trend component using the Hodrick-Prescott (HP) filtering method. Also, breakdown years for real GDP were also determined via fluctuations obtained from the HP filtering method. Figure 4, presents the real GDP variable.

As can be seen from Figure 4, consistent with our intuition, structural breakdowns are existent in 2001 and 2007 which coincides with the global economic crisis associated with the *dot.com* bubbles and sub-prime rates respectively, and propagated globally from the US. The impact of the global economic crisis not only depress economic growth in SA, but also caused the domestic stock exchanges to crash due to capital flight. On this basis, to build a robust ARDL model, we include two dummy variables, $D1$ and $D2$ to account for the identified crisis periods of 2001 and 2007. In addition, based on the ZA unit root results, a deterministic trend variable (TR) is also included in the estimated ARDL equations since the per capita real GDP variables display a trend inclination.

Figure 4: Decomposition of Real GDP time series into Trend and Cyclical Components



Source: Author's estimation, Eviews 10

Having established that all chosen variables are $I(1)$. The long-run equilibrium relationship between real government expenditures on health, education, social development, capital asset, current, transfers and subsidies, and real GDP per capita is investigated as computed in section 4 following both the Wagnerian approach and Keynesian view. For a robust analysis, the estimated ARDL models for Eqs. 1.3 to 1.10 are reported, and discussed as models hereafter.

Following Pesaran et al (2001) bound-testing approach, we test for cointegration using the Wald F-statistic to test for the joint significance of $\beta_1, \beta_2, \beta_3$ in Eq.1.20 and π_1, π_2, π_3 in Eq. 1.21. Since our sample size is relatively small (68 observations), we rely on the computed critical values provided by Narayan et al. (2005). The optimal lag structure is determined by making use of Schwartz-Bayesian Criteria (SBC) or Akaike Information Criteria (AIC). We used

AIC to make sure that the residuals do not suffer from the problem of significant serial correlation.

Before drawing conclusions on the long-run equilibrium relationships and intertemporal causative links (in the short-run) underpinning the government expenditure-economic growth nexus using provincial data, and also ensure that a well-specified parsimonious ARDL model is estimated as in Eqs. 1.3 to 1.10, we undertake the following crucial steps: First, the estimated models are subjected to battery of diagnostic tests to assess the univariate properties of the residuals, which ideally should be uncorrelated and homoscedastic (Herenkson, 1993). Second, to ascertain the robustness of the estimated models, we test for parameter constancy by making use of the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests proposed by Brown et al. (1975), which also determine the long-run parameter stability. In reference to Pesaran et al. (2001) and Pesaran and Pesaran (1997) posit that parameter tests are important, especially when variables are cointegrated, since an unstable parameters can result in model misspecification, which has the potential to bias the results. The deployed residual diagnostic tests includes: Breusch-Godfrey LM test for serial correlation, ARCH LM test for heteroscedacity, Jarque-Bera test for normality. The pre-diagnostic test results is reported in Table 9 in the Appendix. The results show that the residuals are uncorrelated, homoscedastic and normally distributed at a 5% level of significance. In addition, all estimated models passed the recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests suggesting the absence of any instability of the parameter coefficients since the plot of the CUSUMSQ statistic is confined within the 5% critical bounds of parameter stability in the case of both models as shown in Figures 5 in the Appendix.

Turning to the cointegration test, the bounds-test results reported in Table 3 shows that the null hypothesis of no integration, $H_0 : \beta_1 = \beta_2 = \beta_3 = 0$ and $H_0 : \pi_1 = \pi_2 = \pi_3 = 0$ is rejected confirming the existence of long-run relationships between the variables under study since the *F-statistics* on the joint significance of the lagged value variables exceeds the upper bound critical values. In contrast, we also find an evidence of no long-run relationship in model where the real government expenditures on social development and capital assets were treated as exogenous variables following Wagner's Law, as the Wald *F-statistics* falls below the lower bound critical value.

More specifically, the cointegration test result provide evidence for long-run relationship between provincial government spending on education, health and population per capita with the exception of social welfare expenditure. Similar finding supporting cointegration is observed between real GDP per capita and government expenditures on re-current, transfers and population per capita, with the exception of capital expenditure. In all cases, the *t-statistics* test developed by Pesaran et al. (2001) also validate the (in) existence of a long-run relations between disaggregated government expenditure and output in the FS province.

By interpretation, the government expenditure on education, health, current, transfers and subsidies affect the long-term growth of real output in the FS province. Additionally, a significant increase in population per capita will influence economic activity level in the long-run. Whereas, there government expenditures on social development and capital asset has no effect on long-term growth. This empirical results strongly confirm the anecdotal evidence in relation to the pervasively low public expenditures on capital asset accumulation and social development suggesting an intricately linked public function.

Unsurprisingly, our result of no long-run relationships between disaggregated government expenditure data and economic growth is consistent with the surveyed studies in section 3, for example, the studies by Alshahrani and Alsadiq (2014) for Saudi Arabia, Al-shatti (2014) for

Jordan, and [Oyinlola and Akinnibosun \(2013\)](#) for Nigeria. Conversely, the obtained result is consistent with [Ansari et al. \(1997\)](#) and [Chang et al. \(2004\)](#) for South Africa, who failed to find a cointegrating relationship between total government expenditure and economic growth, but at odds with cointegration test results reported by [Ziramba \(2008\)](#), [Menyah et al. \(2012\)](#), [Odhiambo \(2016\)](#) for South Africa, and [Omoshoro-Jones \(2016\)](#) for FS province, amongst others. See [Table 9 in the Appendix](#) for full cointegration test result including pre-estimation diagnostic test results.

Table 3: Bound F-test for Cointegration

Set A					
Models	Dependent Variable	Function	F-test statistic	t -statistic	N
1	$\ln(y / N)$	$\ln(y / N) (\ln EDU, \ln HEA, \ln SOC, \ln(N / Y))$	7.679**	-5.289*	63
2	$\ln EDU$	$\ln EDU (\ln(y / N), \ln HEA, \ln SOC, \ln(N / Y))$	7.869*		57
3	$\ln HEA$	$\ln HEA (\ln(y / N), \ln EDU, \ln SOC, \ln(N / Y))$	12.615*		57
4	$\ln SOC$	$\ln SOC (\ln(y / N), \ln EDU, \ln HEA, \ln(N / Y))$	1.772	-0.806	60
5	$\ln(N / Y)$	$\ln(N / Y) (\ln(y / N), \ln EDU, \ln HEA, \ln SOC)$	7.719*		60
Set B					
6	$\ln(Y / N)$	$\ln(Y / N) (\ln CAP, \ln CUR, \ln TRNSF, \ln(N / Y))$	3.402***		63
7	$\ln CAP$	$\ln CAP (\ln(y / N), \ln CUR, \ln TRNSF, \ln(N / Y))$	2.004		63
8	$\ln CUR$	$\ln CUR (\ln(y / N), \ln CAP, \ln TRNSF, \ln(N / Y))$	29.210*	-6.459*	61
9	$\ln TRNSF$	$\ln TRNSF (\ln(y / N), \ln CAP, \ln CUR, \ln(N / Y))$	11.059*	-4.154***	58
10	$\ln(N / Y)$	$\ln(N / Y) (\ln(y / N), \ln CAP, \ln CUR, \ln TRNSF)$	17.784	5.066*	58

Note: *, **, *** denotes significance at 1%, 5% and 10%. N = Sample size.

Bounds-test CVs are those by Eviews 10, provided by [Narayan \(2005\)](#). CVs for models 1, 2, 8, 9 and 10 are estimated as Case 5, with unrestricted constant and unrestricted trend; models 3, 4, 5 and 6 are computed as Case 2, with restricted constant and no trend, and model 7 is estimated based on Case 4, with unrestricted constant and restricted trend

5.3. Causality Test Result

5.3.1. Analysis of Causality Test Based on the Error-Correction Model

Next, we investigate the direction and nature of causal relationship among components of provincial government expenditure, population, and output using the error correction model within the ARDL framework. As discussed earlier, the ECT_{t-1} has been included in models with cointegrated variables, with the exception of estimated Eqs. 1.5 and 1.6, where evidence of no long-run relationship is noted.

The results for the modified Granger causality test reported in Tables 4a and 4b. As expected, in most cases the coefficient of the error correction term, ECT_{t-1} are statistically significant and negative reinforcing the evidence of long-run relationships among variables detected earlier, and also ascertain the reversion to steady state equilibrium in the presence of an external shock (or disturbance) to the system. The direction of causality in this case is

determined by the F -statistic and the lagged error correction term. The evidence of a significant relationship in the first difference variables establish the direction of causality in the short-run, while a significant t -statistics on the ECT_{t-1} confirm the presence of long-run causality.

The ARDL-based causality results reported in Tables 4a and 4b shed more light on the direction and nature of the causative links in both the long-run and short-run among the variables under study. As expected, the negative and statically significant error correction terms in the models where government expenditure on education (model 2) and health (model 3) are exogenous variables concretely confirm the long-run relationship between these social expenditures and real GDP per capita as expounded by Wager's theory. In addition, there is a long-run relationship between real GDP per capita (model 1) and population per capita (model 5) and the components of social expenditures where the real GDP per capita and population per capita are independent variables, in line with both Keynesian and endogenous theories. But, there is no evidence of cointegration between government expenditure on social development and economic growth in the long-run.

In the presence of an external shock, there is a slow reversion to the steady state ranging from 6% to 54% that is corrected in the next period (or year) in the long-run. The slowest reversion to long-run equilibrium is inferred in the population per capita equation (model 5), followed by the GDP per capita equation (21%), and fastest mean reversion (82%) is found in the health expenditure equation (model 3).

On long-run causality, the results indicate a bi-directional (feed-back effect) between government expenditure on education and economic growth, and a unidirectional causal flow running from government expenditures on health, social development and population per capita to economic growth, implying that a long-term real economic growth (per capita) in the FS province can be influenced by social expenditures on education and health, and population growth (per capita) as the economy prospers. This finding confirm Barro's endogenous growth theory on the positive effect of human capital accumulation on economic growth for the FS province, asserting that high literacy level will enhance access to the mainstream labour market which has become more capital-intensive demanding high-level skills, and adequate provision of health care that produce a healthy workforce will has a positive effect on economic activity level.

On short-run causality, evidence suggest a unidirectional causality running from real GDP per capita to social expenditures (education, health and social development) and population per capita, consistent with Wagner's prediction. In other words, a rise in income per capita is intricately linked to the intensity of public investment that improves education, health and social welfare (development), as the population increases. Further analysis indicates a bi-directional causality between education expenditure and GDP per capita, whereas, population per capita Granger-cause economic growth, in the short-run. Likewise, a bi-directional causality between population per capita and education exist. Among disaggregated government expenditures data, there is generally bi-directional causality between education, health and social development expenditures running interactively via real GDP per capita.

Based on these empirical findings, we conclude that the provincial government spending on education and health, and population growth are key determinants of economic growth in FS in both the long and short-run, with education spending playing a greater role. Nevertheless, in the absence of a long-run relation, the public spending on social development has a short-run impact on real income per capita. Over all, our findings aligns with, e.g., [Devilin and Hansen \(2001\)](#), [Afxentiou et al. \(1996\)](#), [Bose et al. \(2007\)](#), [Baum et al. \(993\)](#), [Kunu, et al. \(2015a\)](#),

Asghaur (2011), Bojanic, (2013), Chude et al. (2013), Narayan et al. (2006), Abdullahi (2007) and Khan et al. (2015).

Additionally, the results of the nature and direction of the causative links between provincial expenditures on capital assets, current and transfers and economic growth is reported in Table 5b. In general, the causality test result provides evidence for a long-run equilibrium relationship between real GDP per capita and components of government expenditures on current, and population per capita, transfers and subsidies. This inference is validated given the statistically significant and negative coefficient of the lagged error correction terms and its significant t-statistic at 1% significance level in models 6, 8, 9 and 10, with the exception of the capital expenditure equation (model 7) that produces evidence of no long-run relationship with other variables, which include economic growth (real GDP per capita). This inference provides reinforced the observed anecdotal evidence in section 2, as provincial government expenditure on capital assets fail to generate (and support) economic growth in the FS province as result of pervasively low public investment in productive capital assets.

Table 4a: ARDL ECM-based Causality Test Result

Set A						
Dependent Variable	Short-run causality					Long-run causality (ECM _{t-1})
	$\Delta \ln(y/N)$	$\Delta \ln EDU$	$\Delta \ln HEA$	$\Delta \ln SOC$	$\Delta \ln(N/Y)$	ECM Coefficient [t-statistic]
	F-statistic (p-value)					
$\Delta \ln(y/N)$	-	4.504 (0.04)**	2.510 (0.12)	-	0.047 (0.83)	-0.21 (0.00) [-6.449]*
$\Delta \ln EDU$	3.127 (0.02)**	-	135.326 (0.00)*	19.364 (0.00)*	27.842 (0.00)*	-0.54(0.00) [-7.722]*
$\Delta \ln HEA$	3.841 (0.01)*	18.155 (0.00)*	NA	6.761 (0.00)*	5.301 (0.00)*	-0.82(0.00) [-9.967]
$\Delta \ln SOC$	16.748 (0.00)*	56.320 (0.00)*	2.338 (0.07)***	-	4.178 (0.01)*	No LR
$\Delta \ln(N/Y)$	26.539 (0.00)*	9.024 (0.00)*	-	-	-	-0.06(0.00) [-7.199]

Note: *, **, *** denotes significance at 1%, 5% and 10%. N = Sample size.

On long-run causality, economic growth Granger-causes capital, current, transfers and subsidies expenditure, and vice-versa, indicative of a feedback effect, implying that government expenditures on current, capital assets, transfers and subsidies are determinants of long-term growth, while the opposite is also true (ceteris paribus).

Furthermore, in the presence of an external innovation, the reversion to steady state of cointegrated variables in the estimated models ranges from 2% to 33% corrected in the next period (or year) in the long-run. Equations where per capita GDP (model 6), current expenditures (model 8) and the population per capita (model 10) are independent variables display the slowest long-run adjustment of about 2% in the long-run, whereas, a moderate mean-reversion of 33% is found in the transfers and subsidies equation (model 9). This observed slow reversion to a long-run equilibrium, in part, can be associated with, for example,

low public investment, ineffective public employment programmes to create jobs and lessen poverty rate, low capital intensive projects, wasteful expenditures and the rapidly expanding wage bill which has no effect on productivity and output growth.

On short-run causality, the analysis of the results in Table 5b reveals a bi-directional causality running from real GDP per capita and government expenditure on capital, current, transfers and subsidies. We also deduce a unidirectional causality from economic growth to population per capita running interactively through the components of government expenditures. Whereas, population (per capita) Granger-causes government expenditures on current, transfers and subsidies, and vice-versa (bi-directional effect). Whereas, population per capita Granger-causes current, transfers and subsidies, without any feedback. In addition, among the disaggregated government expenditures, there is a unidirectional causal flow from capital asset expenditure to current expenditure. On the whole, these inferences is consistent with those reported by, e.g. [Deverajan et al. \(1996\)](#), [Alshahrani et al.\(2014\)](#) and [Danladi,\(2015\)](#).

Table 4b: ARDL ECM-based Causality Test Result

Set B						
Dependent Variable	Short-run causality					Long-run causality (ECM _{t-1})
	F-statistic (p-value)					ECM Coefficient [t-statistic]
	$\Delta \ln(y / N)$	$\Delta \ln CAP$	$\Delta \ln CUR$	$\Delta \ln TRNSF$	$\Delta \ln(N / Y)$	
$\Delta \ln(y / N)$	NA	6.552 (0.01)*	5.982 (0.01)*	3.162 (0.08)***	1.526 (0.22)	-0.02(0.00) [-4.752]*
$\Delta \ln CAP$	4.140 (0.04)**	-	5.262 (0.02)**	-	-	No LR
$\Delta \ln CUR$	11.680 (0.00)*	-	-	1.9444 (0.17)	4.071 (0.01)*	-0.02 (0.00) [-13.970]*
$\Delta \ln TRNSF$	10.631 (0.00)*	0.799 (0.53)	1.394 (0.25)	-	4.358 (0.00)*	-0.33(0.00) [-7.901]*
$\Delta \ln(N / Y)$	-	-	7.294 (0.00)*	6.670 (0.00)*	-	-0.02 (0.00) [-7.566]*

Note: *, **, *** denotes significance at 1%,5% and 10%.

5.3.2. Linear non-Granger Causality Test Result

To conclusively determine the causative links between the components of government expenditures and economic growth in the short-run, we employed the powerful linear parametric Toda-Yamamoto non-Granger causality test taking the following critical steps: First, in order to estimate compute the “augmented” multivariate VAR(p) model such that $p = k + d_{\max}$ proposed by Toda-Yamamoto. The optimal lag length (k) is determined using the following test: LR (sequential modified LR test statistic - each test at 5% level), FPE (Final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion) and HQ (Hannan-Quinn information criterion). This allows us to select the optimal lag length, thus avoiding over (under) parametrization. The chosen optimal lags of 5 and 6 was chosen for the result of the augmented VAR models reported in Tables 5a and 5b respectively, with the obtained Wald test results.

Second, we tested the null hypothesis of no Granger causality, in line with both the Wagner's view and its opposing Keynesian theory.

Broadly, the TY non-Granger causality test result corroborate the deduced causative links in the error correction model within the ARDL framework. As can be seen in Table 6a, we note that, in the short-run, provincial government expenditures on education and social development Granger-causes real GDP per capita in the short-run, whereas, provincial government expenditures on social welfare Granger-causes population per capita. These causality test result suggest a unidirectional causality in the support of Keynesian view. This finding makes sense, since a rise in public spending on social welfare is intricately linked to population growth, for example, an increase in birth rate needed to raise the workforce (i.e. labour force participation rate). On the fiscal front, a rise in population growth rate has a positive influence on the fiscal allocation to the province from the national government, indirectly increasing the national revenue (equity) share allocated to the province. Besides, as per capita income increases, aggregated demand for service delivery and inelastic public goods, for example, construction of hospitals, schools, road networks, water infrastructures, tend to rise putting an upward pressure on government budget and fiscal allocation.

Table 5a: Linear **Granger Causality – Toda-Yamamoto non-Granger Causality Test**

Set A					
Model	Cause	Effect	Test statistic (χ^2)	p-value	Inference from \rightarrow to
1	$\ln(y/N)$	$\ln HEA$	1.441	0.919	$(y/N) \neq HEA$
		$\ln EDU$	1.727	0.885	$(y/N) \neq EDU$
		$\ln SOC$	0.559	0.989	$(y/N) \neq SOC$
		$\ln(N/Y)$	3.831	0.574	$(y/N) \neq (N/Y)$
2	$\ln EDU$	$\ln(y/N)$	9.553	0.089***	$EDU \rightarrow (y/N)$
		$\ln HEA$	17.369	0.003*	$EDU \rightarrow HEA$
		$\ln SOC$	3.099	0.685	$EDU \neq SOC$
		$\ln(N/Y)$	1.118	0.952	$EDU \neq (N/Y)$
3	$\ln HEA$	$\ln(y/N)$	7.789	0.168	$HEA \neq (y/N)$
		$\ln SOC$	5.494	0.358	$HEA \neq SOC$
		$\ln EDU$	5.542	0.353	$HEA \neq EDU$
		$\ln(N/Y)$	4.096	0.535	$HEA \neq (N/Y)$
4	$\ln SOC$	$\ln(y/N)$	40.759	0.000*	$SOC \rightarrow (y/N)$
		$\ln HEA$	2.069	0.839	$SOC \neq HEA$
		$\ln EDU$	6.338	0.247	$SOC \neq EDU$
		$\ln(N/Y)$	15.647	0.007*	$SOC \rightarrow (N/Y)$
5	$\ln(N/Y)$	$\ln(y/N)$	21.123	0.001*	$(N/Y) \rightarrow (y/N)$
		$\ln HEA$	1.673	0.892	$(N/Y) \neq HEA$
		$\ln SOC$	4.201	0.520	$(N/Y) \neq SOC$
		$\ln EDU$	0.521	0.952	$(N/Y) \neq EDU$

Note: *, **, *** denotes significance at 1%, 5% and 10%.

Further causality analysis shows that population per capita Granger-causes real GDP per capita, with no feedback effect. While, among components of provincial expenditures, education expenditure Granger-causes health expenditure - this is a one-way causality effect.

Conversely, a closer look at the causality results reported in Table 6b reveals the following: First, government expenditures on transfers and subsidies Granger-causes real GDP per capita. Second, government expenditures on transfers and subsidies Granger-causes population per capita and vice-versa (bi-directional causality). Third, current expenditure Granger-causes transfers and subsidies expenditures, and vice-versa (bi-directional causality). Finally, population per capital Granger-causes real GDP per capita. On the whole, economic growth in the FS is also influenced by growth in population (per capita) and government expenditures on transfers and subsidies, in the short-term. In general, the Toda-Yamamoto causality test result concretely support the causative linkages observed in the ARDL-based ECM, and also consistent with those reported in the voluminous literature.

Table 5b: Linear **Granger Causality – Toda-Yamamoto non-Granger Causality Test**

Set B					
Model	Cause	Effect	Test statistic (χ^2)	p-value	Inference from \rightarrow to
6	$\ln(y/N)$	$\ln CAP$	5.879	0.318	$(y/N) \neq CAP$
		$\ln CUR$	3.379	0.642	$(y/N) \neq CUR$
		$\ln TRNSF$	0.818	0.976	$(y/N) \neq TRNSF$
		$\ln(N/Y)$	6.383	0.271	$(y/N) \neq (N/Y)$
7	$\ln CAP$	$\ln(y/N)$	3.894	0.564	$CAP \neq (y/N)$
		$\ln CUR$	4.731	0.449	$CAP \neq CUR$
		$\ln TRNSF$	5.627	0.344	$CAP \neq TRNSF$
		$\ln(N/Y)$	4.218	0.518	$CAP \neq (N/Y)$
8	$\ln CUR$	$\ln(y/N)$	4.399	0.493	$CUR \neq (y/N)$
		$\ln CAP$	8.052	0.153	$CUR \neq CAP$
		$\ln TRNSF$	14.955	0.010*	$CUR \rightarrow TRNSF$
		$\ln(N/Y)$	1.670	0.892	$CUR \neq (N/Y)$
9	$\ln TRNSF$	$\ln(y/N)$	45.057	0.000*	$TRNSF \rightarrow (y/N)$
		$\ln CAP$	4.907	0.427	$TRNSF \neq CAP$
		$\ln CUR$	11.306	0.045**	$TRNSF \rightarrow CUR$
		$\ln(N/Y)$	14.125	0.014*	$TRNSF \rightarrow (N/Y)$
10	$\ln(N/Y)$	$\ln(y/N)$	17.725	0.003*	$(N/Y) \rightarrow (y/N)$
		$\ln CAP$	4.341	0.501	$(N/Y) \neq CAP$
		$\ln CUR$	3.225	0.665	$(N/Y) \neq CUR$
		$\ln TRNSF$	11.655	0.039**	$(N/Y) \rightarrow TRNSF$

Note: *, **, *** denotes significance at 1%, 5% and 10%.

6. FINAL REMARKS AND POLICY IMPLICATION OF FINDINGS

This present study is motivated by the long-standing debate on the relationship between government expenditures and economic growth in public economics and applied econometrics literature, and inspired by the concern among policy makers on the unproductive effect of the rapidly growing government expenditure on economic growth in the Free State province.

In this spirit, we investigate the relationship between components of government expenditures and economic growth over the period 1994Q – 2016Q4 in a multivariate model,

using the ARDL-bound testing approach developed by [Pesaran et al. \(2001\)](#) to establish the long-run relationship and the Toda-Yamamoto non-Granger causality procedure proposed by [Toda and Yamamoto \(1995\)](#) to uncover the causative links among variables in a multivariate model, building on the previous work by [Omshoro-Jones \(2016\)](#), who examined the government expenditure –economic growth nexus for the FS province at the aggregate level.

Vast literature testing the validity of Wagner's Law and the Keynesian theory in the public finance and macroeconomic studies typically reported mixed findings. Likewise, extant studies in the South African literature have empirically investigated the relationship between government expenditure and economic growth only at the aggregate level, but up till now, no author has attempted to analyze the long-run relationship and short-run dynamics between components of government expenditures and economic growth using aggregated data. This type of empirical assessment is important since an in-depth knowledge of the relationship, and the causative linkages between major budgetary allocations and economic growth is paramount, particularly for policymakers since it allows the design and implementation of an effective fiscal and macroeconomic policy that promotes growth.

In this paper, we attempt to shed light on the relationship between components of government expenditures and economic growth in the FS province. Our analysis confirmed that social expenditures influence economic growth, with education playing a more significant role. More specifically, empirical evidence reveals a long-run relationship between population per capita, government expenditures on education, health, current, transfers and subsidies and economic growth, but social and capital expenditures are not cointegrated with economic growth. On short-run dynamics, economic growth Granger-causes government expenditures on health, social development and population per capita. Whereas, education expenditure Granger-causes economic growth in both long-run and short-run. A bi-directional causality between education expenditure and population per capita, while the latter Granger-causes economic growth in the short-run. Further causality analysis also shows that economic growth Granger-causes capital, transfers and subsidies expenditures in both the short and long run, and vice-versa. Economic growth Granger-causes population per capita, whereas, population per capita Granger-causes current, transfers and subsidies in the short-run.

To the best of our knowledge, this is the first attempt to empirically analyse the relationship between the components of government expenditures and economic growth at provincial level, and also using disaggregated provincial government expenditure data in South Africa. Hence, our contribution to the existing literature.

The policy implications of our findings are clear. In the long run, the determinants of economic growth are government expenditures on education, health, current, transfers and subsidies, including population growth. Hence, budgetary cuts in the social expenditures such as education and health can retard provincial economic growth (economic activity level), even so, insofar education and current expenditure grows at a faster rate, it is imperative that the growth trend of these social expenditures are monitored periodically and their budgetary allocation to be managed prudently since it is widely accepted that high government expenditure can become unproductive over time without affecting economic growth as diminishing marginal effect decreases (see, e.g. [Deverajan et al. 1996](#)). Similarly, high government expenditure could lead to higher taxes that discourage private investment ([Asghar, Azim and Rehman, 2011](#)). Thus, to maintain a sustained economic growth along a long-run equilibrium path, policy makers should monitor the growth in social expenditures by a combination of budgetary cuts and/or tax changes ([Kolluri, 2000](#)).

Furthermore, the inexistence of a long run relationship between economic growth, capital asset and social development expenditures in the Free State province, is indicative of a crucial

missing link needed to stimulate output growth and socioeconomic development. It has been proven empirically that high public investment on capital assets (physical infrastructure) has a positive-inducing effect economic growth, reduces poverty, inequality and unemployment rate (see, e.g. [Ascaheur, 1986](#), [Estache et al. 2005, 2012](#); [Romp et al. 2007](#)). The deduced evidence of severely low fiscal allocations on accumulation of capital stock and social development, emphasise the pressing need to raise public investment on the provision of durable capital assets, implement labour-intensive infrastructure projects associated with some social development initiatives such as the EPWP, and community work programme (CWP). An indirect impact of this policy, could significantly reduce unemployment by increasing the absorption of the unskilled labour in the domestic economy. The adoption of this policy prescription should entail attracting foreign aid and external funding to support long-term growth.

In general, it is mostly advisable to allocate government spending to maintain existing infrastructure and social projects and to start new projects. These projects should be concentrated in areas that provide public services and facilitate Research and Development and human capital. It is preferable that the government involve the private sector in these projects, since the contribution of private to the growth rate is higher by allocating some subsidies. This would help the provincial government to achieve fiscal sustainability over the medium- and long-term.

The empirical analysis in this paper is considered to be more robust and satisfactory with reliable conclusion from an econometric perspective than earlier studies in several ways. Firstly, the misspecification bias and erroneous causality between variables is avoided by accounting for structural breaks in the data using the Zivot-Andrew structural break unit root test to determine the stationarity properties of timeseries, and adding dummy variables to capture notable crisis periods. Secondly, we decompose the provincial economic growth series into its real, trend and cyclical components employing the Hodrick-Filtering procedure. This exercise is important to correctly identify trend component from the real series, and accounted for in the specified econometric model to ensure a parsimonious model. Lastly, population variable is added to the estimated model to avoid 'omission variable' problem, as well as ascertain the nature and the direction of causative link between variables running interactively in the short-run.

APPENDIX

Table 6: Macroeconomic and Socioeconomic data

	SA							FS				
	GDP growth (%)	Real GDP growth (%)	Per capita GDP	Inflation rate (%)	Gross Public Debt (% GDP)	Official Unemployment rate (%)	LFPR	LF Absorption rate (%)	GDP growth rate (%)	Official Unemployment rate (%)	LFPR (%)	LF Absorption rate (%)
2008	3,2	3,2	2,1	11,5	26,5	21,5	59,2	45,7	2,6	22	60,2	46,6
2009	-1,5	-1,5	-2,6	7,1	30,1	24,1	56,5	42,6	-2,3	24,8	57,9	43,7
2010	3	3	1,8	4,3	34,7	23,9	55	41,3	2,5	27,1	58,4	42,8
2011	3,3	3,3	1,9	5	38,2	23,8	55,6	42,4	2	29,2	57,7	40,9
2012	2,2	2,2	0,8	5,6	41	24,5	55,9	42,2	3	31,6	58,3	39,7
2013	2,5	2,5	1	5,7	44,1	24,1	57,1	43,3	1,9	33	60,2	40,3
2014	1,7	1,7	0,3	6,1	47	24,3	56,8	43	2	32,2	61,1	41,5
2015	1,3	1,3	-0,1	4,6	49,3	24,5	58,8	44,2	-0,1	29,8	62,7	44
2016	0,3	0,3	-1	6,4	51,7	26,5	59,2	43,5	0,6	34,7	61,5	40,2
2017	1,3	0,7		5,3	53	26,7	58,8	43,1		32,6	63,2	42,6

Sources: IMF (2018), World Bank (2018), StatsSA (2018)

Table 7. Descriptive Statistics

	LGDP	LEDU	LHEALTH	LSOCDEV	LCAPEX	LCUREX	LTRNSF	LPOP
Mean	11.83379	15.60805	15.19251	13.50182	13.81803	16.26274	14.57861	7.069320
Median	11.87280	15.57290	15.15942	13.56820	14.07762	16.22559	14.55319	6.983197
Maximum	11.98933	16.31080	15.98282	14.55742	14.73090	17.00277	15.26072	7.391088
Minimum	11.65174	14.83986	14.27861	12.54927	12.36873	15.46924	13.88837	6.794575
Std. Dev.	0.111350	0.472970	0.545947	0.532259	0.713625	0.477896	0.442429	0.170830
Skewness	-0.267313	-0.053159	-0.078193	-0.135082	-0.322001	-0.115226	0.094287	0.318928
Kurtosis	1.678719	1.648557	1.640662	2.139805	1.569092	1.772633	1.460702	1.804245
Jarque-Bera	5.502276	4.977106	5.070695	2.201667	6.668558	4.223749	6.513538	4.974371
Probability	0.063855	0.083030	0.079234	0.332594	0.035640	0.121011	0.038513	0.083144
Sum	769.1965	1014.523	987.5132	877.6182	898.1720	1057.078	947.6094	459.5058
Sum Sq. Dev.	0.793521	14.31685	19.07574	18.13119	32.59270	14.61661	12.52760	1.867716
Observations	65	65	65	65	65	65	65	65

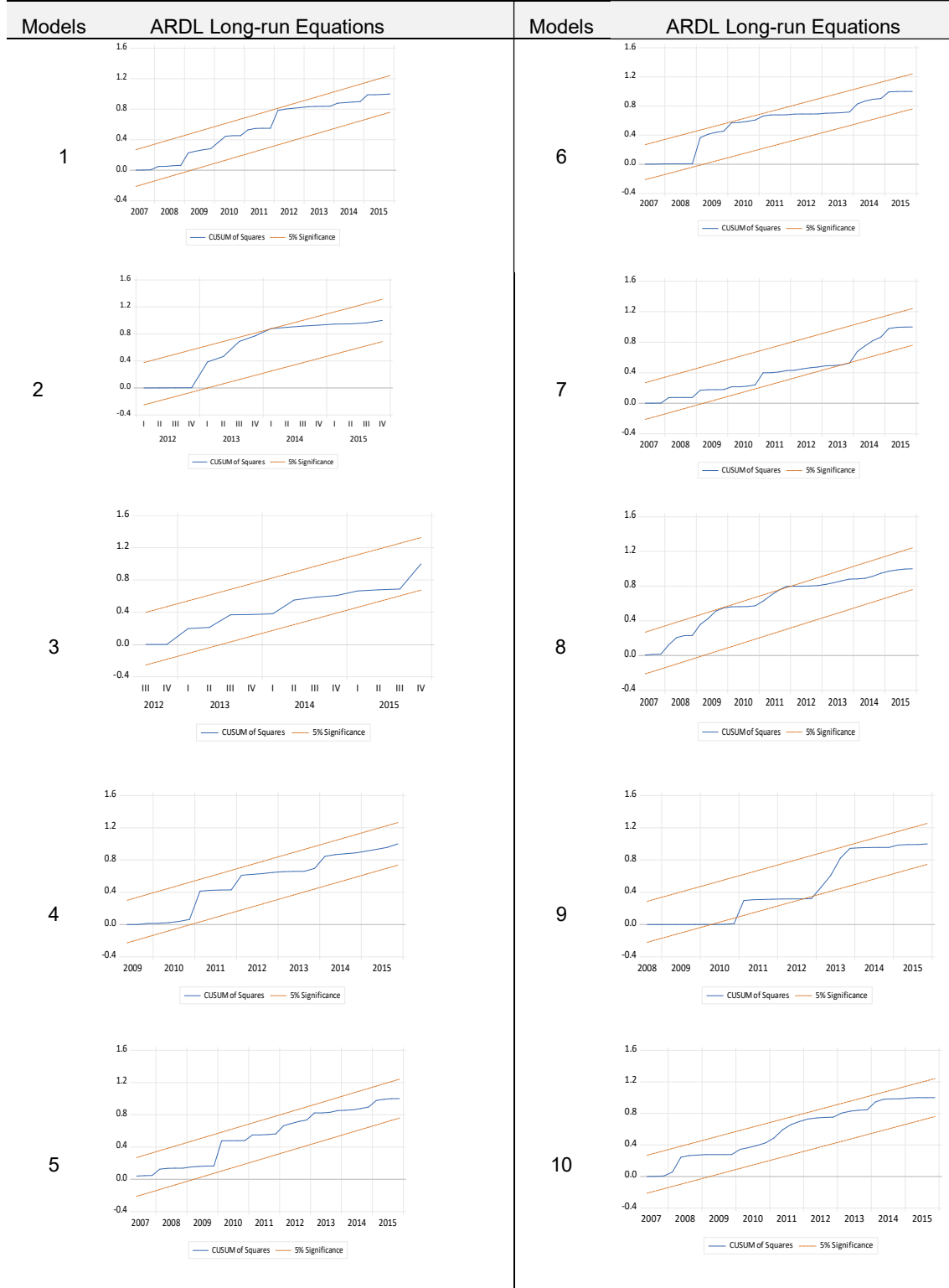
Sources: Author's computation, Eviews 10.

Table 8: Correlation Matrix

	LGDP	LEDU	LHEALTH	LSOCDEV	LCAPEX	LCUREX	LTRNSF	LPOP
LGDP	1	0,9822	0,9817	-0,1599	0,9728	0,9717	0,7446	0,9141
LEDU	0,9822	1	1,000	-0,0717	0,9580	0,9893	0,8272	0,9659
LHEALTH	0,9817	0,9998	1	-0,0750	0,9595	0,9891	0,8270	0,9650
LSOCDEV	-0,1599	-0,0717	-0,0750	1	-0,1306	-0,1347	0,4619	0,1019
LCAPEX	0,9728	0,9580	0,9595	-0,1306	1	0,9269	0,7497	0,8829
LCUREX	0,9717	0,9893	0,9891	-0,1347	0,9269	1	0,7896	0,9514
LTRNSF	0,7446	0,8272	0,8270	0,4619	0,7497	0,7896	1	0,8977
LPOP	0,9141	0,9659	0,9650	0,1019	0,8829	0,9514	0,8977	1

Sources: Author's computation, Eviews 10.

Figure 5: CUSUM Parameter Constancy (Stability) Test for Parsimonious ARDL models



Source: Authors computation, Eviews 10

Table 9: Estimated ARDL cointegration with Post-diagnostic test Results

Group A									
Estimated Models	Dependent variable	Function	D1	D2	Trend	F-test statistic	t-statistic	N	
1	$\ln(y / N)$	$\ln(y / N) (\ln EDU, \ln HEA, \ln SOC, \ln(N / Y))$	-0.007*	0.001	0.001*	7.679**	-5.289*	63	
2	$\ln EDU$	$\ln EDU (\ln(y / N), \ln HEA, \ln SOC, \ln(N / Y))$	-0.015*	0.007*	0	7.869*		57	
3	$\ln HEA$	$\ln HEA (\ln(y / N), \ln EDU, \ln SOC, \ln(N / Y))$	0.013*	0.005*	0	12.615*		57	
4	$\ln SOC$	$\ln SOC (\ln(y / N), \ln EDU, \ln HEA, \ln(N / Y))$	-0.340**	-0.044	0	1.772	-0.806	60	
5	$\ln(N / Y)$	$\ln(N / Y) (\ln(y / N), \ln EDU, \ln HEA, \ln SOC)$	0.002	0.007*	0	7.719*		60	
Group B									
6	$\ln(Y / N)$	$\ln(Y / N) (\ln CAP, \ln CUR, \ln TRNSF, \ln(N / Y))$	-0.005*	0.001	0	3.402***		63	
7	$\ln CAP$	$\ln CAP (\ln(y / N), \ln CUR, \ln TRNSF, \ln(N / Y))$	-0.023	0.017	0	2.004		63	
8	$\ln CUR$	$\ln CUR (\ln(y / N), \ln CAP, \ln TRNSF, \ln(N / Y))$	0.045*	0.075*	-0.023*	29.210*	-6.459*	61	
9	$\ln TRNSF$	$\ln TRNSF (\ln(y / N), \ln CAP, \ln CUR, \ln(N / Y))$	-0.218***	-0.199*	0.100*	11.059*	-4.154***	58	
10	$\ln(N / Y)$	$\ln(N / Y) (\ln(y / N), \ln CAP, \ln CUR, \ln TRNSF)$	0.012*	0.014*	0.001	17.784	5.066*	58	
Post-estimation diagnostic test									
			Adj R ²	SER	DW stats	BG (2 LAGS)	ARCH (2lags)	JB	
Model 1			0.99	0.002	1.93	0.12 (0.94)	1.59 (0.45)	4.78 (0.09)	
Model 2			0.99	0.001	1.98	9.06 (0.21)	1.60 (0.44)	15.05 (0.89)	
Model 3			0.99	0.001	1.90	3.29 (0.19)	0.11 (0.95)	6.12 (0.65)	
Model 4			0.98	0.095	1.87	6.03 (0.05)	0.11 (0.94)	29.95 (0.45)	
Model 5			0.99	0.002	2.02	2.18 (0.34)	3.78 (0.15)	0.17 (0.91)	
Model 6			0.99	0.002	1.68	5.92 (0.05)	0.11 (0.99)	9.31 (0.92)	
Model 7			0.99	0.033	1.99	0.18 (0.91)	0.21 (0.89)	32.79 (0.10)	
Model 8			0.99	0.011	1.61	7.17 (0.42)	4.58 (0.10)	2.27 (0.32)	
Model 9			0.99	0.333	1.59	3.44 (0.17)	1.02 (0.60)	13.68 (0.00)	
Model 10			0.99	0.002	1.78	5.83 (0.05)	15.72 (0.30)	1.07 (0.59)	

Note: *, **, *** denotes significance at 1%, 5% and 10%. N = Sample size.

Bounds-test CVs are those by Eviews 10, provided by Narayan (2005). CVs for models 1, 2, 8, 9 and 10 are estimated as Case 5, with unrestricted constant and unrestricted trend; models 3, 4, 5 and 6 are computed as Case 2, with restricted constant and no trend, and model 7 is estimated based on Case 4, with unrestricted constant and restricted trend.

Adj R² = Adjusted R-squared; SER = Serial Error of Regression; DW stats = Durbin-Watson statistics; BG = Breusch – Godfrey serial correlation test; ARCH-LM heterocedcity test; and JB = Jacque–Berra Normality test.

Table 10: ARDL- Bound test Bootstrapped Critical Values for Small sample size

Asymptotic Values		Case 5					
<i>N = 63</i>		1%	1%	5%	5%	10%	10%
<i>F-statistics</i>							
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		4.974	6.378	3.732	4.92	3.196	4.262
<i>t-statistics</i>		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		-3.96	-4.96	-3.41	-4.36	-3.13	-4.04
<i>N = 60</i>		1%	1%	5%	5%	10%	10%
<i>F-statistics</i>							
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		5.066	6.394	3.772	4.956	3.2	4.31
<i>t-statistics</i>		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		-3.96	-4.96	-3.41	-4.36	-3.13	-4.04
Asymptotic Values		Case 4					
<i>N = 61</i>		1%	1%	5%	5%	10%	10%
<i>F-statistics</i>							
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		4.347	5.552	3.3	4.28	2.848	3.743
<i>t-statistics</i>		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Asymptotic Values		Case 2					
<i>F-statistics</i>		1%	1%	5%	5%	10%	10%
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
<i>N = 60</i>		3.71	4.965	2.743	3.792	2.323	4.965
<i>N = 63</i>		3.725	4.94	2.75	3.755	2.335	3.252
Asymptotic Values		Case 3					
<i>F-statistics</i>		1%	1%	5%	5%	10%	10%
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
<i>N = 60</i>		4.176	5.676	3.062	4.314	2.568	3.712
<i>t-statistics</i>		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
		-3.43	-4.6	-2.86	-3.99	-2.57	-3.66

Source: Narayan (2005), as reported in Eviews 10

Note: Bounds-test CVs are those by Eviews 10, provided by Narayan (2005). CVs for models 1, 2, 8, 9 and 10 are estimated as Case 5, with unrestricted constant and unrestricted trend; models 3,4, 5 and 6 are computed as Case 2, with restricted constant and no trend, and model 7 is estimated based on Case 4, with unrestricted constant and restricted trend.

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