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Actual vs Optimal Size of the Public Sector in South Africa

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Abstract: The optimal size of government or the public sector in general has been the topic of many studies and debates all over the world. There are some who state that the public sector should play a much greater role in the economy, while others proclaim the private economy is a much better placed to generate the desired economic outcomes. This article investigates this issue and applies it to South Africa as there is no consensus on the optimal size of the South African government. The reporting formats of the National Treasury and South African Reserve Bank (SARB) were used to define the public sector, and estimate its actual size and contribution to the country's economy. The research period ranges from 1992 to 2017. In theory, the BARS or Armey curve suggests that there exists an inverted U shape association between the size of government and optimal economic growth, and that was tested. Various regression equations were assessed using the fully modified OLS (FMOLS) estimation technique. The optimum level of the public sector size is estimated to be between 18 and 24% of the economy, which compares to the current level of between 30 and 50%, while optimal levels were experience between 2005 and 2007. The results suggest that the size of the South African public sector is significantly larger than optimal.

Keywords: Economic growth; optimum level; public sector

JEL Classification: E62, H10, H50, H70

1. Introduction

South Africa has developed and adopted a developmental state ideology defined as a condition when the state possesses the vision, leadership and capacity to positively transform the South African society within a defined period of time (NPC, 2012). The South African Government has officially adopted the implementation of a

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developmental state agenda as Government policy. The developmental state objective was a key element of the 2009 State of the Nation Address (SONA) by President Jacob Zuma, as well as of the 2009 Medium-term Strategic Framework. The National Development Plan (NDP) also targets an annual economic growth rate of six per cent in order to address the triple challenges of unemployment, poverty and inequality (NPC, 2012).

The developmental state concept directly and indirectly envisages or rather demands an increasing role (size) of the public sector in the South African economy. It is believed that greater government participation in the economy is both a necessary and sufficient condition with regard to the pursuit of the objectives as set in the NDP. Nobel Prize-winning economist Joseph Stiglitz, for example, said that Conventional wisdom is wrong. Government intervention is required for a successful South African economy (Blaine, 2009).

On the other hand, many economists follow the Adam Smith ideology of limited government size in the pursuit of economic objectives (Smith, 1776). The followers of Smith's ideology, for example Noble laureates FA Hayek (1960) and Milton Friedman (1997), argue that economic objectives are best achieved by the free market and that government's role must be limited. The private market is best suited to decide what to produce, when to produce and for whom to produce, not just with regard to the private interest, but also for the betterment of society at large.

In South Africa, the prevailing economic paradigm is very much against the free market ideology and is evident from South Africa's declining economic freedom rankings (Coetzee & Kleynhans, 2017). During 2016, South Africa ranked 80th out of 186 countries on the Index of Economic Freedom, which classed the country moderately free (Miller, Kim, Roberts & Tyrrell, 2019). The Fraser Institute ranked the country at 96th out of 175 countries on their Economic Freedom of the World with regard to government size, but overall at the bottom of 121 countries in 2016 (Vásquez & Porčnik, 2018). Since 2006/07, the country's ratings declined continually in all of the economic freedom indices. This also coincided with an extended period of sluggish economic growth, increasing unemployment and a worsening of poverty and inequality levels in South Africa. It can therefore be argued that, following the adoption of the developmental state ideology, the size of government is ever increasing, while economic freedom is consistently deteriorating and the overall economic situation in South Africa is worsening.

In South Africa, a very large part of society prefers the government or public sector, whereas another part prefers free markets in terms of the production and allocation of goods and services and/or the redistribution of wealth. Ul Husnain (2011) states that historical evidence indicates that the role of government is needed for a society to achieve high levels of economic well-being. Government's primary role, according to Hayek (1960), should be to enforce the rule of law and to protect private property in the pursuit of economic development. On the other hand, ul Husnain (2011) states that, in societies where government makes all the decisions, the spirit of the private market will severely be limited and therefore will experience relatively low levels of economic well-being.

Forte and Magazzino (2016) argue that a capable free market economy is reliant on some public expenditure, in general, in order to produce the national output and income growth. However, the continuous expansion of government expenditure cannot be assumed or prejudged to be consistent with the long-run maximisation of GDP output. The question then arises; what is the optimal size that government should be?

The terms state, public sector and government are used colloquially in this article. The public sector, for the purpose of this article, consists of government (national, provincial and local) and all agencies, enterprises and entities controlled and/or funded publicly that deliver public goods and/or services. The definition also includes governmental regulation and mandates of private market activities.

With these premises, i.e., the optical size of the public sector in South African in mind, the remainder of the article is structured as follows. Section 2 is devoted to briefly discuss recent theoretical and empirical research regarding how economic growth is connected to the size of the authorities. The actual magnitude of the public sector in South Africa is accounted and measured in section 3. In section 4, the magnitude of the public sector in South African is examined in relation to other national accounts that may reflect its relative size. The contribution of South Africa's governing authority in terms of total gross value added (GVA) and expenditure on gross domestic product (GDP) is discussed in section 5, while its optimal size is estimated empirically in section 6. Finally, section 7 provides the conclusions.

2. Theoretical Background and Review of Literature

The article relates to the theoretical BARS curve that is the culmination of the work by Barro (1991), Armey (1995), Rahn and Fox (1996), and Scully (1994 & 1995). The curve uses government expenditure relative to GDP as a proxy for the size of government (horizontal X axis) and depicts it against the rate of economic growth (vertical Y axis). The law of diminishing returns of factor leads to the so-called Armey curve, displayed in Figure 1.

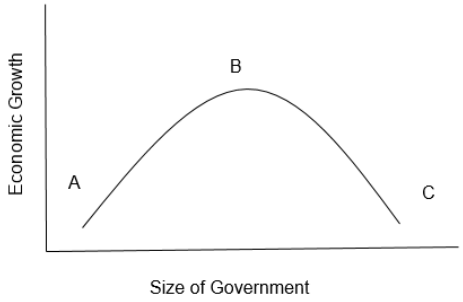

Figure 1. Armey Curve

Source: Munene (2015)

When expenditure by the public sector is extremely low, it is associated with the non-compliance of contracts and lack of protection of property rights because of the state's failure to enforce these (Armey, 1995). In this environment, the rate of economic growth will be zero. On the other hand, large public sector expenditures lower and limit the incentive of the private economy to invest and produce, associated with crowding-out effects. The Armey curve, according to Miller (2010), proposes that there is a quadratic relationship between the size of government and economic output. This means that, due to the law of diminishing factor returns, the Armey curve has an inverted U shape. This implies that, as the public sector grows larger, so does the GDP, but after the point of optimisation, economic growth starts to decline.

Point A on the Armey curve effectively assumes nearly no public sector with very little associated economic growth. While government size rises, starting from point A, public sector contribution to economic growth increases. At the point of optimal government size, no further increase or decrease in the size of government is required, located at point B (Dosti & Grabova, 2014). Beyond this point, maximum

economic growth and the effect of the public sector are negative and inefficient, coinciding with lower levels of national income.

To determine the optimal size of government where real economic growth is maximised in the long term, Scully (1994) used the general tax rate as a measure of government expenditure and determined how it relates to real economic growth. Taking real GDP (Y), government's total expenditure (G at constant prices) and the tax rate (τ), the Cobb-Douglas production function is expressed as:

$$Y = a(G_{t-1})^b [(1-\tau_{t-1})Y_{t-1}]^c \text{eq. 1}$$

Assuming the budget to be balanced and continuous (where $G = \tau Y$), and substituting the assumption into the equation, yield real GDP as:

$$Y_t = a(\tau_{t-1}\ Y_{t-1})^b [(1-\tau_{t-1})Y_{t-1}]^c \text{eq. 2}$$

Calculating the highest attainable real output (Y_t) using the first and second income differentials relative to τ yields the point where expenditure of government as a percentage of GDP is at:

$$\tau^* = \frac{b}{b+c} \text{eq. 3}$$

The optimum size of the public sector in relation to its spending $\ln(y_{i,t})$ can then be estimated using equation 4:

$$\ln(y_{i,t}) = \ln(a) + b\ln(\tau_{t-1}Y_{t-1}) + c\ln[(1-\tau_{i,t-1})Y_{i,t-1}] \text{eq. 4}$$

The strength of this connection between government expenditure and growth was determined by Vedder and Gallaway (1998) and Pevcin (2004) employing a standard quadratic equation. Using real GDP growth (g) and consumption expenditures of the public sector relative to GDP (GC %), a theoretical inverted U curve can be derived in the form of:

$$1 + g_{i,t} = a + b(GC)_{i,t} + c(GC)^2_{i,t} \text{eq. 5}$$

The public sector's consumption expenditures as a percentage of GDP (CG), which is necessary to obtain maximum economic growth (GC^*) in this quadratic equation, is now determined by differentiating *g* with respect to *GC* in equation 5, yielding:

$$GC^* = -\frac{b}{2c} \text{eq. 6}$$

A central issue in the debate on an optimal government depends on how the public sector is defined. Pathirane and Blades (1982) state that the term public sector must

also include public enterprises in addition to government departments and agencies. The public sector therefore refers to general government (national and sub-national), non-financial corporate enterprises and financial institutions publically controlled (owned). Pathirane and Blades (1982) further state that the primary difference between the private and public market is based on ownership, where the ownership and/or control of an enterprise rests in the public authorities or private parties.

The majority of the empirical studies related to the Armey curve obtained an optimal position between certain threshold values (Altunc & Aydin, 2013; Facchini & Melki, 2011; Vaziri *et al*., 2011; Pevcin, 2004). It was found that the optimal size of governments is between 15 and 50%, depending on a country's level of development (Friedman, 1997).

The majority of the research also accepted Barro's (1989) theoretical framework by assuming that the optimal size of government expenditure is at the point where marginal productivity equals unity. This occurs where the productive efficiency of government services is most efficient; measured by f = g/y where y being the output per person and g the real government average purchases per person.

Table 1 lists a number of studies that have tested for the relationship of government size and economic growth on the assumption of a theoretical inverted-U relationship between the two variables. The list is only an illustrative example.

Table 1. Brief Literature Review

Authors	**Article title**	**Study aim**	**Method of analysis**	**Country & period**	**Conclusion: Optimal gov. size % of GDP**
De Witte & Moesen (2010)	Sizing the government	Inverted U-shaped between government size & economic performance	Non-parametric data envelopment analysis	23 OECD countries 1999	41.22%
Forte & Magazzino (2016)	Government size and economic growth in Italy: time-series analysis	Empirically assess the relationship between government size & economic growth	Auto-regressive integrated moving average – exogenous variables	Italy 1861-2008	35.32%
Aly & Strazicich (2000)	Is government size optimal in the gulf countries of the Middle East?	Examined the amount of consumption by government in relation to national output	Panel regressions	Middle East: 5 Gulf countries 1970-1992	12%
Ahmad & Othman (2014)	Optimal size of government and economic growth in Malaysia	Test long run relation between government size & economic growth	Auto-regressive distributed lag (ARDL) bound testing approach	Malaysia 1970-2012	16.32%
ul Husnain (2011)	Is the size of government optimal in Pakistan?	Determine the optimal size of Government	Time series	Pakistan 1975-2008	21.48%
Mutascu & Milos (2009)	Optimal size of government spending: European Union member states	Determined optimal size: Both old & new EU members	Econometric model of pool data	Old and new member states of the EU 1999-2008	27%, 46 %.
Munene (2015)	The optimal size of government expenditure and economic growth in Kenya	Examine the effects of government size on economic growth in Kenya	Quadratic or a second-degree polynomial function	Kenya 1963–2012	23%

Asimakopoulos & Karavias (2016)	The impact of government size on economic growth: a threshold analysis	Examines the relationship between government size & economic growth, & identifies optimal level of government size	Novel and general non-linear panel Generalised method of moments approach.	129 countries	Developing countries = 14.83%, Developed countries = 17.88%.
Turan (2014)	Optimal size of government in Turkey	Determines how the size of the public sector relates to economic growth, & the optimal size of Turkey's government	Cobb Douglas production	Turkey 1950 - 2012	Varies between 8.8 & 9.1% (1950-2012 And 15.4-17% (1970-2012)
Hok, Jariyapan, Buddha-wongsa & Tansuchat (2014)	Optimal size of government spending: empirical evidence from eight countries in Southeast Asia	Explores an inverted U curve between government spending & economic growth, & optimum size of public expenditure	Auto-regressive distribution lags	Eight ASEAN countries 1995 to 2011	Optimal size of government expenditure share of GDP was 28.5%

3. Accounting and Estimating the Size of the South African Public Sector

Labonte (2010) and Di Matteo (2013) suggest that measuring the size of government can be complicated, since it can be manifested in a number of different units of measurement, i.e., dollars, per capita, total employees, or relative to GDP. These measurements individually have their own relative advantages and disadvantages. In most cases, these various methods will also deliver different results (Dosti & Grabova, 2014). Labonte (2010) argues that the size of the government is in most cases measured according to government expenditure (outlays) and/or revenues (receipts), i.e. the size of government should be measured by the resources it commands, whether directly or indirectly. This will also be the preferred methodology of measurement followed in this article.

All transactions by government are divided between receipts, payments and funding by National Treasury (NT, 2018). Government receipts include taxes; transfers; sales; income from financial assets and liabilities, dividends, interest, rent on property; as well as penalties, forfeiting and fines. Government payments, on the other hand, relate to present payments, subsidies, transfers, and expenditure on

capital and financial assets. Financing includes financial transactions that were not included among deals on financial assets and liabilities and payments thereof. Financing will, however, not be taken into account in this article since it only reflects financial flows and not any actual operating activities of the government. Cash receipts represent the financing side of the public sector, while intensity of public sector transactions is reflected in payments.

The consolidated central Government account, according to the National Treasury (NT, 2018) and the SARB (SARB, 2019) includes transactions of national government, extraordinary budget accounts and the social security funds (displayed in Figure 2). The consolidated central Government account includes 47 national government departments and 185 central government entities, known as extra-budgetary agencies. National Treasury (2018) also includes various state-owned enterprises under this category. Their output and services are mainly rated at regulated prices on behalf of public institutions and departments, and/or are directly financing and developing infrastructure.

The account of the consolidated general government also includes the provincial and local government, as displayed in Figure 2 (NT, 2017; SARB, 2019). This includes approximately 116 provincial departments, their public entities and business enterprises (approximately 77), eight metropolitan municipalities, 44 district municipalities and 205 local municipalities and their public entities/business enterprises (approximately 39). This account therefore accounts for approximately 722 national and provincial departments, municipalities, entities and business enterprises in South Africa.

All levels of the public sector accounts were combined, and to avoid double counting, intergovernmental transactions are removed. That implies that only transactions between the public sector and agencies outside government were considered. The consolidated process therefore aimed to estimate the financial position of government and its true size in the economy much more accurately.

The data is sourced from the SARB online statistical query facility and expressed in nominal terms. Although it is customary to use real data in economic analysis, there is, however, no need for that in the current study, as the figures are here only used as an illustration and not analysis *per se*. The data covers calendar years, and not fiscal years, between 1992 and 2018.

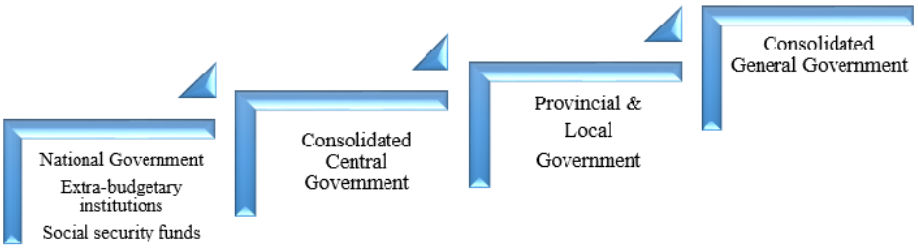

Figure 2. Flow Chart of Consolidated Central and General Government Accounts

Source: Authors' design, SARB (2019)

The consolidation process is illustrated in Figure 3. The size of each block illustrates the natural ordering (size) of the various components of general government. Firstly, the cash receipts and cash payments from/for operating activities of the various components of the consolidated general government account were calculated, respectively. Table 2 displays receipts of the consolidated general government, which include receipts of the national, provincial and local government, social security funds and extra-budgetary institutions. A similar table was computed for payments by the consolidated general government, which also includes the accounts of these sub-divisions.

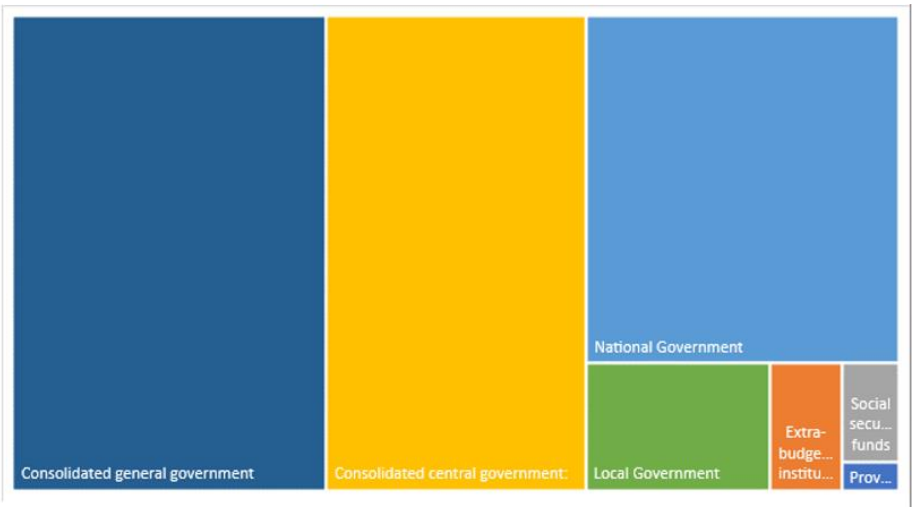

Figure 3. Tree Map of Consolidated Central and General Government Accounts (2018)

Source: Authors' Calculations, SARB (2019).

Table 2. Cash Receipts from Operating Activities of the Various Components of the Consolidated General Government Account (R mil.)

	National government	Extra-budgetary institutions	Social security funds	Provincial government	Local government	Consolidated general government
1992	77 929	2 804	1 797	5 430	10 408	98 368
1993	82 534	4 032	2 043	5 742	10 187	104 538
1994	99 292	4 247	2 289	6 337	12 808	124 973
1995	113 270	4 616	2 530	6 746	14 316	141 478
1996	128 926	5 299	3 173	4 317	16 086	157 801
1997	149 264	6 506	5 560	4 075	33 262	198 667
1998	166 693	6 586	6 513	3 408	38 287	221 487
1999	188 364	4 912	6 850	3 394	45 096	248 616
2000	210 445	5 902	7 111	3 975	46 906	274 339
2001	224 458	10 268	8 094	4 621	51 299	298 740
2002	258 402	12 944	8 235	4 897	50 270	334 748
2003	288 516	9 683	11 515	5 925	60 968	376 607
2004	307 229	17 597	12 370	6 392	69 947	413 535
2005	360 531	21 271	14 355	6 164	77 009	479 330
2006	429 497	29 975	17 022	7 262	86 681	570 437
2007	509 692	27 143	19 406	7 913	82 143	646 297
2008	587 132	27 397	25 176	9 273	97 766	746 744
2009	641 550	30 502	29 914	11 937	107 950	821 853
2010	613 214	34 718	33 315	11 223	121 771	814 241
2011	690 232	42 898	36 101	11 619	140 204	921 054
2012	764 954	58 660	36 391	12 136	155 904	1 028 045
2013	831 580	54 755	41 592	13 128	171 108	1 112 163
2014	924 176	69 568	49 056	14 160	188 735	1 245 695
2015	1 013 638	95 314	47 120	16 435	212 760	1 385 267
2016	1 121 501	88 825	58 787	16 229	225 067	1 510 409
2017	1 171 902	97 651	60 399	17 682	251 654	1 599 288
2018	1 254 522	100 010	63 434	18 788	258 727	1 695 481

Source: Authors' calculations, SARB (2019).

Table 3 displays the structure of the consolidated general government account. The consolidation process that accounts for all intergovernmental transactions causes the structure of cash receipts and cash payments to differ. Provincial government, for example, only generates a small percentage of cash receipts from operating activity compared to cash payments for operating activities; the difference being transfers

from national government to provincial government. Cash receipts from operating activities occur on a national level, but the cash payments for operating activities occur on a provincial level.

Table 3. Structure of the Consolidated General Government Account (%)

	Cash receipts from operating activities	**Cash payments from operating activities**
National government	75.31	37.83
Extra-budgetary institutions	4.88	10.77
Social security funds	3.44	2.51
Consolidated central government:	83.63	51.11
Provincial government	1.39	32.30
Local government	14.98	16.59
Consolidated general government	100	100

Source: Authors' calculations, SARB (2019).

In order to obtain the final account of the consolidated public sector, approximately 21 government enterprises are to be added and consolidated with the general public sector, as displayed in Figure 4. The SARB distinguishes between non-financial public enterprises and corporations, such as Telkom and Transnet, and financial public enterprises and corporations, such as the Industrial Development Cooperation (IDC).

Kahn (2011) states that the consolidation process up to this point does not sufficiently and holistically take into account the scope of government's role in the economy, in that many government interventions cost little or nothing, but have a potentially large impact on the economy. It is therefore essential that one has to account for government regulations and trade restrictions (as displayed in Figure 4). For example, tax payers are required to file tax returns every year for which each tax payer incurs costs. These costs are not paid over to the government, but to private institutions. This is a diversion of private resources for public purposes because of government mandates, and represents government's control over resources. Since no official or unofficial data exists, the article assumed a cost of regulation equal to five per cent of the expenditure on the GDP and is accounted as a cash receipt from operating activity since it is a non-voluntary tax.

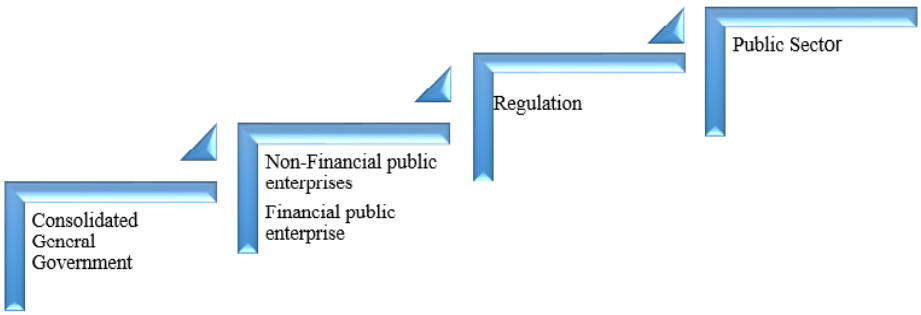

Figure 4 Flow Chart of the Public Sector Account

Source: Authors' design, SARB (2019).

Table 4 displays the cash receipts from operating activities of the public sector account in million rand, where the consolidated general government, public enterprises, regulations, and the public sector constitute the various components, respectively. A similar table was also calculated for cash payments by these respective categories.

Table 4 Cash Receipts from Operating Activities of the Public Sector Account (R Mil.)

	Consolidated general government	Public enterprises	Regulation	Public sector
1992	97 264	37 151	19 186	153 601
1993	103 962	41 006	21 944	166 912
1994	123 189	45 275	24 812	193 276
1995	141 264	52 029	28 194	221 487
1996	157 588	55 785	31 731	245 104
1997	198 506	62 812	35 156	296 474
1998	221 487	71 472	38 083	331 042
1999	248 561	82 701	41 738	373 000
2000	274 288	104 314	47 316	425 918
2001	298 689	107 753	52 307	458 749
2002	334 699	122 801	60 863	518 363
2003	376 608	140 362	66 288	583 258
2004	413 535	150 114	73 831	637 480
2005	479 379	144 854	81 963	706 196
2006	570 692	176 568	91 970	839 230
2007	646 490	187 187	105 475	939 152
2008	747 045	196 581	118 453	1 062 079
2009	822 298	227 092	125 384	1 174 774
2010	815 271	248 087	137 400	1 200 758
2011	921 449	282 895	151 183	1 355 527

2012	1 028 480	318 611	162 693	1 509 784
2013	1 112 685	352 403	176 990	1 642 078
2014	1 246 376	371 477	190 384	1 808 237
2015	1 385 956	443 156	202 488	2 031 600
2016	1 510 425	413 827	217 290	2 141 542
2017	1 599 920	444 858	218 377	2 291 626
2018	1 695 481	467 768	231 049	2 394 298

Source: Authors' calculations, SARB (2019).

The cash receipts and cash payments from, and for operating activities of the public sector account over the period are displayed in Figure 5.

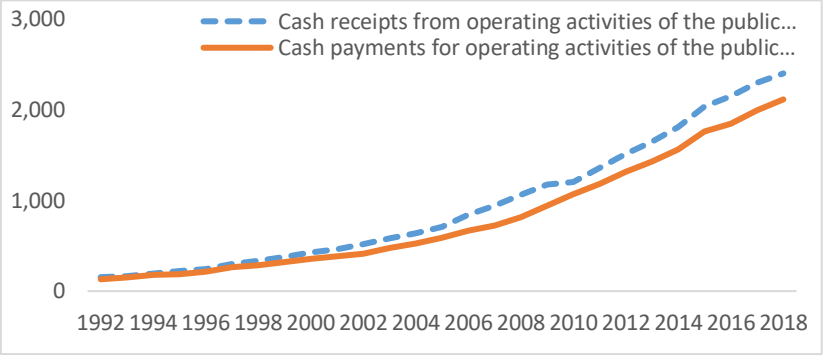

Figure 5. Public Sector Account (R mil.)

Source: Authors' calculations, SARB (2019).

4. The Size of South Africa's Public Sector

Alimi (2014) states that the quantum of public sector receipts and/or expenditure is the most popular method to determine the size of the public sector. Comparing the quantum with an alternative is therefore essential in order to estimate the relative true size of public sector. Gross national income (GNI) is used in this article since it includes all claims by the country's citizens, including government, from local and international funds. GNI consists of the GDP and net income received from abroad. It considers all income of the country regardless from where it is earned (Mankiw, 2014, p. 463).

Table 5. Public Sector Cash Receipts and Payments from/for Operating Activities as a Percentage of GNI (R mil. & %)

	Gross national income (GNI)	Public sector: Cash receipts from operating activities	Public sector: Cash payments for operating activities
1992	375 322	40.93	34.67
1993	430 184	38.80	35.66
1994	487 634	39.64	36.96
1995	553 443	40.02	33.93
1996	621 231	39.45	33.95
1997	688 273	43.08	38.20
1998	744 170	44.48	38.16
1999	815 152	45.76	39.09
2000	924 300	46.08	38.66
2001	1 013 968	45.24	37.65
2002	1 187 865	43.64	34.64
2003	1 290 897	45.18	36.86
2004	1 448 773	44.00	36.28
2005	1 607 829	43.92	36.40
2006	1 804 625	46.50	36.76
2007	2 040 684	46.02	35.46
2008	2 295 188	46.27	35.36
2009	2 451 518	47.92	38.39
2010	2 689 409	44.65	39.70
2011	2 946 328	46.01	39.95
2012	3 165 515	47.69	41.49
2013	3 446 999	47.64	41.25
2014	3 706 132	48.79	42.13
2015	3 949 393	51.44	44.49
2016	4 238 590	50.52	43.36
2017	4 514 015	50.77	44.11
2018	4 719 854	50.73	44.67

Source: Authors' calculations, SARB (2019).

The data in Table 5 shows that public sector cash receipts from operating activities (government's command of national resources) increased from 41% of GNI in 1992 to 51% in 2018. This represents an average annual increase of 0.52% of the share of GNI allocated to the public sector. On the other hand, public sector cash payments for operating activities (government expenditure) increased from 35% of GNI in 1992 to 45% in 2017. This represents an average annual increase of 0.49% of the share of GNI spent by the public sector.

Using a nonparametric estimate allows public sector cash receipts and payments to vary with gross national income over the distribution. The objective is to provide an

estimate of the unknown relationship between public sector cash receipts and payments and gross national income using smoothing. The estimated regression relationship to be tested is $g_t = m(S_t) + \varepsilon_t$ where t = 1992 to 2018, g_t is gross national income (GNI, log format) and S_t is the public sector cash receipts (PSCRA) and payments (PSCPA), respectively (both log format). The smoothing is done using a Kernel. The Kernel K used is the Epanechnikov kernel. The bandwidth h determines the scale of the smoothing (h=0.5). The estimate of *m* is calculated using the Nadaraya-Watson method. The nonparametric estimate of the conditional mean seems fairly stable and linear across gross national income, except for the very top of the distribution. There seems to be a very definite linear relationship between gross national income and public sector cash receipts and payments, respectively.

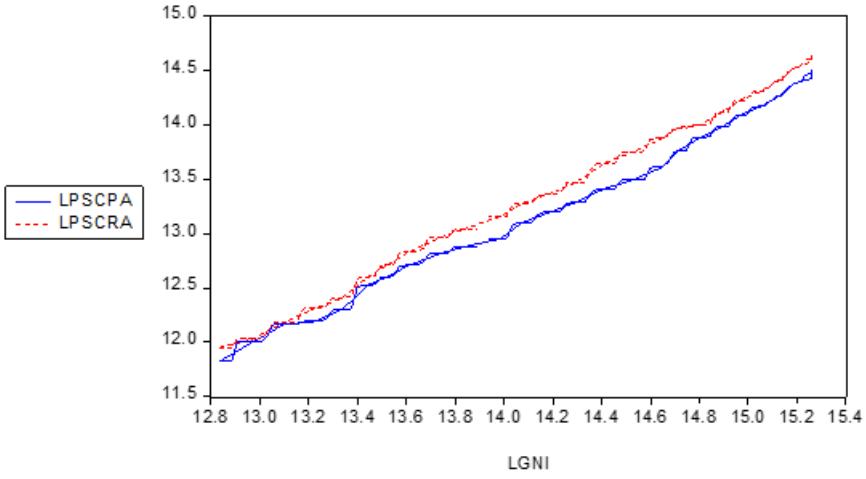

Figure 6. Kernel Estimate of Public Sector Cash Receipts and Payments (h=0.5)

Source: SARB (2019); own calculations

5. The Contribution of the Public Sector in South Africa?

Gross value added (GVA) is the measure of the value of goods and services produced in an economy over a set period. The GVA, by kind of economic activity table as published by the SARB, unfortunately only includes the GVA of the general government and not that of public enterprises. For this purpose, the GVA of public enterprises was determined using all of the contributions (GVA) by the electricity, gas and water sectors, and only 20% of the GVA of transport, storage and communication (SARB data). The GVA at basic prices of all sectors and that of the

public sector (general government services and public enterprises) is displayed in Table 6. The data shows that the public sector's contribution to the economy (public sector GVA) increased from 21.7% of total GVA in 1992 to 23.3% in 2017. This represents an average annual increase of 0.06% of the share of total GVA contribution by the public sector.

Table 6. Public Sector Gross Value Added as a Percentage of Total GVA (R mil. & %)

	GVA at basic prices (GDP)	**GVA at basic prices of public sector services (GDP)**	**As a %**
1992	355 052	77 049	21.70
1993	403 593	87 281	21.63
1994	454 260	99 518	21.91
1995	516 124	112 211	21.74
1996	582 127	130 694	22.45
1997	644 554	145 098	22.51
1998	694 108	156 238	22.51
1999	759 943	166 537	21.91
2000	862 394	180 370	20.92
2001	954 352	192 648	20.19
2002	1 111 876	215 147	19.35
2003	1 208 379	233 730	19.34
2004	1 331 950	255 610	19.19
2005	1 469 239	277 993	18.92
2006	1 642 221	306 164	18.64
2007	1 884 723	340 254	18.05
2008	2 137 190	391 718	18.33
2009	2 277 146	454 977	19.98
2010	2 494 860	518 487	20.78
2011	2 724 400	586 792	21.54
2012	2 932 879	648 754	22.12
2013	3 183 431	716 162	22.50
2014	3 418 060	781 471	22.86
2015	3 625 466	834 368	23.01
2016	3 878 162	900 004	23.21
2017	3 897 553	908 007	23.30

Source: Authors' calculations, SARB (2019).

The estimated regression relationship to be tested is $g_t = m(S_t) + \varepsilon_t$ where t = 1992 to 2017, g_t is gross value added (GVA, log format) and S_t is the public sector GVA (PSGVA, log format). Using the same methodology as earlier, there seems to be a very definite linear relationship between total GVA and public sector GVA (see Figure 7).

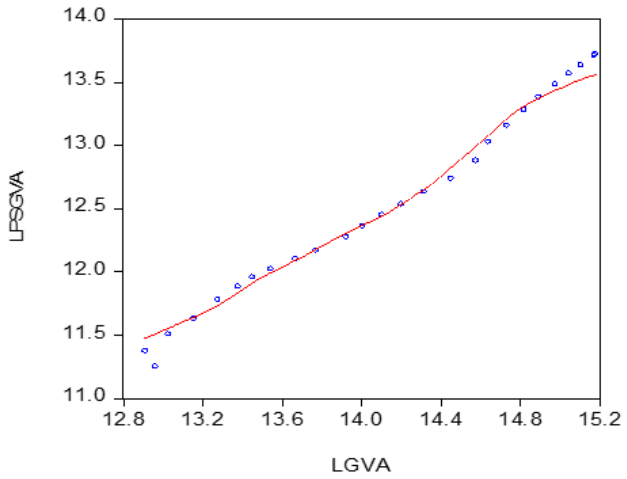

Figure 7. Kernel Estimate of Public Sector GVA (h=0.5)

Source: Authors' calculations, SARB, 2019

Total expenditure on gross domestic product (EGDP) relates to the gross domestic product (GDP) in an economy for a set period and includes consumption, investment, government spending and net exports. The item referring to expenditure of the general government on gross domestic products and published by the SARB includes their final consumption expenditure and fixed capital formation, as well as that of the state-owned enterprises. Table 7 displays the gross fixed capital formation of the general government (GFCF) and of public enterprises (public sector) at basic prices, expressed as a percentage of total expenditure on gross domestic products plus the general government's total consumption expenditure (C).

The data shows that public sector expenditure on GDP (public sector's contribution to the economy) increased from 25.7% of total GDP in 1992 to 30% in 2017. This represents an average annual increase of 0.21% of the share of total expenditure on gross domestic product by the public sector (Coetzee & Kleynhans, 2018).

Table 7. Final Consumption Expenditure and Capital Investment (GFCF) of the Public Sector (R mil. & %)

	Expenditure on GDP	Final C and GFCF of public sector	As a %
1992	383 723	98 706	25.72
1993	438 884	109 208	24.88
1994	496 233	121 699	24.52
1995	563 870	129 846	23.03
1996	634 611	152 529	24.04
1997	703 117	171 405	24.38
1998	761 658	189 772	24.92
1999	834 753	195 482	23.42
2000	946 324	214 245	22.64
2001	1 046 144	235 306	22.49
2002	1 217 265	277 954	22.83
2003	1 325 766	311 156	23.47
2004	1 476 623	347 385	23.53
2005	1 639 254	391 845	23.90
2006	1 839 400	425 194	23.12
2007	2 109 502	504 146	23.90
2008	2 369 063	622 097	26.26
2009	2 507 677	695 435	27.73
2010	2 748 008	743 826	27.07
2011	3 023 659	798 169	26.40
2012	3 253 851	878 872	27.01
2013	3 539 790	979 312	27.67
2014	3 807 676	1 065 995	28.00
2015	4 049 759	1 137 844	28.10
2016	4 345 806	1 224 952	28.19
2017	4 367 535	1 310 699	30.01

Source: Authors' calculations, SARB (2019).

The estimated regression relationship to be tested is $g_t = m(S_t) + \varepsilon_t$ where t = 1992 to 2017, g_t is total expenditure on gross domestic product (GDP, log format) and S_t is the public sector expenditure on gross domestic product (PSGDP, log format). Using the same methodology as earlier, there seems to be a very definite linear relationship between total expenditure on gross domestic product and public sector expenditure on gross domestic product (see Figure 8).

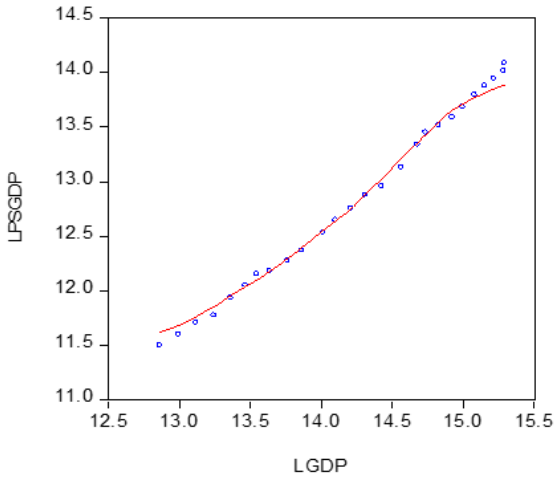

Figure 8. Kernel Estimate of Public Sector Expenditure on GDP (h=0.5)

Source: Authors' calculations, SARB (2019).

The graph in Figure 9 summarises the results of the size of the public sector and the contribution of the public sector analysis. Public sector cash receipts (PSCRS), cash payments (PSCPS), GVA (PSGVAS) and expenditure of GDP (PSGDPS) are expressed as percentages of GNI. The size (PSCRS & PSCPS) and the contribution of the public sector (PSGVS and PSGDPS) differ much over time, averaging approximately 20% over the period.

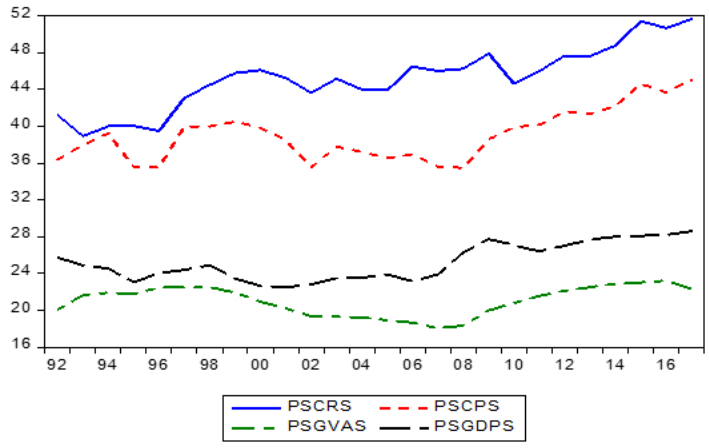

Figure 9. Public Sector Size and Contribution to the Economy

Source: Authors' calculations, SARB, 2019

The scatter plot of Figure 10 suggests there is almost no relationship between public sector cash receipts (PSCRS) as a percentage of GNI and public sector GVA (PSGVAS) and expenditure on GDP (PSGDPS) as a percentage of GNI. The estimated regression relationship is tested using a Kernel smoothing technique. The Kernel K used is the Epanechnikov kernel. The bandwidth h determines the scale of the smoothing (h=0.8) as suggested by Di Matteo (2013). The estimate of *m* is calculated using the Nadaraya-Watson method.

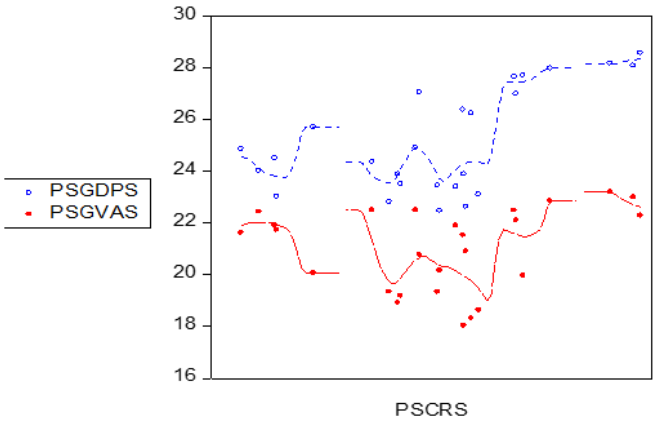

Figure 10. Association between Size and Contribution of the Public Sector

Source: Authors' calculations, SARB, 2019

6. The Optimal Size of the South African Public Sector

Taking per capita GNI annual economic growth at current prices (AAPCGNI) for the quarter century from 1992 to 2017, and comparing it with the public sector cash receipts (PSCRS), public sector cash payments (PSCPS), public sector GVA (PSGVAS) and expenditure ratios (GDP to GNI) (PSGDPS) on a graph together with a Kernel, smooth yields the results shown in Figure 11. The graphs give some evidence of an inverse relationship. A government public sector that is smaller in size leads to higher levels of efficiency and more economic growth and welfare. This analysis did not take all the aspects possible into account, but it can be deduced from this study that the larger the public sector is in relation to the size of the economy the lower the rates of per capita GNI growth will be. When dividing the public sector by range of sizes, Table 8 indicates that economic growth is between 12 and 15% for average public sector size ratios below 30%, compared to 3 to 6% for average public sector size ratios higher than 35%.

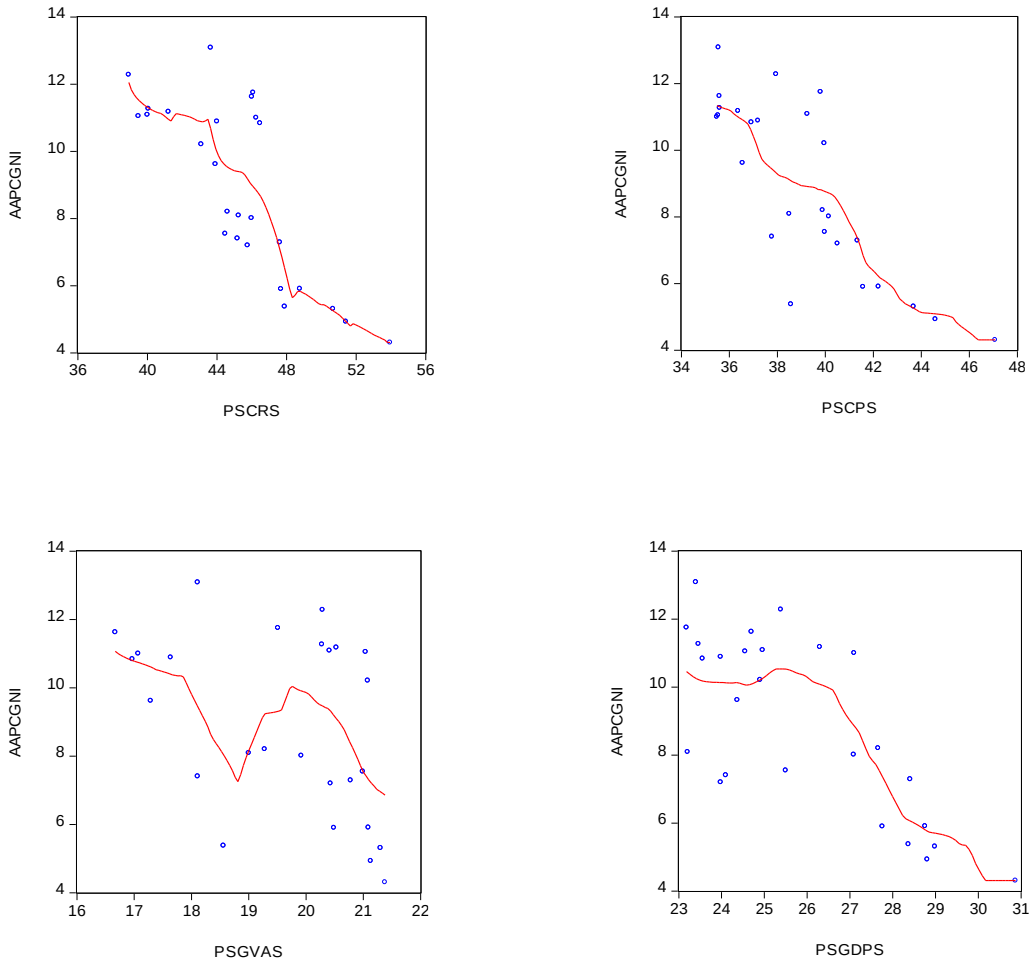

Figure 11. Annual Growth Rates of Per Capita GNI to Public Sector GNI Ratios

Source: Authors' calculations, SARB (2019).

Table 8. Average Annual per Capita GNI Growth Rates by Public Sector Size Ranges (%)

AAPCGNI	Ave. PSCRA	Ave. PSCPA	ve. PSGVA	Ave. PSGDP	Ave. RATIO
3-6	49.60	42.54	20.47	28.66	35.32
6-9	45.56	39.74	19.79	25.71	32.70
9-12	43.33	37.11	18.95	24.64	31.01
12-15	41.29	36.75	19.20	24.39	30.41

Source: Authors' calculations, SARB, 2019

Mutaşcu and Milos (2009) stated that national income (Y) is a function of the public sector's engagement in the economy (G) and other exogenous factors (N), and expressed the Armey curve mathematically as:

$Y = f(G,N)$eq. 7

The per capita annual economic growth rate (in nominal terms) then represents national output or income, while spending by government relative to the total expenditure on GDP constitutes the size of the sector. These two variables are displayed in Figure 12.

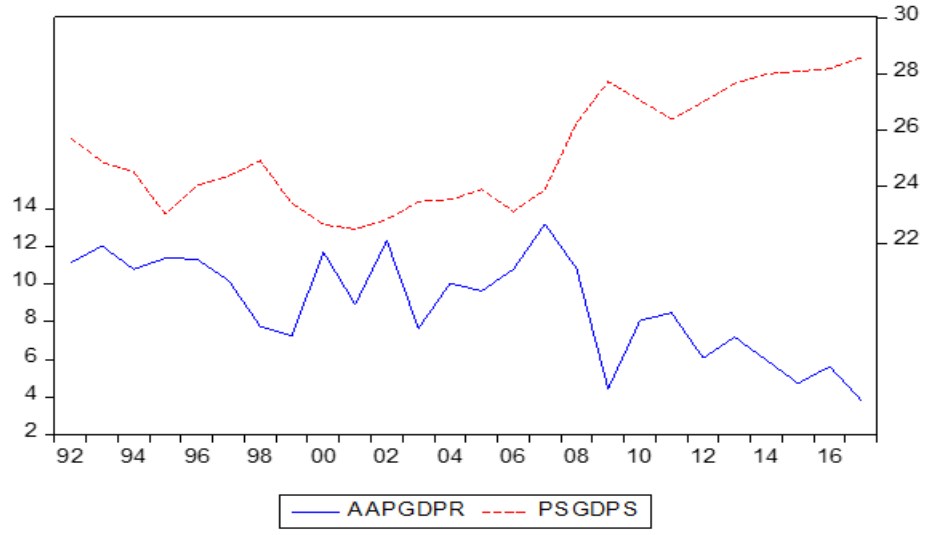

Figure 12. Output of the Economy and Size of the Public Sector over the Period

Note: PSGDPS = public sector spending on GDP as a % of total expenditure on GDP (vertical axis, %)

Source: Authors' calculations, SARB (2019).

The descriptive statistics of the two variables are displayed in Table 9. Both variables are normally distributed (p>0.05).

Table 9. Descriptive Statistics of the Two Variables, 1992-2017

	AAPGDPR	PSGDPS
Mean	8.907692	25.22346
Median	9.295000	24.70000
Maximum	13.22000	28.59000
Minimum	3.820000	22.49000
Std. Dev.	2.684254	2.023047
Skewness	-0.320131	0.295904
Kurtosis	1.955611	1.607047
Jarque-Bera	1.625740	2.481433
Probability	0.443583	0.289177
Sum	231.6000	655.8100
Sum sq. dev.	180.1305	102.3180

Source: Authors' calculations, SARB, 2019

Chobanov and Mladenova (2009) suggest that the theoretical characteristic inverted U curve relationship between economic growth and the size of the public sector can only be obtained when the model is converted into a simple quadratic equation. The model therefore needs to be rewritten as the following non-linear regression (keeping N constant):

$GDP_t = \alpha_1 + \alpha_2 * Gt + \alpha_3 * Gt^2$ eq. 8

Where GDP represents the per capita GDP growth (AAPGDPR, nominal, %); and G the public sector expenditure on GDP (PSGDPS, % in GDP).

Identifying the optimal level of public sector expenditure on GDP as % of GDP is done by computing the equation above as a function that must be maximised (Chobanov *et al.*, 2009). The derivation of the function by G that equalises it to zero is as follows:

$2 * \alpha_3 * G + \alpha_2 = 0$eq. 9

From where the optimum level of public sector size is:

$G = \alpha_2 / 2 * \alpha_3$eq. 10

Testing both variables for stationarity using the Augmented Dickey Fuller test (5 lags) suggests that the variables are trend and intercept stationary, i.e. integrated in order 0 or I (0). The results of the regression analysis are displayed in Table 10.

Altunc *et al*. (2013) obtained a positive sign for this linear expression of the size of the public sector ($\alpha_2 G = 14.94036$). On the other hand, the quadratic expression of the size of the public sector ($\alpha_3 G^2 = -0.312093$) is negative, indicating the negative consequences of an over-sized public sector. It can be predicted in advance that the curve will be downward sloping, showing that the negative effects of public spending will dominate any positive consequence, because the quadratic expression rises faster in terms of value than the linear equation does.

Table 10. Regression Results Regarding the Optimal Level of Public Sector Size

Dependent variable: AAPGDPR (GDP)		
Variable	Coefficient	p-value
PSGDPS (G)	14.94036***	0.0154
PSGDPS^2 (G^2)	-3.12E-01***	0.0103
C	-168.1511***	0.0295
Adjusted R^2	0.637407	
F-statistic	22.97389***	0.000
Durbin-Watson stat	1.960712	

Note: **** = Statistically significant ($p < 0.05$)

Testing the regression model for stability (considering the residuals for a unit root) found no unit roots among the residuals (Phillips-Perron test statistic p-value = 0.006). The residuals are also normally distributed (Jarque-Bera p-value = 0.536). The residuals, according to the Breusch-Godfrey Serial Correlation LM Test, are not serially correlated (F-statistic p-value = 0.8569). The Harvey heteroscedasticity test reveals the absence of any heteroscedasticity (F-statistic p-value = 0.0834).

The Engel-Granger (EG) and the Johansen tests were then conducted to determine whether there exists any association between the variables in the long run. These tests both indicated that these two series are indeed cointegrated (Engle-Granger tau-statistic p-value = 0.0087 and Jonansen hypothesised number of cointegrating equation(s) none p-value = 0.0391). The optimum level of the public sector size can therefore be estimated to be 23.94%. This compares to the current level of approximately 30%. The optimal level is comparative to the levels seen during the 2005 to 2007 period.

Alimi (2014), Altunc *et al.* (2013), Asimakopoulos *et al.* (2016), and Turan (2014), among others, expand on the above regression model by including a number of exogenous factors or explanatory and control variables (N). The most common factors and variables are investment share of GDP (IGDP), consumption share of GDP (CGDP), openness of the economy (imports plus exports) relative to the size

of the domestic economy (OGDP), and the rate of unemployment (UNEMP). Given that the variables are expressed in nominal terms, an inflation variable (INF = average annual % price increase) will also be included.

The descriptive statistics of the variables are displayed in Table 11. All of the variables seem to be normally distributed ($p>0.05$).

Table 11. Descriptive Statistics of the Variables (1992-2017)

	AAPGDPR	PSGDPS	$PSGDP^2$	CGDP	IGDP	OGDP	INF	UNEMP
Mean	8.91	25.22	640.16	80.70	18.75	27.55	6.70	23.55
Median	9.30	24.70	610.12	80.93	18.79	28.27	6.00	24.70
Maximum	13.22	28.59	817.39	82.62	23.15	35.62	13.90	27.30
Minimum	3.82	22.49	505.80	78.67	15.16	20.70	1.40	16.90
Std. dev.	2.68	2.02	103.28	1.10	1.95	3.76	2.60	2.78
Skewness	-0.32	0.30	0.36	-0.06	0.12	-0.15	0.75	-0.73
Kurtosis	1.96	1.61	1.64	1.89	2.43	2.34	3.98	2.68
Jarque-Bera	1.63	2.48	2.56	1.34	0.41	0.57	3.46	2.40
Probability	0.44	0.29	0.28	0.51	0.82	0.75	0.18	0.30
Sum	231.60	655.81	16644.12	2098.15	487.4	716.36	174.10	612.20
Sum sq. Dev.	180.13	102.32	2.67E+05	30.35	95.16	353.11	169.55	193.68

Source: Authors' calculations, SARB (2019).

Performing a group unit root test yielded the results given in Table 12, suggesting that the variables are individual intercept and trend stationary.

Table 12. Group Unit Root Test of the Variables (1992 – 2017)

Method	**Statistic**	**Prob.****	**Cross-sections**	**Obs.**
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.58232	0.0049	8	195
Breitung t-stat	-2.05277	0.0200	8	187
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.87845	0.0302	8	195
ADF – Fisher chi-square	25.7393	0.0578	8	195
PP – Fisher chi-square	26.7140	0.0448	8	200

Source: Authors' calculations, SARB (2019).

The following regression equation is estimated:

$$GDP_t = \alpha_1 + \alpha_2*Gt + \alpha_3*Gt^2 + \alpha_4*CGDP_t + \alpha_5*IGDP_t + \alpha_6*OGDP_t + \alpha_7*INF_t + \alpha_8*UNEMP_t + \varepsilon_t \quad \text{eq. 11}$$

where GDP is per capita GDP growth (AAPGDPR, nominal, %); G the public sector expenditure on GDP (PSGDPS, % in GDP); CGDP consumption share of GDP (% in GDP); IGDP the investment share of GDP (% in GDP); OGDP openness of the economy (imports plus exports) relative to the size of the economy (% in GDP); INF the average annual percentage price increase (%); and UNEMP the official unemployment rate (%)

The regression equation is estimated using the fully modified OLS (FMOLS) estimation technique. In this function, the sign of government's size is positive ($\alpha_2 G$ = 9.528844), while the quadratic expression ($\alpha_3 G^2$ = -0.201762) is negative (see Table 13). Both coefficients are statistically significant. The majority of control and explanatory factors and variables are also statistically significant.

Table 13. Regression Results Regarding the Optimal Level of Public Sector Size

Dependent variable: AAPGDPR (GDP)		
Variable	Coefficient	p-value
PSGDPS	9.528844***	0.007
PSGDPS^2	-0.201762***	0.004
CGDP	-0.302698	0.124
IGDP	-0.456223***	0.0185
OGDP	0.371303***	0.0029
INF	0.09278	0.3399
UNEMP	-0.568137***	0.0003
C	-66.75476	0.1312
Adjusted R^2	0.767428	

Note: **** = Statistically significant ($p < 0.05$)

Testing the regression model for stability (considering the residuals for a unit root) again indicated no unit roots among the residuals (Phillips-Perron test statistic p-value = 0.000). The residuals are also normally distributed (Jarque-Bera p-value = 0.823). The Engel-Granger (EG) test suggests that the series are indeed cointegrated (Engle-Granger tau-statistic p-value = 0.0007). The Jonansen Trace test indicates two cointegrating equations at the 0.05 level. The optimum level of the public sector size can therefore be estimated to be 23.61% compared to the 30% in 2017.

The following regression equation will also be tested using the same methodology as above, i.e.:

$GDP_{2t} = \alpha_1 + \alpha_2*Gt + \alpha_3*G_t^2 + \alpha_4*CGDP_t + \alpha_5*IGDP_t + \alpha_6*OGDP_t + \alpha_7*INF_t + \alpha_8*UNEMP_t + \varepsilon_t$eq. 12

Where GDP_2 is per capita GDP growth without public sector component (AAPGDPMR, nominal, %).

Equation 12 has two distinct advantages over the standard equation that was estimated in Table 15, i.e. first it affirms the causality (if any) between the expenditure by the public sector and real national income, and indicates that the causality is spending leading towards real GDP and not the other way. Secondly, as the less productive public sector is excluded, the productive output flow is due to the adjusted real GDP. The optimum level of the public sector size based on the above equation (Table 14) is estimated to be 23.18% compared to the 30% in 2017.

Table 14. Regression Results Regarding the Optimal Level of Public Sector Size

	GDP2
α_2	14.00334***
	(0.007)
α_3	-0.30212***
	(0.0044)

Note coefficients: * and **** = statistically significant (p <0.1 and < 0.05)

According to Barro's rule, the size of the public sector reaches the point of optimisation where the marginal product of its consumption (G) relative to the value added equals unity (1). Aly and Strazicich (2000) used the following methodology to test the Barro rule. Taking a country's real GDP (Y), the level of capital (K) and employed labour (L), they derived an economy-wide production function in the form of:

$Y = F(K, L, G/L)$eq. 13

To obtain growth rates, the production function can be rewritten as:

$(\Delta Y/Y) = \alpha (\Delta L/L) + \beta (\Delta K/Y) + \psi [(\Delta g/g)(G/Y)]$ eq. 14

In equation 14, the size of consumption by the public sector relative to GDP (G/Y) is determined as the gross value added, which is obtained as the coefficient of the expenditure on GDP and production; while 'g' is estimated as G/L. The 'Δ' indicates

a first derivative implying a growth rate. A change in capital stock usually implies investment spending.

This equation now yields α as the output elasticity of labour, while the marginal product of capital is β and the marginal product of services by the public sector ψ . The rule states that if ψ is lower than one ($\psi < 1$), then the size of the public sector size is larger than optimal. On the other hand, if ψ exceeds one, then government size is smaller than optimal.

The results are displayed in Table 15. The estimated marginal product of public sector services (ψ) where G is public sector expenditure of GDP is positive and significant, and given that the ψ is below one, it is possible to argue that the size of the South African public sector is larger than optimal. The residuals are normally distributed and stationary in level form (Phillips-Perron test statistic = -5.35)

Table 15. Marginal Product of Government Services (ψ), 1992 – 2017

Dependent variable: Δ(Y)/Y		
Variable	Coefficient	p-value
Δ(L)/L	0.141458	0.3099
Δ(K)/Y	0.729862***	0.0011
(Δ(G)/G)*(ΔV/Y)	0.616602***	0.0384
C	0.085837***	0
@TREND	-0.001633***	0.0001
Adjusted R^2	0.605	

Note Δ = first derivative with respect to time – coefficients:
* & **** = statistically significant (p <0.1 & < 0.05)

Taking γ as the output elasticity of government consumption (G), it is now possible to estimate the optimal size of the public sector using the following equation:

$(\Delta Y/Y) = \alpha(\Delta L/L) + \beta(\Delta K/Y) + \gamma(\Delta g/g)$ eq. 15

The results displayed in Table 16 indicate that the optimal size of the public sector is now on average 0.185, or 18.5% of final consumption expenditure and capital investment (GFCF) of the public sector compared to the actual size of approximately 30% in 2017, as the output elasticity of G (γ) is now positive and significant (at a 5% level).

Table 16. Optimal Public Sector Size, 1992 – 2017

Dependent Variable: Δ(Y)/Y		
Variable	Coefficient	p-value
Δ(L)/L	0.178043	0.1857
Δ(K)/Y	0.668523***	0.0017
(Δ(G)/G)	0.185423***	0.0103
C	0.08242***	0
@TREND	-0.001525***	0.0002
Adjusted R^2	0.623	

Substituting public sector consumption with public sector gross value added, i.e. G is public sector gross value added, and using the same methodology, yield the following results:

$\Psi = 0.314$ (p=0.504)

$\gamma = 0.118$ (p=219)

The results suggest that the output elasticity of South Africa's public sector is fairly low and insignificant.

7. Conclusions

There is growing evidence that the size of the public sector in South Africa has increased fairly significantly since the current Government adopted the developmental state agenda around 2009. The central idea behind this ideology is that the state has a central function in addressing the triple challenges of unemployment, poverty and inequality. The state must therefore intervene in the economy so as to bring about the intended change. On the other hand, many economists argue that the private economy is much better placed to produce the desired economic outcomes, and therefore a smaller state is advocated with less government intervention. This implies that the government consumes and diverts scarce resources that would be much better used by the private economy.

Given these divergent views about the appropriate size of the government or public sector, the question arises then: How large should the size of government be? The focus of this article is therefore twofold, to determine how large the public sector in South Africa in reality is, given that different measurement units would most probably deliver different results, and secondly, to estimate what the optimal and most efficient size of the South African public sector should be using similar methodologies used in the literature.

The starting point is the theoretical BARS or Armey curve that suggests an inverted U-shape relationship between the rate of economic growth and the size of government. The Barro rule states that the public sector reaches its optimal size at the point where its marginal product of consumption relative to the value added equals one. The majority of studies published use simple quadratic equations to examine the relationship between government size as measured by consumption expenditures and economic growth based on the theoretical inverted U curve suggested by the Armey curve. Most research has found that the public sector is too large in those countries studied.

The actual size of the South African public sector was derived from data from the National Treasury and SARB and their reporting format, which include national government, extraordinary budget accounts, social security funds, provincial and local government, government business enterprises and the authority's mandates or regulation. The cumulative cash receipts and cash payments from, and to operating activities of the collective public sector give a fairly accurate measurement of the South African public sector's true size (which agrees with empirical results by other researchers, such as Dosti & Grabova, 2014). The magnitude of government receipts and/or payments is applied to GNI in order to measure the size of the public sector relative to the total national income. Public sector cash receipts from operating activities (government's command of national resources) increased from 41% of GNI in 1992 to 54% in 2017, while public sector cash payments for operating activities (government expenditure) increased from 35% of GNI in 1992 to 47% in 2017.

The public sector's contribution to the economy is mostly measured by its gross value added (GVA = goods and services produced by the public sector) and its expenditure on gross domestic product (the final consumption expenditure and gross fix capital formation by the public sector). The data shows that public sector GVA increased from 21.7% of total GVA in 1992 to 23.3% in 2017, while public sector expenditure on GDP increased from 25.7% of total GDP in 1992 to 30% in 2017.

The data used in this study was obtained from the SARB, ranging between 1992 and 2017. The variables are in all cases normally distributed and range between stationary in level and stationary in first-differenced format. The various regression equations were estimated using the fully modified OLS (FMOLS) estimation technique. The results, in general, indicate that the size of the public sector has a positive and significant sign, suggesting a positive impact of the public sector on national output in the short term, while the quadratic expression relating to the public

sector size is negative, but also significant, suggesting negative consequences to an inflated public sector. The graph shows a negative slope because the negative effects of government expenditure overshadow any positive consequences, as the quadratic equation rises faster in terms of value than the graph of the linear expression.

It is estimated that the public sector size reaches an optimum level between 18 and 24% of the economy. This compares to the current level of 30 to 50% of the economy in 2017. The optimal level is comparative to the levels seen during the 2005 to 2007 period. The results support the notion that the size of the South African public sector is significantly larger than optimal. The focus of the government therefore should be to cut the size of the public sector rather than to expand it in order to free up scarce resources much needed by the private economy.

8. Acknowledgement

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