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# Estimating tax capacity, tax effort and tax buoyancy for South Africa

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**2019**

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Naape, Baneng Lucas, (2019). Estimating tax capacity, tax effort and tax buoyancy for South Africa, University of the Witwatersrand, https://hdl.handle.net/10539/29687

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# Estimating Tax Capacity, Tax Effort and Tax Buoyancy for South Africa[1]

By

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Submitted in partial fulfilment of the requirements for the degree

Master of Commerce in Economics

In the

Faculty of Commerce, Law and Management

At the

University of the Witwatersrand

September 2019

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(16 000 words)

1 "The financial assistance of the National Treasury towards this research is hereby acknowledged. Opinions expressed, and conclusions arrived at are those of the author and should not be attributed to the National Treasury."

## ABSTRACT

The main objective of this study is to assess South Africa's tax revenue performance. This is achieved by estimating tax capacity and tax effort from 1960 - 2017 and tax buoyancy from 1995 - 2017. The study is unique in that, it tracks tax capacity, tax effort and tax buoyancy at an aggregate level for a particular country. The 2SLS results indicate that GDP per capita and inflation have a strong positive and statistically significant impact on revenue mobilisation while population growth, trade openness and agriculture share in GDP have a strong negative and statistically significant impact on revenue mobilisation. Furthermore, we find that South Africa's tax effort index varies between 0.92 which is below capacity and 1.10 which is above capacity. On average, the tax effort index is 1.00, implying that South Africa performs well above its potential tax capacity. Notwithstanding, the tax system was also found to be fairly buoyant, although there is still room for improvement. The ARDL results indicate that VAT revenues and custom duties grow at a faster pace than the growth in final household consumption and import value, respectively. Total tax revenue growth, however, still falls behind as the estimated coefficient is below unity, implying that the growth in total tax revenues does not match the growth of the economy. Given these findings, we conclude that South Africa's tax revenue performance has been fairly satisfactory over the period 1960 – 2017, albeit there is still room for improvement. For the government to generate value from the rapidly growing population, adequate investments in human capital and entrepreneurial skill development need to be made. The focus should be on broadening the tax base than on hiking already high tax rates.

## DECLARATION

I declare that this is my true work and it was written free from intentional and unintentional misquotations and plagiarisms. All sources that were used have been properly quoted and referenced.

Signature_____ Date____/____/_____

## ACKNOWLEDGEMENTS

I would like to give special thanks to the Almighty God who gave me the strength and understanding to write and complete the study. Secondly, I would like to thank my supportive family that has been with me through thick and thin. To all my friends, colleagues and acquaintances who have witnessed my struggle and success, thank you for your constant support and love towards my great work. Above all, I would like to acknowledge my team, including my mentors; Mbali Buthelezi, Refilwe Mokanse, Tony Matlasedi and Kwena Matjekana as well as my supervisor Dr. Nyasha Mahonye, who have been guiding and nurturing me to this end.

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CHAPTER 1

# 1. GENERAL INTRODUCTION

The manner by which governments raise and spend revenue substantially affects the financial and social advancement of nations (Ortiz-Ospina and Roser, 2015). Following the introduction of Sustainable Development Goals (SDGs) in 2015, governments in most, if not all, developing countries have been challenged to revisit their tax frameworks in hopes of generating additional revenues to finance their share of SDGs (SDG Guide, 2015). Notably, increased tax yields play a crucial role in eliminating aid-dependency among low income countries (Le, Moreno-Dodson and Bayraktar, 2012). In 2015, tax revenues for developing countries ranged between 10% and 15% of Gross Domestic Product (GDP) on average, which is relatively low compared to 35% in developed countries (Ploumen, 2015). Notwithstanding, the United Nations (UN) has advised developing countries to raise their tax revenues to 20% of GDP in order to realize SDGs (SDG Guide, 2015).

South Africa's tax to GDP ratio has averaged 25% in the last decade which is above the UN benchmark of 20% (World Bank, 2018). For the 2017/18 financial year, the South African tax to GDP ratio stood at 27% in the midst of slower global growth and poor domestic economic performance (World Development Indicators, 2018). This has served an impetus for researchers (i.e. Attiya and Umaima, 2012: Schoeman and Jordaan, 2015) to revisit the determinants of tax revenue in developing countries. Most of the existing empirical studies (e.g. Davoodi and Grigorian, 2007: Khwaja and Iyer, 2014: Piancastelli, 2015) however, placed more focus on the determinants of revenue than on the responsiveness of revenue to economic growth. In other words, they have undermined the role of automatic stabilizers in tax collections. Automatic stabilizers such as income taxes and welfare spending, have the potential to raise or lower tax revenue collections during periods of economic expansion and contraction. Hence, this study closes the gap by assessing revenue performance in South Africa while considering the ability to pay and collect taxes and the responsiveness of the tax system. Furthermore, most of the existing body of literature on revenue performance (i.e. Gupta, 2007: Le, Moreno-Dodson and Rojchaichaninthorn, 2008: Attiya and Umaima, 2012: Khwaja and Iyer, 2014) assessed revenue performance over short horizons. In this study, we analyse revenue performance over a long horizon. An overview analysis of revenue performance overtime can give a better idea of revenue performance trends and can generate credible and sustainable policy insights.

## 1.1. RESEARCH QUESTIONS

The study aimed to answer the following set of questions:

(i) Does South Africa's tax effort fall short of its tax capacity?

(ii) What is the revenue generating potential for South Africa?

(iii) How buoyant is South Africa's tax system?

## 1.2. OBJECTIVES

The objectives of the study are:

(i) To track tax capacity, tax effort and tax buoyancy for South Africa.

(ii) To understand the relationship and elasticity between income, tax efforts and tax buoyancy for South Africa.

(iii) To relate tax revenue and revenue potentials to the institutional quality and fiscal and monetary policy strengths in South Africa.

## 1.3. PROBLEM STATEMENT

The South African tax system has long been faced with issues of tax under collections, high administration costs, tax evasion and avoidance as well as lack of voluntary compliance, amongst others (Leuvennink, 2017). Moreover, tax rates have been hiked numerous times in an attempt to raise tax revenues and close revenue gaps. For example, Personal Income Tax (PIT) was raised from 41% in 2016 to 45% in 2017 while Value Added Tax (VAT) was increased from 14% to 15% in the 2018/19 financial year (South African Tax Guide, 2018). It should be noted however, that raising tax rates above acceptable levels might end up destroying the generators of revenue, which are the taxpayers.

Notwithstanding, tax morale has been supressed by high levels of corruption and poor service delivery. South Africa's Corruption Index fell from an all-time high of 57 points in 1996 to a record low of 41 points in 2011 and to 43 points in 2017 (Trading Economics, 2018). Chief among tax revenue problems in South Africa, is sustained tax revenue shortfalls. Tax revenue shortfalls have been widening than narrowing post 2008 Global Financial Crisis (GFC). This can be attributable to the poor economic performance as well as surrounding issues of base erosion and profit shifting, amongst others (National Treasury, 2017). For example, for the 2016/17 financial year, the South African Revenue Services (SARS) had a revenue shortfall of R30.4 billion (Brown, 2017) widening to R48.2 billion in the 2017/18 financial year (Omarjee, 2018). It is worth noting that tax revenue shortfalls might be due to both poor economic cycle and inefficiencies in tax administration.

## 1.4.SIGNIFICANCE AND CONTRIBUTION OF THE STUDY

Estimating the tax capacity, tax effort and tax buoyancy will help in providing a comprehensive picture of South Africa's revenue performance. The idea of tax for inclusive growth has been the cornerstone of development policy and because developing nations lag behind, it is for these reasons that the study aims to promote such a notion by assessing revenue performance overtime and advising policy makers on ways to broaden the tax base and lower tax rates, consequently increased tax revenues. Increased tax revenues and quality government spending are necessary to maintain a favourable fiscal balance and lessen pressure on government borrowing.

The study contributes to literature, firstly, by analysing South Africa's revenue performance overtime. Most studies including Davoodi and Grigorian (2007), Khwaja and Iyer (2014) and Piancastelli (2015) have analysed revenue performance over short horizons. An overview analysis of revenue performance over long horizons can give a better idea of revenue performance trends and can generate credible and sustainable policy insights. Secondly, a recent study by Ade, Rossouw and Gwatidzo (2018) only highlighted the role of corruption in domestic revenue mobilization. In this study, we go further to acknowledge the role of corruption and good governance in the process of domestic revenue mobilisation since such factors influence the ability of taxpayers and authorities to pay and collect taxes. Thirdly, the study introduces several control variables of particular interest, namely: employment-population ratio and labour force participation, thereby investigating their potential effect on tax capacity. Fourthly, the study controls for endogeneity and multicollinearity found in tax literature by making use of novel time series econometric methods such as 2Stage Least Squares and ARDL. Lastly, because the literature on tax buoyancy is scant in South Africa, the study goes further to estimate tax buoyancy for South Africa.

## 1.5.DEFINITION OF CONCEPTS

As in many other fields, tax concepts can be quite confusing and difficult to comprehend. This sub-section thus attempts to distinguish between various tax concepts employed in this study. Tax buoyancy to begin with, can be defined as the responsiveness of tax revenues to economic growth (Carolissen, 2017). A value of 1 shows that the pace of revenue growth is matching that of economic growth (National Treasury, 2017). Tax gap on the one hand, refers to the difference between potential revenue and actual revenue collected. Le et al (2012) define tax effort as the ratio between taxable capacity as a share of GDP and the share of

actual tax collection in GDP. Trotman-Dickenson (1996) contributes to economics theory by defining taxable capacity as the ability of businesses and individuals to pay taxes.

## 1.6.OUTLINE OF THE THESIS

Chapter 1 provides introduction to the thesis which provides motivation for the thesis, objectives of the study and significance of the study. Chapter 2 provides an overview of trends and patterns in tax reform and performance over the period 1960 – 2017. Chapter 3 confers on the theoretical framework and empirical literature on the determinants of revenue generating potential. Chapter 4 on the one hand, details different econometric techniques utilised to achieve the set goals and objectives of the study. Chapter 5 provides interpretation of findings, recommendations and summary of the study.

CHAPTER 2

## 2. OVERVIEW OF TAX PERFORMANCE IN SOUTH AFRICA

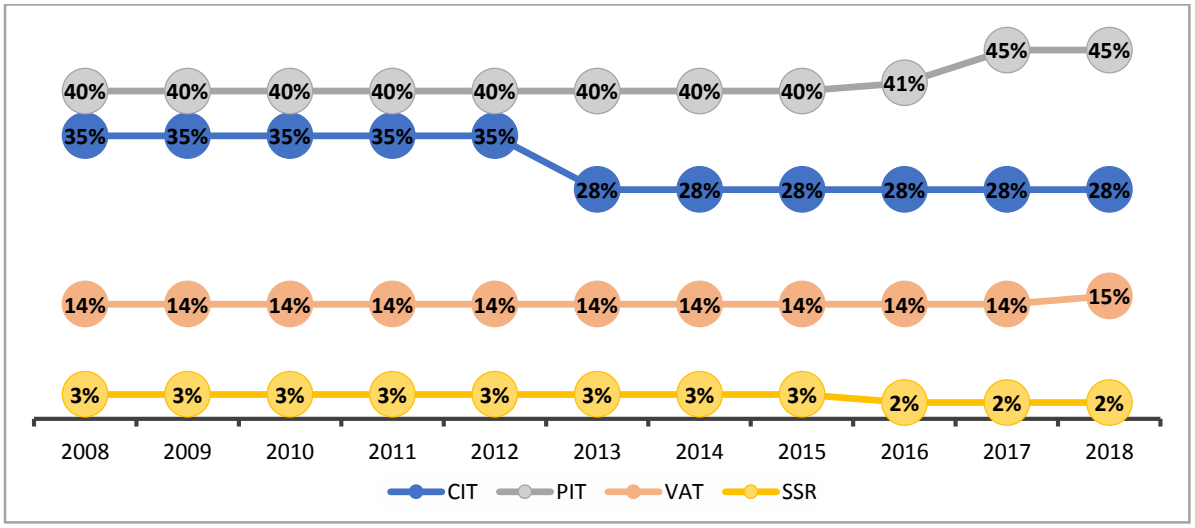
### 2.1.INTRODUCTION

Since the attainment of democracy in 1994, the government had implemented various tax reforms in order to maximize revenue of the South African economy. These reforms include; (i) a reduction in corporate Income Tax (CIT) from 35% to 28% in 2012 (ii) an increase in Personal Income Tax (PIT) from 41% to 45% in 2017 (iii) an increase in Value Added Tax (VAT) from 14% to 15% in 2018, amongst others (South African Tax Guide, 2018). This section thus highlights various types of tax reforms that have been enacted by the South African government and trends in tax revenue performance.

### 2.2.TAX REFORMS

Tax reform, in the form of lower marginal tax rates and exemptions, is well known for improving tax efficiency and collections (Schoeman and Jordaan, 2015). Figure 1 illustrates trends in South African tax rates by tax type. South Africa's tax reform has been characterised by a mixture of tax hikes and cuts. For example, the Top Marginal Tax Rate (TMTR) was increased from 40% in 2015 to 41% in 2016 and from 41% in 2016 to 45% in 2017 (National Treasury, 2018).

*Figure 1: Trends in tax rates between 2008 and 2018*




*Source: Trading Economics (2018)*

Sales tax/VAT has remained stubbornly low at a rate of 14% over the period 1990 – 2017 before rising by 1 percentage point in 2018 as part of fiscal consolidation measures. It also

apparent in figure 1 that Social Security Rates (SSR) have remained relatively low in South Africa, ranging between 2% - 3%. Contrast to South Africa, SSR in other upper middle-income countries has remained stubbornly high. For example, the rate is 39.8% for Brazil, 35% for Belarus, 9% for Mauritius, 18.7% for Jamaica and 37.5% for Turkey (Trading-Economics, 2018). CIT on the one hand, has been reduced significantly from 35% to 28% in 2013. Such an action was undertaken to create a favourable business environment, one that attracts foreign direct investment.

## 2.3.TAX REVENUE PERFORMANCE

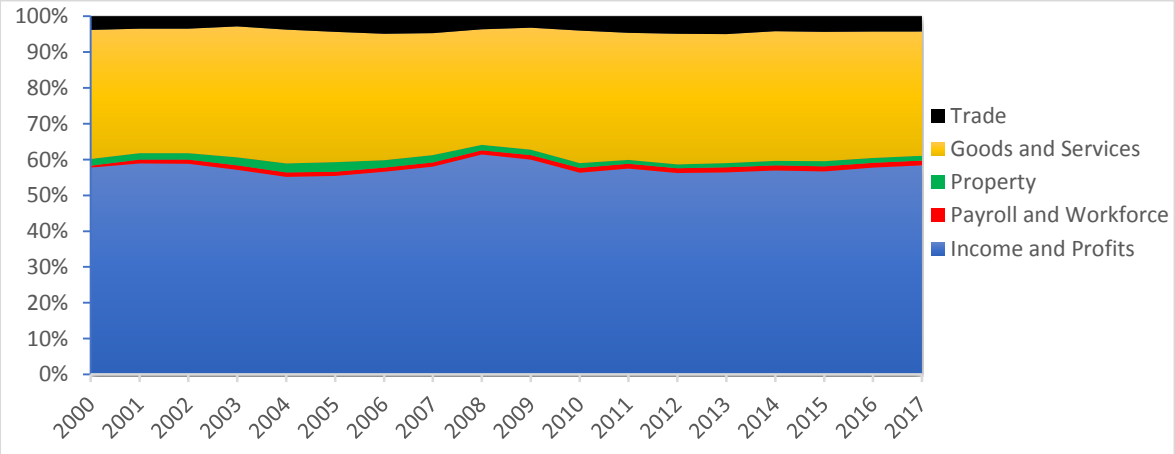
This section highlights tax revenue performance for South Africa in comparison to other emerging market economies.

### 2.3.1. South Africa

#### 2.3.1.1.Composition of tax revenue

Figure 2 shows the composition of tax revenue by source. It is worth noting that income taxes and consumption taxes (Value Added Tax in particular) have been and remain the backbone of tax revenues in South Africa. Additionally, as can be seen in figure 2, income taxes range between 50% - 60% while consumption taxes range between 30% - 35%. To this end, income and profits amount to 58.40% of total tax revenue whereas goods and services (VAT being the largest contributor) stand at 34.73% of total tax revenue (National Treasury, 2018). On that note, VAT revenues are expected to increase by approximately R23 billion given the hike in VAT rate by one percentage points, from 14% to 15% (Leoka, 2018).

*Figure 2: Composition of tax revenue by source (% of total gross revenue)*



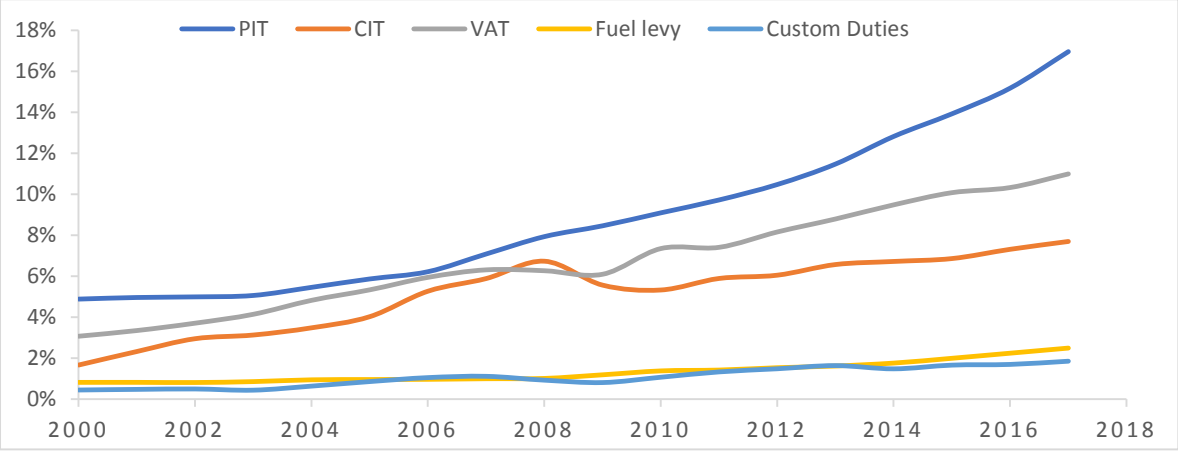

*Source: National Treasury Budget (2018)*

Trade, property and payroll taxes make up less than 10% of tax revenue altogether. This is because; government's intent to levy trade taxes is not to generate revenue but to regulate trade, though revenues are earned in the process. Although Company Income Tax (CIT) has declined over the period, these declines were offset by increases in Personal Income Tax (PIT) (Glenday, 2008). It is also apparent in figure 2 that the 2008 GFC had a huge negative impact on income and profits than on other sources. For example, income and profits fell from 61.3% in 2008 to 56.3% in 2010 while other sources remained steady. However, as the economy gained momentum following the execution of expansionary policies aimed at spurring growth (i.e. Quantitative Easing), so did income and profits revenue. Notably, government revenue in most developing countries comprises of tax revenue, foreign aid, resource rent and non-tax revenue (Ananou and Houngbonon, 2015). Contrast to other developing countries, South Africa relies heavily on tax revenue, which makes about 97.7% of total government revenue. A feasible explanation to this is that, foreign aid usually leads to aid-dependency while resource rent leads to rent seeking by government officials, consequently high levels of corruption and formulation of poor policies.

2.3.1.2.Sources of tax as percentage of GDP

Figure 3 expresses sources of tax revenue as a percentage of GDP. Expressing components as a ratio of GDP helps in determining how much of the GDP is made up of each of these components. It is worth noting that lower middle-income countries are expected to collect tax revenues above 18.6% of GDP while upper middle-income countries are expected to collect tax revenues above 20.4% (Glenday, 2008).

*Figure 3: Sources of tax revenue as a percentage of GDP*



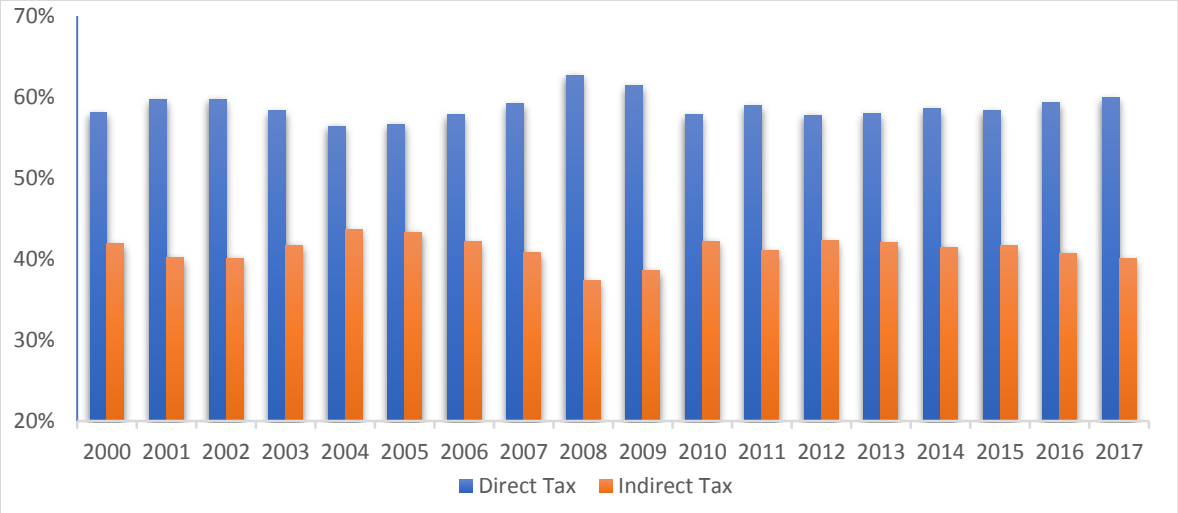

*Source: National Treasury Budget (2018)*

It is undoubtedly clear from figure 3 that PIT makes up a larger fraction of GDP relative to other sources of tax revenue. Over the 17 years' period (2000 – 2017), PIT rose significantly from 4.8% to 17% as a percentage of GDP. VAT on the one hand, rose from 3% to 11% as a percentage of GDP. Although this may be the case for PIT and VAT, CIT has been overlapping, more especially following the 2008 GFC. This is partly due to the cut in CIT rates from 34% to 28% in 2012. Nonetheless, import duties, property taxes and fuel levy have remained reasonably low. As a result of trade openness, South Africa, like many other countries, reduced import duties to as low as 2% of GDP. Currently, import duties are standing at 1.6% of GDP while fuel levies make-up 2.5% of GDP.

2.3.1.3.Direct and indirect tax-mix

Figure 4 shows trends in direct taxes and indirect taxes over the last decade and a half. Direct taxes as a proportion of total revenue have ranged between 56% - 62% over the last decade while indirect taxes ranged between 37% - 44% during the same period. Direct taxes are reasonably higher than indirect taxes as they consist of the largest sources of tax revenue, PIT and CIT to be specific. Furthermore, direct taxes have increased significantly in the last decade and a half, rising from a mere 7.2% in 2000 to a record high of 26.6% in 2017.

*Figure 4: Direct taxes vs Indirect taxes (% of Revenue)*




*Source: National Treasury Budget and SARB (2018)*

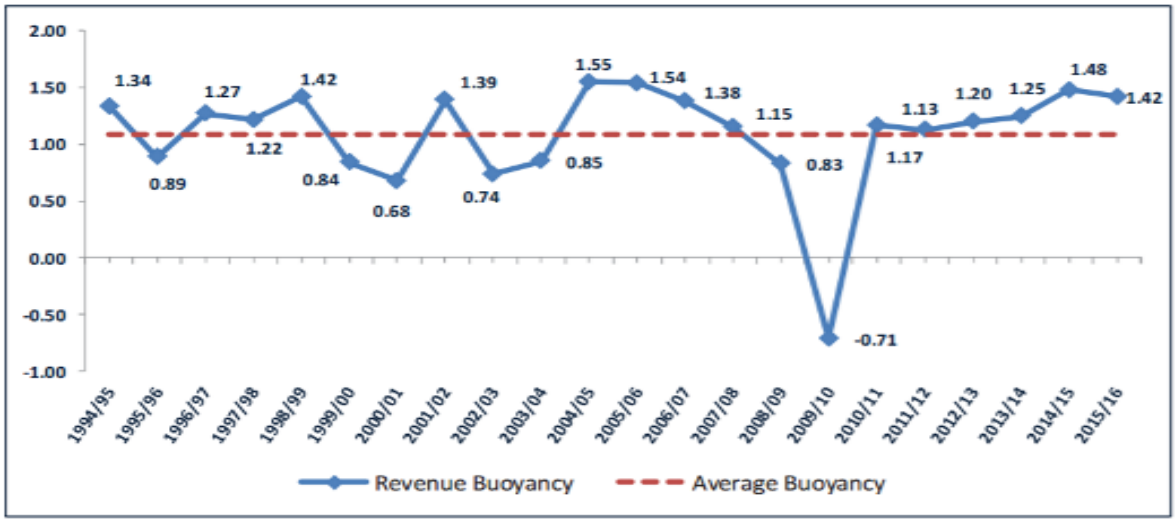
The Davis Tax Committee (2016) noted that dependence on direct taxes can be expected in a country where income inequality is unreasonably high. However, with the introduction of new environmental taxes, indirect tax collections are expected to recuperate (National Treasury, 2012). From figure 4, it is also evident that indirect taxes have been slightly lower

than direct taxes between the period 2000 and 2007, before making a downturn in 2008. Since then, the gap between direct and indirect taxes has widened. Nonetheless, indirect taxes have also risen enormously over the period, hitting a record high of 17.8% of GDP from a mere record low of 5.2% of GDP in 2000.

2.3.1.4.Tax buoyancy performance

Amongst other revenue concepts, is tax buoyancy. To this day, tax buyouncy remains the widely used measure of the responsiveness of the revenue sytem to the growth of the economy (Carolissen, 2017). Figure 5 illustrates buyouncy estimates for the period 1994/95 - 2015/16. Notably, buoyancy estimates are known to be more accurate over long horizons than short horizons. Furthermore, this estimates are largely affected by tax policy changes, economic growth drivers and shocks to the economy. For example, revenue buoyancy was largely affected by the 2008 GFC, contracting from 1.15 in 2007/08 to a mere record low of -0.75 in 2009/10. On average, the revenue system in South Africa has been fairly responsive, averaging 1.09 over the entire period. This average figure of 1.09 is at par with most OECD countries and shows that the pace of revenue growth is matching that of GDP growth.

*Figure 5: Trends in Tax Buoyancy*




*Adopted from: Omarjee (2016)*

We can see from figure 2 that between 2004/05 – 2007/08 and 2010/11 – 2015/16 tax revenue grew faster than the economy. This indicates that automatic stabilizers were extremely efficient during this period. National Treasury (2017) notes that this trend was expected to continue in 2015/16 and 2016/17 due to the substantial tax increases. However, the outcome was way below market expectations as the growth in revenue subsequently

slowed, matching the growth of the economy. It is reasonable to assume that this could be due to shifts in dividend withholding tax revenue in attempt to avoid higher tax rates.

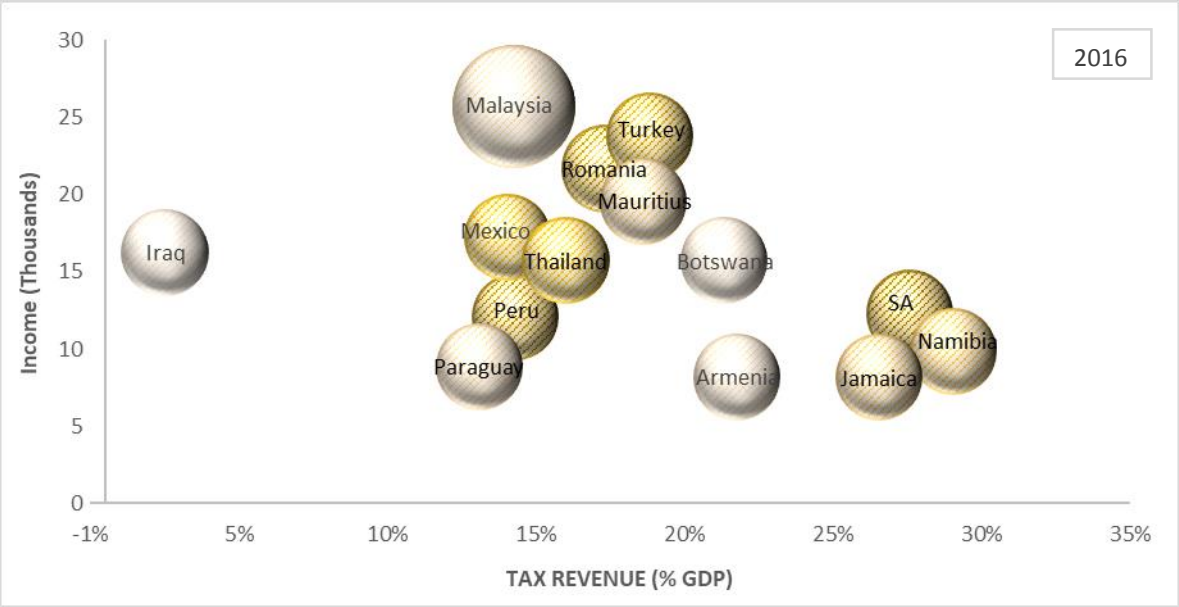
### 2.3.2. South Africa and Other Emerging Market Economies

This section provides an overview of South Africa's tax position in comparison to other emerging market economies. Since South Africa is an emerging market economy, comparisons are made between emerging market economies by tax to GDP ratios, income level and tax rates.

#### 2.3.2.1.Income levels and Tax to GDP ratios

Comparing tax revenue performance across countries in different income groups can provide a completely distorted picture (Le et al., 2014). Thus, to avoid this, we compare tax revenue performance across countries with similar economic structures and income levels. Figure 6 illustrates tax to GDP positions across emerging market economies for the year 2016. The vertical axis represents country incomes measured in terms of GDP per capita, Purchasing Power Parity (constant 2011 international $) while the horizontal axis measures tax revenue as percentage of GDP.

*Figure 6: Income vs Tax-GDP ratio among Emerging Market Economies*




*Source: World Bank Database (2018)*

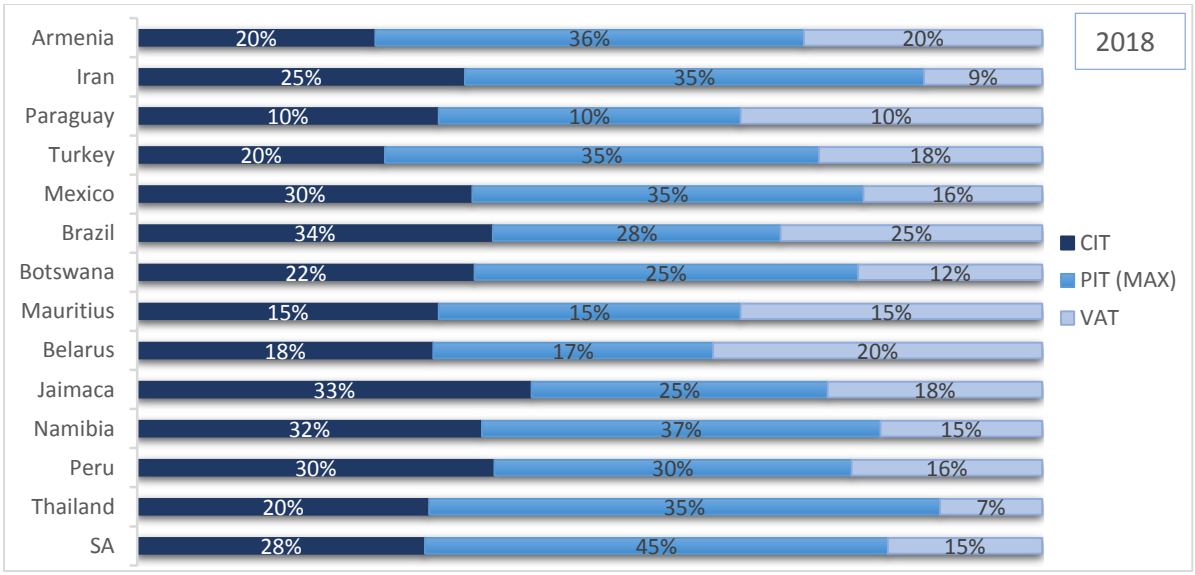
It seems reasonable to assume that countries with higher incomes are expected to have higher tax yields. However, although increases in GDP per capita allows low-income and middle-income countries to realize increased tax yields, certain factors often come to play, which

include, amongst others: compliance-enhancing tax administration, changing economic structures and improved tax policy-mix (Glenday, 2008). For example, figure 6 shows that although South Africa's income level is relatively lower than that of its counterparts; its tax-GDP ratio is much higher than most nations. By 2016, South Africa's tax-GDP ratio was sitting at 27.1%, higher than most nations, with the exception of Namibia. Although this holds, South Africa's income level is unreasonably low. Furthermore, albeit Namibia takes the lead in tax position, its income level is lower than that of South Africa.

2.3.2.2.Tax rates across Emerging Market Economies

Figure 7 provides an overview of tax rates across selected emerging market economies where data is available. PIT rates in this case represent top marginal personal income tax rates. From figure 7, we can see that PIT rates lie between 10% and 45% in selected emerging market economies. Moreover, there seems to be a wide gap of 35% between the lowest (10%) and highest (45%) PIT rates, represented by Paraguay and South Africa, respectively. CIT and VAT rates for selected emerging market economies range between 10% - 34% and 9% - 25%, respectively. For advanced market economies however, the case would be different given their tax designs, which encompass lower tax rates and broader tax bases.

*Figure 7: Differences in tax rates among Upper Middle-Income Countries*




*Source: Our-World-in-Data (2018)*

It is sufficient to note that tax rates in advanced market economies are relatively lower than those in emerging market economies, yet the actual tax revenues collected are much higher than those in emerging market economies. Following this, Besley and Persson (2013) demonstrated that developed countries tend to collect higher tax revenues than developing

countries with equivalent statutory tax rates, which suggests that tax administration systems in low and middle-income countries are faced with compliance issues (Ortiz-Ospina and Roser, 2015). Furthermore, since household incomes are large contributors to tax revenues, this places high income countries at an advantage, given their high-income levels.

## 2.4.CONCLUSION

This section looked into the different tax types, by source, industry, rate, country and policy strengths. Moreover, comparisons were made between South Africa and other emerging market economies given similar income levels and economic structures. Based on the above discussions, we can conclude that South Africa has performed reasonably well in the last decade and a half although there is still room for improvement.

CHAPTER 3

# 3. LITERATURE REVIEW

## 3.1.INTRODUCTION

In this section, we detailed various tax theories that serve as pillars for this study. Although theories do not always hold in the real world, it is worth noting that such theories provide a basis for economic thought. Thus, conducting careful and thorough literature review is of paramount importance.

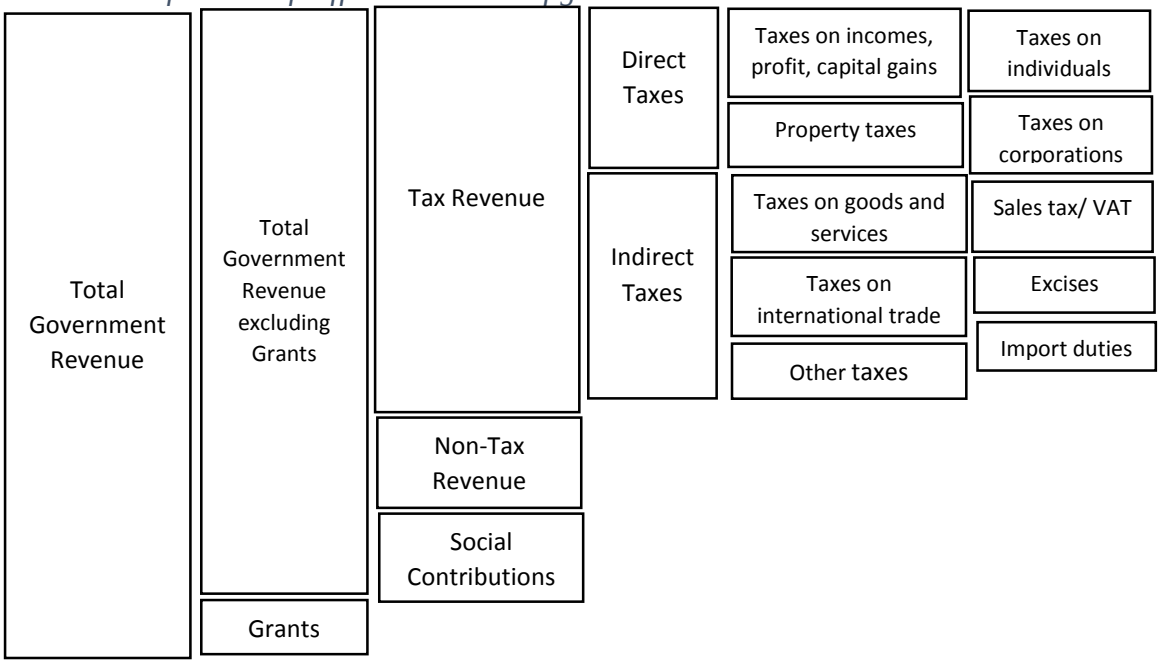
## 3.2.THEORETICAL LITERATURE

The theoretical framework of this study is based on the composition and sources of government revenue. Furthermore, the Laffer hypothesis and several principles guiding tax policy and design are discussed.

### 3.2.1. Sources and Composition of Government Revenue

Mahdavi (2008: 2) states that "tax reforms in developing countries must necessarily include changing the level of tax revenue and/or its composition". It is worth noting however, that sources of tax revenue differ from one country to another based on factors such as the type and availability of resources, economic structures and political mandates. In figure 8, various sources of government revenue and different types of taxes levied are identified.

*Figure 8: Classification of different sources of government revenues*




*Adapted from: Prichard et al (2014)*

Taxes are typically broken into two categories: direct and indirect taxes and vary across countries. This is known as the tax-mix and plays a crucial role in shaping and encouraging savings, investment and work. In short, direct taxes encompass all taxes levied on income, profits, property and capital gains while indirect taxes take the form of sales tax/Vat, fuel levy, payroll, and exercise and import duties. Although different taxes are levied on different sources of revenue, what matters ultimately is not necessarily the impact of each tax in isolation, but the overall impact of the tax-mix on the welfare of individuals (Creedy, 2009). Notably, there is no clear and direct connection between taxes paid by an individual and the provision of public goods and services to the individual taxpayer. This is because; individuals are obliged to pay taxes by law even if there are no direct benefits in return (Australia's Future Tax System Review, 2008).

Economists regard the best tax systems as those characterised by broad tax bases and low tax rates. The reasoning behind this is that the tax burden is much greater when a small pool of individuals is taxed at higher rates than when a large pool of individuals is taxed at lower rates. Moreover, higher tax rates are presumably associated with issues of tax avoidance and evasion. As apparent in figure 8, a large fraction of total government revenue is made up of tax revenue, complemented by non-tax revenue and grants. Non-tax revenue includes fines, interest income, dividends and other profits earned by government. However, because the government is not profit-driven, the government seldom runs profitable operations nor relies on non-tax revenue for financing its operations.

### 3.2.2. Canons of Taxation

One of the potential economic contributions of the classical economists, Adam Smith in particular, was their recognition of the canons of tax policy. According to Smith (1776), a well-designed tax system is one that is based on several principle including efficiency, equity, certainty and convenience. Efficiency to begin with, speaks to the manner in which the cost of collecting and paying taxes should be economical. Smith (1776) accentuates that the cost of collecting taxes should be as low as possible as higher tax administration costs would reduce the net yields of taxes. Since taxes are an expense to taxpayers, they need not incur additional costs in the payment of taxes, as this would make them reluctant to pay taxes. Neill (1997) on the one hand, states that tax systems should be structured in such a way that both parties (taxpayers and public good recipients) benefit equally. In her view, equality of taxation means equality of sacrifice. The equity principle has also been stressed by Smith

(1776) in which he contended that the tax contributions ought to be in proportion to the taxpayer's respective abilities and the income which they enjoy under the insurance of the state. On that note, it is worth noting that the principle of equity comes in two forms: horizontal and vertical equity. In short, vertical equity refers to the idea that people at different income levels should be taxed differently, based on their ability to pay of course. In other words, high-income earners should pay a larger proportion of their income in taxes than low-income earners (Kiprotich, 2016). "The principle of horizontal equity demands that similarly situated individuals face similar tax burdens" (Elkins, 2006; 1).

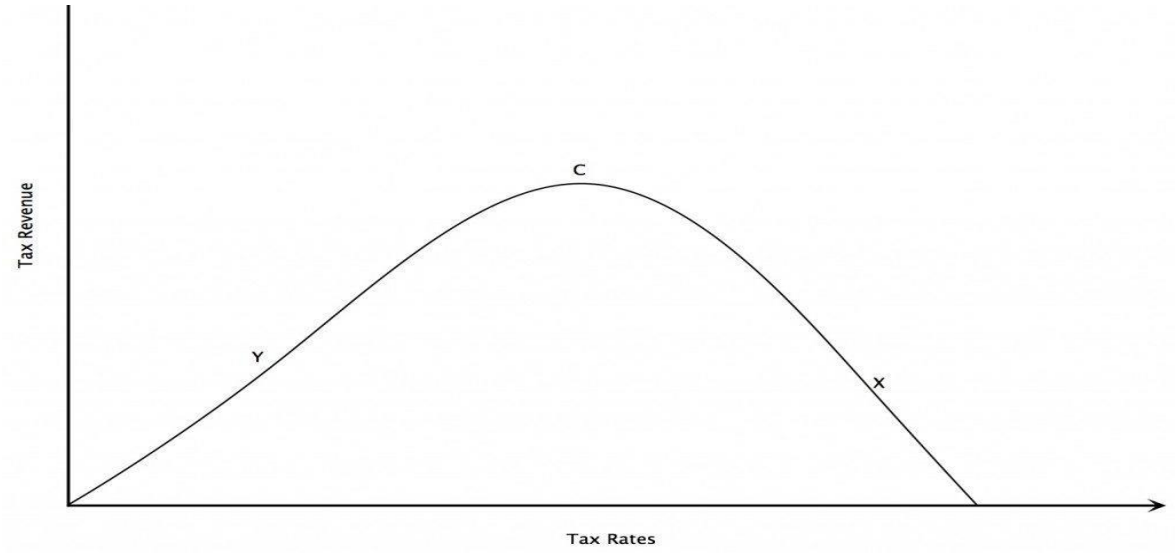
Pigou (1954) adds to the tax literature by thoroughly explaining the principle of certainty. He notes that a tax system ought to be predictable, as individuals and businesses often plan ahead. The time and sum of taxes to be paid should be clearly stated and not arbitrary (Smith, 1776). Kiprotich (2016) further states that although tax reforms take place and tax systems change over time, these changes should be timely and inclusive. The principle of convenience to end with implies that the sum, time and manner of payment of tax should be convenient to the contributor. In addition, tax laws ought to be clearly stated, implemented and understandable to a common person. A simple tax system has the potential to reduce corruption in tax administration and inconveniences to the taxpayers.

### 3.2.3. Laffer Curve Hypothesis

The idea of the Laffer hypothesis (Laffer, 1921) has been widely debated in the tax literature. In simple terms, the Laffer curve shows the relationship between tax revenue and tax rates (Texas Public Policy Foundation, 2006). Figure 9 is a graphic illustration of the Laffer curve hypothesis. The vertical axis measures tax revenue collected by government whereas the horizontal axis measures tax rates facing taxpayers. The U-shape of the Laffer curve is indicative of a unique relationship between tax rates and revenue collected. An increase in tax rates, can lead to either an increase or decrease in revenue collected, depending at which region of the Laffer curve the economy is at. Mitchell (2012) states that higher tax rates, particularly on labour, induce labourers to work less and accumulate less human capital. He further states that the Laffer curve differs depending on the country, period and type of tax. As can be seen in figure 9, as tax rates increase, tax revenues rise to region (y), reach a peak at region (c) and begin to fall to region (x), up to the extent where zero-revenues are realized. Laffer (1921) reasoned that higher tax rates discourage work, output and investment and in

extreme cases, induce tax avoidance and evasion. In other words, unreasonably high tax rates could be the cause of low growth rates in certain countries.

*Figure 9: The Laffer curve*




*Adopted from: Agarwal (2018)*

Interestingly, changes in tax rates appear to have two effects: the arithmetic effect and the economy effect. The arithmetic effect entails situations in which tax rate cuts result in declines in tax revenues (per dollar of the tax base) by an amount equal to the tax cut. The economy effect on the one hand, refers to situations in which lower tax rates encourage participation in taxed economic activities such as work, employment and output. The arithmetic effect is possible between regions (y) and (c) while the economy effect is possible between regions (c) and (x). Given these explanations, one can tell that the arithmetic effect and economy effect work in opposite directions.

## 3.3.EMPIRICAL LITERATURE

Khwaja and Iyer (2014) estimated the determinants of revenue generating potential in 61 countries. They adopted a dual approach to revenue potential: one based on the economic structure and strength of a country and the other based on the legislation. Their study revealed that the revenue potential in legal terms is much higher than the revenue potential in economic terms for most Eastern Europe and Central Asia countries. In addition, they find that the tax gap is higher when the underground economy is considered, implying that countries with a greater share of the underground economy collect way less in tax revenue than they could, given their economic strength.

Ananou and Houngbonon (2015) took several steps to investigate and study the tax-gap dynamics in African countries. These include determining whether the tax gap has widened, narrowed or remained the same throughout the last decade. Surprisingly, they found no evidence of change in the tax gap over the last decade.

Attiya and Umaima (2012) investigated the factors contributing to the revenue generating potential in a sample of developing Asian countries over the period 1984 – 2010. The results showed that both GDP per capita, foreign debt and share of agriculture in GDP are statistically significant in explaining variations in revenue performance. In addition, institutional factors, good governance, control for corruption and trade openness are also found to have a positive and statistically significant impact on revenue potential. Notwithstanding, their tax effort results indicated that countries which are heavily dependent on the agricultural sector tend to have poorer revenue performance.

Davoodi and Grigorian (2007) seek to identify a proximate set of factors that contribute to Armenia's stubbornly low tax-to-GDP ratio using panel data spanning from 1990 – 2004 in 141 countries. They utilised several econometrics techniques including fixed effects, random effects and OLS. Their findings indicate that Armenia's tax effort falls short of its potential by as much as 6½ percent of GDP and this is largely due to weak institutions and a larger shadow economy.

Le et al (2012) undertook a unique study by providing four classifications of tax: high collection, low collection, high effort and low effort. They utilise Panel OLS on cross-country data spanning from 1994 - 2009 in 110 developing and developed countries. Like many other studies, they find that nations with better institutional quality such as bureaucracy quality or corruption have the potential to collect higher tax revenues. Even more, they find that developing nations have more limitations to expand the scope for taxation, efficiently and equitably.

Gupta (2007) undertook a study aimed at estimating the principal determinants of tax revenue potential using a sample of 105 developing countries. The study runs from 1980 to 2004 utilising two commonly used econometric techniques of fixed effects and random effects. Based on findings, several structural factors including GDP per capita, Trade openness and foreign aid are found to be statistically significant and positively correlated with higher tax revenues. On the contrary, agricultural share in GDP is found to be statistically significantly

but negatively associated with revenue performance. Furthermore, the study reveals that countries that rely heavily on taxes on goods and services collect lower tax revenues.

Mertens (2003) estimated tax capacity and tax effort for ten Central and Eastern Europe countries using panel data spanning from 1992-2000. Unlike other studies, agriculture's share of GDP was used as a proxy for the level of economic development while industry and import sector share of GDP were used as proxies for tax handles. Nonetheless, the results of the study indicate that both the level of development and sectoral shares of GDP are significant determinants of tax capacity. In addition, the tax effort index ranges between 0.809 and 1.257.

Raczkowski (2015) appraised the size of the shadow economy and tax-gap for all 28 European Union (EU) states for the period 2011 – 2014. Having utilised various quantitative techniques including: Mixed Data Sampling Regressions (MDSR), Multifactorial Macroeconomic Modelling (MMM) in relation to Multiple Indicators Multiple Causes (MIMIC), he found that the tax gap for all 28 EU states amounted to $1.33 trillion in 2014.

Piancastelli (2015) measured tax effort indices for a sample of 105 developing and developed countries using both time series and cross-section data spanning from 1985 – 1995. Having estimated fixed effects and random effects models, they find that GDP per capita, trade openness and agriculture share in GDP are consistent independent variables of the tax ratio. Mining output to GDP and quasi-money are found to be statistically insignificant in explaining variations in tax ratio.

Karagöz (2013) evaluated the determinants of tax revenue for Turkey by means of econometric analysis. The findings indicate that tax revenues in Turkey are fundamentally influenced by agricultural and industrial sector share in GDP, foreign debt stock, monetization rate of the economy and urbanization rate.

Upender (2008) studied tax buoyancy in India pre-tax reform and post-tax reform to see the prognoses of tax reforms initiated by government. He found that the tax buoyancy estimate was above unity pre-tax reform before falling below unity post-tax reform. This implies that gross tax revenue has been relatively inelastic post-tax reform.

Belinga et al., (2014) estimated short-run and long-run tax buoyancy in OECD countries over the period 1965 - 2012. By means of Pooled Mean Group, they find that long-run buoyancy is greater than one in about half of the countries. This implies that economic growth has

benefited tax revenues in OECD countries. Even more, they find that company income taxes are by far the most buoyant, whereas property taxes and excises are the least buoyant.

Jalles (2017) follows a similar pattern to Belinga et al (2014) by estimating short-run and long-run buoyancy for 37 Sub-Saharan African countries over the period 1990 - 2015. Based on findings, the buoyancy estimate is greater than one only in 11 out of 37 countries. Additionally, the results reveal that the buoyancy estimate is larger during contractions than during economic expansions.

Dudine and Jalles (2017) studied tax buoyancy dynamics in low-income, emerging and advanced economies. They utilised Fully Modified OLS and Pooled Mean Group on panel data spanning from 1980 – 2014. Based on findings, both short-run and long-run buoyancies in advanced market economies do not differ from one. In addition, the results reveal that corporate tax buoyancies in emerging market economies are larger during contractions than during economic expansions. Interestingly, they find that both trade openness and human capital increase buoyancy while inflation and output volatility decrease it.

Omondi et al., (2014) investigated the effects of tax policy changes on tax buoyancy and elasticity for Kenya. They made use of regression analysis on annual time series data spanning from 1960 to 2010. Based on findings, the estimated buoyancy for Kenya was found to be 1.17, implying that revenue grew at a faster pace than the growth in GDP. Additionally, they find a bi-directional causation from tax revenues to GDP and from GDP to tax revenues. Notwithstanding, the elasticity for Kenya's overall tax system is 0.690.

## 3.4.CONCLUSION

This section looked into the theoretical framework governing tax policy and design as well as various empirical studies that attempted to empirically investigate such dynamics. Although different authors utilised different econometric techniques and variables, we learn that their results are somewhat consistent. Furthermore, we also learn that empirical studies built their models based on the demographic, economic, policy and institutional factors of the country. A similar approach will be followed in this study to bring the study in line with empirical studies. The next section thus details the methodology used to track tax capacity, tax effort and tax buoyancy for South Africa at an aggregate level.

CHAPTER 4

# 4. EMPIRICAL STRATEGY

## 4.1.INTRODUCTION

This section unpacks the methodology of the study, including the type, period and sources of data used. Furthermore, the section details variables included in the model, their justification as well as explanation of various econometrics techniques utilised.

## 4.2.DATA

The study made use of annual secondary time series data in two sub-periods: spanning from 1960 – 2017 for tax capacity and tax effort and 1995 – 2017 for tax buoyancy. The data was collected from numerous secondary servers including World Development Indicators (WDI), South African Reserve Bank (SARB), South African Revenue Services (SARS), PolityIV, Federal Reserve Economic Data (FRED), Transparency International and National Treasury of South Africa. Table 12 in appendix provides a description of all variables employed and data sources utilised.

## 4.3.MODEL

The models of this study are built on the demographic, economic, policy and institutional factors of the country. This is in line with existing empirical studies (i.e. Attiya and Umaima, 2012: Khwaja and Iyer, 2014: Omondi et al, 2014 Ananou and Houngbonon, 2015: Karagöz, 2013 and Jalles, 2017).

### 4.3.1. A Measure of Tax Capacity

The model is expressed as follows:

$$\left(\frac{T}{Y_t}\right) = \mu + \beta . X_t + \partial + \varepsilon_t \qquad (1)$$

where $\left(\frac{T}{Y_t}\right)$ is the tax-GDP ratio, $\mu$ is a constant, $\beta$ is the slope coefficients of the parameters, $\partial$ is a dummy for the 2008 crisis, $\varepsilon_t$ is the idiosyncratic error term with usual properties $\sim N(0, \sigma^2)$ and $X_t$ is the vector consisting of control variables that affect tax revenue:

$$X_t = (GDPC_t; TOP_t; AGR_t; MAN_t; SERV_t; GOV_t; POP_t; INF_t; EMPL_t; LFPR_t; COR_t) \qquad (2)$$

in which case $GDPC$ is GDP Per Capita (constant 2010 prices) measuring household incomes, $TOP$ is trade openness measured by trade-GDP ratio, $AGR$ is the share of

agriculture in GDP, $MAN$ is the share of manufacturing in GDP, $GOV$ is the PolityIV index used as a proxy for good governance, $INF$ is the inflation rate measured by the Consumer Price Index (CPI), $SERV_t$ is services share in GDP, $EMPL$ is the employment to population ratio, $LFPR$ is the labour force participation rate, $POP$ is population growth and $COR$ is corruption measured by the corruption score index. Most empirical studies (Davoodi and Grigorian, 2007: Attiya and Umaima, 2012: Khwaja and Iyer, 2014) have utilised Fixed Effects (FE), Random Effects (RE), Generalised Method of Moments (GMM) and Panel OLS techniques. In our case, we employ the Instrumental Variable (IV) technique, 2Stage Least Squares (2SLS) to be specific, given the threat of endogeneity in our model. In econometrics, endogeneity may be a result of either simultaneity or unobserved heterogeneity. In this study, the source of endogeneity is the simultaneity between agriculture share of GDP and tax revenue. The rationale is that, the agriculture sector is subsidized through tax revenue while tax revenue is in turn, partly collected from the agricultural sector.

4.3.2. A Measure of Tax Effort

As defined earlier, tax effort is the extent to which taxable capacity is being used. This can be obtained from the ratio between actual tax capacity and potential tax capacity. A simple calculation of tax effort index is expressed as:

$$TE = \frac{(T/Y)}{(\hat{T}/Y)} \qquad (3)$$

where $\left(\frac{T}{Y}\right)$ is the actual tax capacity and $\left(\frac{\hat{T}}{Y}\right)$ is the potential tax capacity. The potential tax capacity was estimated using equation (1). The values of tax effort should be zero and positive. A tax effort index that lies below the regression line implies that the country falls short of its potential tax capacity whereas a tax effort index above the regression line indicates that a country performs well above its potential tax capacity.

4.3.3. A Measure of Tax Buoyancy

$$Ln(RT_t) = \mu + \beta_1 Ln(TB_t) + \varphi + \varepsilon_t \qquad (4)$$

where $Ln(RT_t)$ is different types of tax revenues including: (i) Value Added Tax (VAT) (ii) total tax revenue growth (TREV) and (iii) custom duties (CUST). $TB_t$ is the tax base consisting of (i) GDP growth (GDPG) (ii) final private consumption by households (PCONS) and (iii) import value (IMPV) and $\varphi$ is a 2008 dummy to account for the 2008 GFC shock. Nkoro and Uko (2016: 3) state that "cointegration has become an over-riding requirement for

any economic model using non-stationary time series data". In this study, we employed the ARDL Bounds Test to cointegration of Pesaran (1997) and Pesaran et al., (2001). The choice of technique was guided by the characteristics of the data. Given that we used small sample data (26 observations) and the variables are integrated in different orders, ARDL Bounds test became appropriate. Equation (4) is thus transformed as follows:

$$\Delta Ln(RT)_t = \mu_0 + \sum_{i=1}^{q} \beta_1 \Delta Ln(TR)_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta Ln(TB)_{t-i} + \varphi + ECT_{-1} + \varepsilon_t \quad (5)$$

in which case $ECT_{-1}$ is the Error Correction term, also known as the speed of adjustment to equilibrium. The null hypothesis of no cointegration is $H_0: \beta_1 = 0$ and $H_1: \beta_1 \neq 0$ is the alternative hypothesis of cointegration. It is sufficient to note that the ARDL Bounds test is robust when dealing with small sample data and when variables are integrated in different orders (Nkoro and Uko, 2016). The estimated equations are:

$$\Delta Ln(VAT)_t = \mu_0 + \sum_{i=1}^{q} \beta_1 \Delta Ln(VAT)_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta Ln(PCONS)_{t-i} + \varphi + ECT_{-1} + \varepsilon_t \quad (6)$$

$$\Delta Ln(TREV)_t = \mu_0 + \sum_{i=1}^{q} \beta_1 \Delta Ln(TREV)_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta Ln(GDPG)_{t-i} + \varphi + ECT_{-1} + \varepsilon_t \quad (7)$$

$$\Delta Ln(CUST)_t = \mu_0 + \sum_{i=1}^{q} \beta_1 \Delta\, Ln(CUST)_{t-i} + \sum_{i=1}^{q} \beta_1 \Delta Ln(IMPV)_{t-i} + \varphi + ECT_{-1} + \varepsilon_t \quad (8)$$

Eq (6) is an estimation of VAT revenue in relation to changes in private household consumption, Eq (7) total tax revenue in relation to the growth of the economy and Eq (8) custom duties in relation to the change in import value. To determine the optimal lag length, several lag selection criterions were utilised, such as; the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Criterion (HQC).

#### 4.3.4. Justification of Variables

GDP per capita measures a country's level of development and is expected to be positively associated with the government's ability to collect taxes. As the economy grows and income levels rise, tax revenues would follow suit due to automatic stabilisers. The relationship between trade openness and revenue mobilization is twofold. On the one hand, economies that are extremely open to trade are likely to collect fewer tax revenues on imports as trade taxes are relatively low (Gupta, 2007). On the other hand, open economies are known to grow faster, hence higher levels of GDP, consequently higher revenue collections. The inclusion of the agriculture sector is very crucial as it represents difficulties incurred by official in collecting taxes. Governments usually offer tax exemptions and subsidies to farmers and this reduces the size of the tax base. Thus, the sign for agriculture is expected to be negative.

The growing body of literature has highlighted the importance of good governance and quality institutions in tax collections. These factors affect tax collections through their contributions to tax evasion, weak administration and improper tax exemptions (Davoodi and Grigorian, 2007). The sign for good governance is expected to be positive. Le et al (2012) notes that population growth distorts tax collection capacity and lower the fraction of productive population. Hence, population growth is expected to have a negative sign. Like trade openness, the impact of inflation on revenue collection remains ambiguous. While Musharraf, Martinez-Vazquez and Vulovic (2013) state that inflation may increase revenues in progressive tax systems, Attiya et al (2012) argue that inflation has a negative impact on revenue mobilization through the consumption and investment channels. Since South Africa is faced by a progressive tax system, inflation is expected to have a positive sign. The corruption index is expected to have a positive impact on revenue mobilization as high levels of corruption and poor service delivery hamper tax morality. Both the labour force participation rate and employment-population ratio are expected to have positive signs. The reasoning is that, higher levels of employment and/or labour participation result in increased economic activity and thus income generation, which is then taxed and collected by tax authorities.

For tax buoyancy estimates, we used private consumption by households as the tax base for VAT since most of the variations in VAT revenues are explained by private consumption. Import duties on the other hand, are largely explained by changes in import value, hence the base. Notably, variations in personal and corporate income taxes are largely explained by the wage bill and company profits, respectively. Due to lack of data, we failed to estimate tax buoyancy for personal and corporate income taxes. Nonetheless, GDP growth was used as the tax base for total tax revenues since changes in revenue growth are largely explained by the growth of the economy.

## 4.4.ESTIMATION TECHNIQUES

### 4.4.1. Unit Root Tests

Arltova and Fedorova (2016) state that one of the basic principles of econometric modelling is testing for stationarity of variables, more especially when dealing with time series data. The reasoning is that non-stationary variables may lead to spurious results or even break the model. Thus, to avoid this, we began by testing the variables for unit root using Augmented Dickey Fuller (ADF) (Dickey and Fuller, 1979) and Phillips-Perron (PP) (Phillips and Perron,

1988) non-stationarity tests. The choice of techniques was based on their simplicity, since there is no uniformly better test for unit root (Sjo, 2008).

4.4.1.1.Augmented Dickey Fuller Unit Root Test

Following (Arltova and Fedorova, 2016), our initial ADF model, derived from the Box-Jenkins model (Box and Jenkins, 1970), can be expressed as:

$$y_t = \alpha_1 y_{t-1} + \sum_{i=1}^{q-1} \gamma_i \Delta y_{t-i} + \varepsilon_t \qquad t = 1, \ldots\ldots, T \qquad (9)$$

Where $\alpha_1$ is the auto-regression parameter, $\varepsilon_t$ is the non-systematic component of the model that meets the characteristics of the white noise term. The null hypothesis is $H_0: \alpha_1 = 1$ in which case the process contains a unit root and will thus be denoted as I (1) and the alternative hypothesis is $H_1: \alpha_1 < 1$ in which case the process does not contain a unit root and will thus be denoted as I (0).

4.4.1.2.Phillips-Perron Unit Root Test

Using multiple unit root tests allows one to come up with robust and accurate results. An alternative test to ADF is the PP test and one of its advantages is that it is a non-parametric test, implying that it is not necessary to specify the model and lag parameter in the regression test.

4.4.2. 2Stage Least Squares

As stated earlier in the study, we employed the IV technique given the threat of endogeneity in our model. Consider a simple regression equation:

$$y = \mu + \delta x + \varepsilon \qquad (10)$$

where $y$ is the dependent variable, $\mu$ is the constant, $\delta$ is a slope parameter to be estimated, $x$ is the independent variable and $\varepsilon$ is the error term. If $x$ and $\varepsilon$ are correlated, then this violates an assumption of the regression framework (Oczkowski and Farrell, 1998). Notably, if we apply the standard OLS technique, the coefficients will be biased and inconsistent. To remedy this, one can apply the instrumental variable technique. The instruments (say $v$) however, should satisfy two conditions: (i) $v$ should be uncorrelated with $\varepsilon$, and (ii) $v$ must be correlated with $x$. An advantage of the technique is that it easily caters for non-linear and interactions effects (Bollen and Paxton, 1998). Even more, it produces consistent results even when $x$ and $\varepsilon$ are correlated. The procedure involves two stages of OLS:

- An OLS regression $x$ on $v$ and get predictions for $x$, say $\hat{x}$.
- OLS regression $y$ on $\hat{x}$.

4.4.3. Autoregressive Distributed Lag

The ARDL technique by Pesaran (1997) and Pesaran et al., (2001) was employed in this study to estimate tax buoyancy. Unlike conventional cointegration techniques (i.e. Engle Granger, 1987: Johansen and Julius), the technique does not require pre-tests of unit root (Nkoro and Uko, 2016). However, it is worth noting that the technique becomes explosive in the presence of 2nd difference variables. A simple reparametrized ARDL model (1,0) can be expressed as:

$$y_t = \mu + \beta . x_t + \gamma y_{t-1} + \varepsilon_t \qquad (11)$$

where $(\gamma y_{t-1})$ is the error correction term. Compared to other cointegration approaches, the ARDL Bounds test to cointegration reduces the potential problem of autocorrelation (Dritsakis and Stamatiou, 2016). Nkoro and Uko (2016) state that the long run relationship is established when the t-statistic exceeds the critical value band. The hypothesis can be expressed as follows:

$$H_0: \gamma_1 = \gamma_2 = 0 \rightarrow no\ cointegration \qquad (12)$$

$$H_A: \gamma_1 \neq \gamma_2 \neq 0 \rightarrow cointegration \qquad (13)$$

After a long run relationship is established, the next step is to estimate the speed of adjustment to equilibrium as well as short run and long run coefficients.

4.4.4. Residual diagnostics

Time series analysis is not without risk and chief among those risks are the risks of heteroscedasticity and serial correlation. Thus, to ensure that our models do not suffer from serial correlation and heteroskedasticity, we ran several diagnostic tests ranging from Breusch-Godfrey Serial Correlation LM test (Breusch and Godfrey, 1978), White-Heteroscedasticity test (White, 1980), Jarque-Bera Normality test and CUSUM stability tests. The CUSUM test was used to determine the stability of the model.

CHAPTER 5

# 5. FINDINGS, CONCLUSION, RECOMMENDATIONS

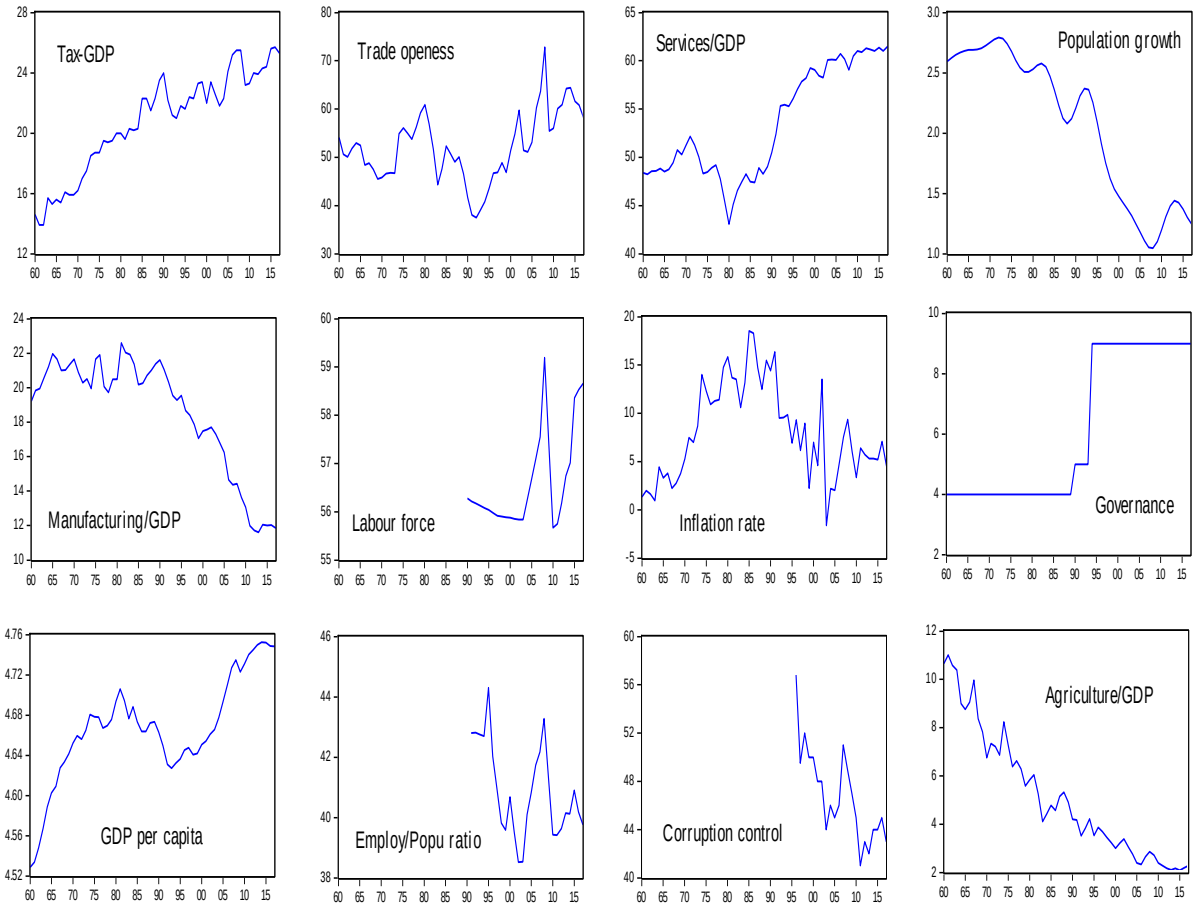
## 5.1.INTRODUCTION

This section is an interpretation of findings of the study. The section is divided into two parts: Part A, which details results for tax capacity and tax effort and Part B, which details results for tax buoyancy. Various tests that have been performed are thus discussed in detail. The last part of the section provides conclusions and policy implications.

## 5.2. Part A

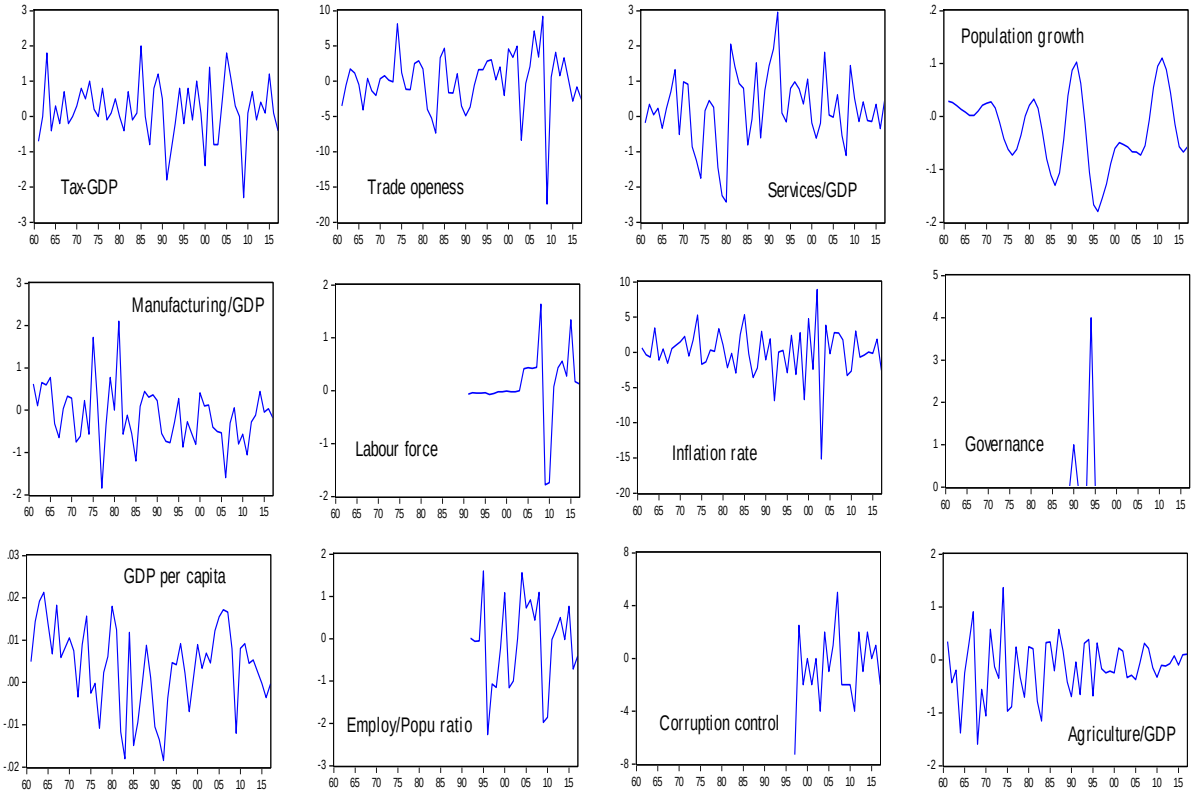
This sub-section details the finding for tax capacity and tax effort for South Africa over the period 1960 – 2017. These include stationarity tests, regression output, residual diagnostics and calculations for tax effort. We begin by plotting the data for visual inspection. The visualisations are provided in figure 10 and 11.

Figure 10: Raw data




Source: Author's computations

Figure 11: Differenced data




Source: Author's computations

From figure 10, we can see that certain variables (i.e. tax revenue, GDP per capita and agriculture share in GDP) seem to have a trend. Visual inspections are however necessary though not sufficient for one to conclude on the characteristics of the data. Additionally, we can observe from figure 10 that most, if not all, variables seem to be non-stationary. Nonetheless, figure 11 provides 1st differenced variables and all variables seem to be stationary. However, to confirm this, we performed formal stationarity tests.

### 5.2.1. Descriptive statistics

In this sub-section, we present the descriptive statistics of individual variables to assess their mean and standard deviations. Table 1 details the minimum, maximum, standard deviation and mean value for each variable. The total number of observations differs in each case due to data availability.

Table 1: Descriptive Statistics

| | Mean | S-Deviation | Min | Max | Obs. |
|---|---|---|---|---|---|
| Tax Revenue %GDP | 20.77 | 3.37 | 13.90 | 25.70 | 58 |
| Trade Openness | 52.13 | 7.15 | 37.49 | 72.86 | 58 |
| GDP Per capita | 4.67 | 0.05 | 4.53 | 4.75 | 58 |

| | | | | | |
|---|---|---|---|---|---|
| Agriculture %GDP | 5.14 | 2.60 | 2.08 | 11.01 | 58 |
| Governance | 6.14 | 2.44 | 4.00 | 9.00 | 58 |
| Population growth | 2.08 | 0.61 | 1.05 | 2.79 | 58 |
| Inflation | 8.06 | 4.93 | -1.63 | 18.52 | 58 |
| Manufacturing %GDP | 18.57 | 3.34 | 11.61 | 22.61 | 58 |
| Services %GDP | 53.41 | 5.66 | 43.07 | 61.49 | 58 |
| Corruption Index | 46.79 | 3.78 | 41.00 | 56.80 | 22 |
| Employment ratio | 40.89 | 1.53 | 38.52 | 44.31 | 27 |
| Labour force rate | 53.50 | 0.77 | 52.31 | 55.78 | 28 |

Source: author's computations

Tax revenue has a mean of 20.7 and standard deviation of 3.36 while the labour force participation rate has the highest average, amounting to 53.5, followed by services share in GDP (53.4), trade openness (52.1) and corruption index (46.8). Notwithstanding, trade openness has the highest standard deviation of 7.15, indicating that the values are spread out. On the contrary, GDP per capita, labour force participation rate and population growth have low standard deviations of 0.05, 0.77 and 0.6, respectively. This shows that most of the data points are very close to the mean.

### 5.2.2. Pairwise Correlation

Table 2 details correlations amongst the variables in question. Correlation estimates provide a useful tool for analysing and understanding the relationship between the dependent variable and independent variables, identifying and confirming the expected signs of variables as well as detecting issues of multicollinearity. From Table 2, it is evident that most of the independent variables are highly correlated, implying that the model is most likely to suffer from multicollinearity. Nonetheless, trade openness and inflation are found to be weakly and positively correlated with tax revenue. On the contrary, population growth and agriculture share in GDP are found to be strongly and negatively correlated with tax revenue. These findings are in line with Le et al., (2007) and Gupta (2007). Governance and GDP per capita are found to be strongly and positively associated with tax revenue, as expected.

Table 2: Pairwise Correlation test results

| | REV | TOP | POPG | GOV | GDPP | AGR | INF | SERV | MAN | COR | EMPL | LFPR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REV | 1.00 | | | | | | | | | | | |
| TOP | 0.35 | 1.00 | | | | | | | | | | |
| POPG | -0.84 | -0.50 | 1.00 | | | | | | | | | |
| GOV | 0.74 | 0.36 | -0.91 | 1.00 | | | | | | | | |

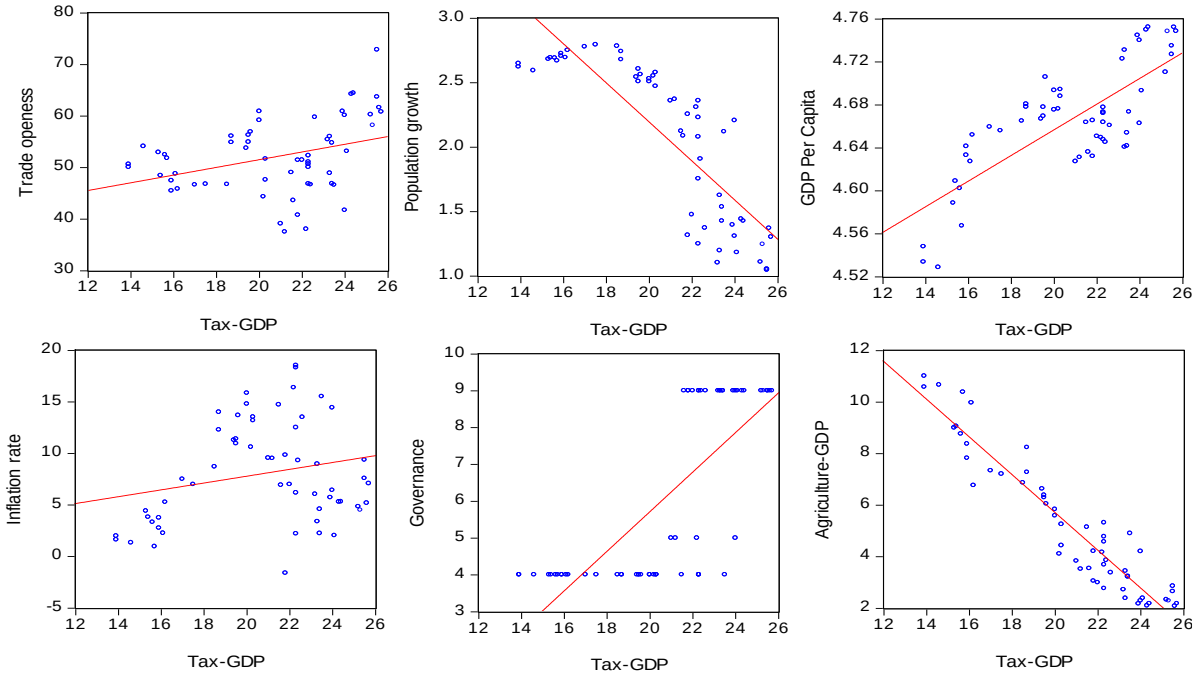
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GDPP | 0.77 | 0.56 | -0.60 | 0.48 | 1.00 | | | | | | | |
| AGR | -0.95 | -0.25 | 0.82 | -0.78 | -0.76 | 1.00 | | | | | | |
| INF | 0.23 | -0.08 | 0.24 | -0.35 | 0.23 | -0.14 | 1.00 | | | | | |
| SERV | 0.69 | 0.30 | -0.89 | 0.94 | 0.49 | -0.75 | -0.45 | 1.00 | | | | |
| MAN | -0.68 | -0.62 | 0.86 | -0.82 | -0.64 | 0.67 | 0.36 | -0.86 | 1.00 | | | |
| COR | -0.32 | -0.45 | 0.46 | - | -0.69 | 0.81 | 0.44 | -0.85 | 0.73 | 1.00 | | |
| EMPL | 0.40 | 0.28 | -0.18 | -0.45 | 0.16 | 0.03 | 0.28 | -0.15 | -0.01 | 0.44 | 1.00 | |
| LFPR | 0.81 | 0.65 | -0.51 | 0.16 | 0.65 | -0.48 | 0.13 | 0.42 | -0.55 | -0.19 | 0.54 | 1.00 |

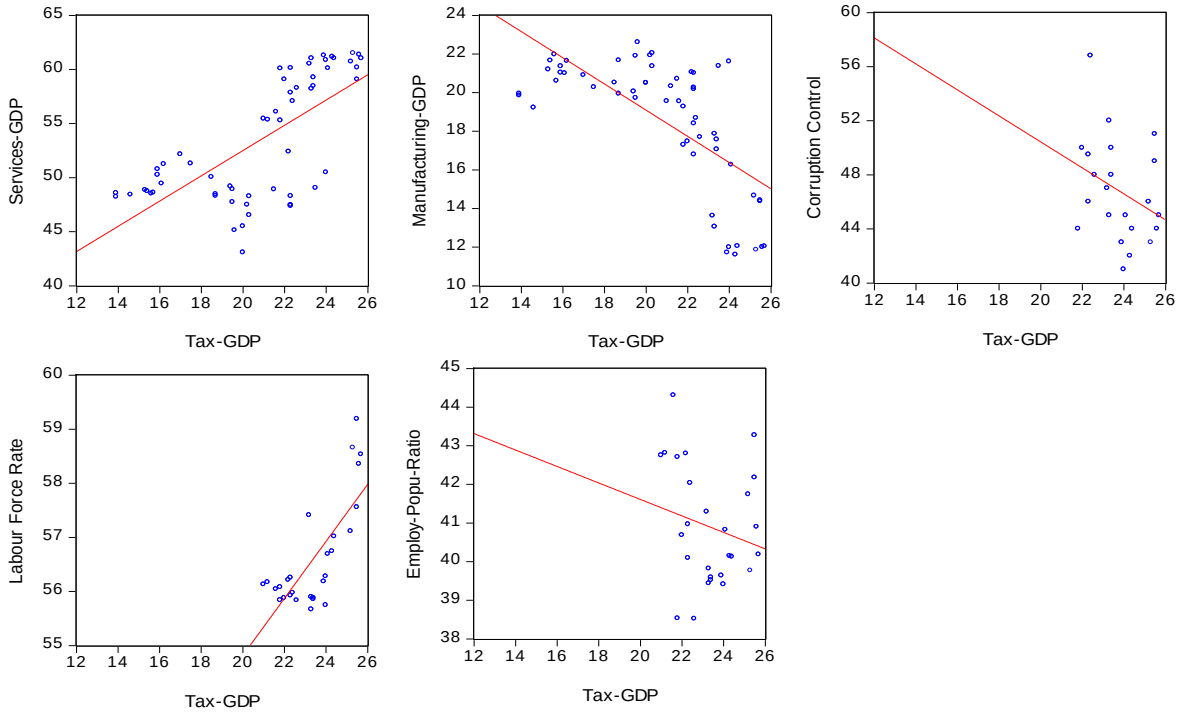
| | | |
|---|---|---|
| TOP - trade openness | GDPP - GDP per capita | MAN - manufacturing/GDP |
| POPG - population growth | LFPR – labour force participation rate | SERV- services/GDP |
| GOV - Good governance | AGR - agriculture/GDP | COR- corruption score index |
| REV – tax revenue/GDP | EMPL – employment/population ratio | INF - Inflation rate |

Source: Author's computations

Agriculture share of GDP, manufacturing share of GDP, services share of GDP and industry share of GDP are perfectly correlated with population growth, amounting to (in absolute terms) 82%, 89%, 86% and 87%, respectively. Even worse, we find a strong correlation between governance, services share in GDP, manufacturing share in GDP and industry share in GDP, measuring 93%, 82% and 91%, respectively. To overcome multicollinearity and the risk of endogeneity, we used the 2SLS technique. Before we ran regressions, we continued to plot the data to see the relationship between depend variable and independent variables, graphically. To do so, we made use of scatter plots in Figure 12.

Figure 12: Scatter diagram






At a basic level, the association between two variables can be illustrated using a line of best fit known as the regression line. From figure 12, it is clear that a perfect linear relationship exists between tax revenue and GDP per capita, population growth, agriculture, manufacturing and services share in GDP. A weak linear relationship also exists between tax revenue and trade openness, inflation and employment-population ratio.

### 5.2.3. Stationarity Analysis

As noted earlier on, we used both ADF and PP stationarity tests. It is sufficient to note that the PP test has more power over the ADF test. Thus, in cases where one or more variables is/are inconsistent across tests, the conclusion will be based on the PP test. Table 3 shows the results from the stationarity tests. From the stationarity tests performed, we find that tax revenue, GDP per capita, governance, population growth, manufacturing and services share in GDP, employment-population ratio and trade openness are consistent in all tests and stationary after 1st differencing. In addition, corruption index and agriculture share in GDP are also found to be consistent across all tests yet stationary at level. In other words, the former variables are integrated in order I(1) while the latter variables are integrated in order I(0). Only inflation and the labour force participation rate are found to be inconsistent across both tests. The conclusion is based on the PP test given its power over ADF. Hence, inflation is stationary at level whereas the labour force participation rate is stationary after 1st differencing. Interestingly, no variable is found to contain a trend.

Table 3: stationarity tests results

| Variable | Augmented Dicker Fuller test | | | Phillip-Perron test | | |
|---|---|---|---|---|---|---|
| | Intercept | Trend and intercept | Order of integration | Intercept | Trend and intercept | Order of integration |
| REV | -1.36 | -2.86 | | -1.32 | -2.80 | |
| D(REV) | -7.52* | -7.52* | \| (1) | -8.73* | -10.08* | \| (1) |
| GDPC | -2.39 | -2.56 | | -2.24 | -2.20 | |
| D(GDPC) | -4.52* | -4.59* | \| (1) | -4.56* | -4.63* | \| (1) |
| TOP | -2.17 | -2.57 | | -2.08 | -2.48 | |
| D(TOP) | -7.36* | -7.29 | \| (1) | -8.22* | -8.51* | \| (1) |
| GOV | -0.65 | -1.91 | | -0.64 | -1.91 | |
| D(GOV) | -7.55* | -7.49* | \| (1) | -7.55* | -7.49* | \| (1) |
| INF | -1.98 | -2.01 | | -2.98** | -2.95 | \| (0) |
| D(INF) | -12.03* | -7.10* | \| (1) | - | - | |
| POPG | -0.19 | -2.39 | | -0.33 | -2.32 | |
| D(POPG) | -3.30** | -3.49** | \| (1) | -2.93** | -2.93 | \| (1) |
| AGR | -3.57* | -1.63 | \| (0) | -3.66* | -2.33 | \| (0) |
| MAN | 0.57 | -2.12 | | 0.514 | -2.07 | |
| D(MAN) | -6.50* | -6.20* | \| (1) | -6.47* | -7.07* | \| (1) |
| SERV | -0.59 | -1.91 | | -0.35 | -1.55 | |
| D(SERV) | -5.48* | -5.46* | \| (1) | -5.32* | -5.28* | \| (1) |
| COR | -3.10** | -3.87** | \| (0) | -3.09** | -3.79** | \| (0) |
| LFPR | -2.97** | -3.17 | \| (0) | -1.95 | -2.17 | |
| D(LFPR) | - | - | | -4.00* | -3.94** | \| (1) |
| EMPL | -2.41 | -2.56 | | -1.96 | -2.21 | |
| D(EMPL) | -4.19* | -4.11* | \| (1) | -4.18* | -4.09* | \| (1) |
| Critical values | | | | Critical values | | |
| 1% | -3.55 | -4.12 | | -3.55 | -4.13 | |
| 5% | -2.91 | -3.49 | | -2.91 | -3.49 | |
| 10% | -2.59 | -3.17 | | -2.59 | -3.17 | |

| | | |
|---|---|---|
| TOP - trade openness | GDPP - GDP per capita | MAN - manufacturing/GDP |
| POPG - population growth | INF - Inflation rate | SERV- services/GDP |
| GOV - Good governance | AGR - agriculture/GDP | LFPR – labour force participation rate |
| REV – tax revenue/GDP | COR- corruption score index | EMPL – employment/population ratio |

Asterisks *, **, *** indicate significance at 1%, 5% and 10%, respectively

### 5.2.4. Regression outputs

The main regression output is provided in Table 4. The total number of observations is 58 and the value of R-squared is significant (95%), implying that the model fits the data well. The Durbin-Watson value of 1.74 is near 2, insinuating that the model is less likely to suffer from serial correlation. As stated earlier in the study, we made use of 2SLS econometric technique to accommodate the risk of endogeneity. Trade openness to begin with, has a negative and statistically significant impact on tax capacity. The economic intuition is that, South Africa is an open economy and thus collects less tax revenues from trade since trade taxes and barriers are relatively low. On the contrary, GDP per capita is found to have a huge positive and statistically significant impact on tax capacity. This is consistent with existing literature (i.e. Piancastelli, 2001: Davoodi and Grigorian, 2007: Gupta, 2007: Garg et al., 2017). A unit increase in GDP per capita will increase tax capacity by approximately 9 units whilst a unit increase in trade openness will decrease tax capacity by roughly 3.5 units. This implies that as the economy grows and household incomes increase, so does the ability of tax authorities to collect increased tax revenues.

Table 4: Regression output

| **Dependent variable: Tax-GDP Ratio** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | TOP | POPG | GOV | GDPP | AGR | INF | MAN | SERV | DUM | C |
| Coefficient | -3.51 | -4.31 | 1.26 | 9.22 | -2.77 | 0.23 | -3.05 | -4.58 | -0.89 | 21.91 |
| S.E | (1.91)*** | (1.20)* | (1.02) | (5.15)*** | (0.96)* | (0.04)* | (2.51) | (4.71) | (0.74) | 29.61 |
| T-stat | -1.84 | -3.59 | 1.23 | 1.79 | -2.88 | 6.02 | -1.22 | -0.97 | -1.20 | 0.74 |

| | | |
|---|---|---|
| TOP - trade openness | GDPP - GDP per capita | MAN - manufacturing/GDP |
| POPG - population growth | INF - Inflation rate | SERV- services/GDP |
| GOV - Good governance | AGR - agriculture/GDP | COR- corruption score index |

$R^2$ (0.95), DW-stat (1.74), IV tank (9), Asterisks *, **, *** indicate significance at 1%, 5% and 10%, respectively.

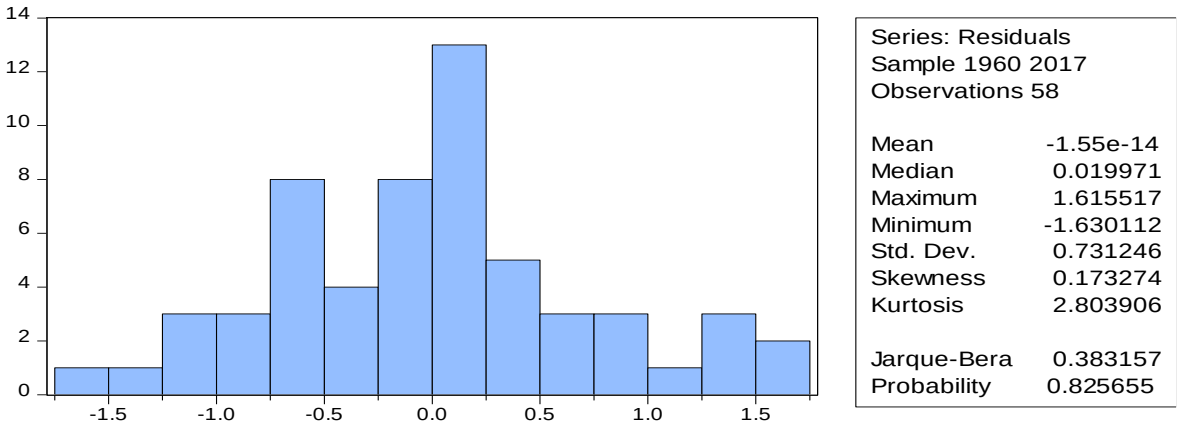
The substantial value for GDP per capita is not surprising since personal and corporate income taxes make-up a larger fraction of tax revenues in South Africa. Nonetheless, good governance is found to have a weak positive and statistically insignificant impact on tax capacity whereas population growth has a strong negative and statistically significant impact on tax capacity. Bird et al., (2004) and Attiya et al., (2012) also found an inverse relationship between population growth and revenue mobilization. A unit increase in population growth decreases tax capacity by as much as 4.3 units whereas a unit increase in good governance

increases revenue collection by as little as 1.2 units. The reasoning is that, as the population increases, the tax base becomes more complex, making it difficult for the government to identify and tax potential candidates. Agriculture on the one hand, has a negative sign as expected and is significant in explaining variations in tax capacity. Inflation on the other hand, has a positive sign, which is expected in a country following a progressive tax system. A unit increase in inflation can increase tax capacity by approximately 0.23 units whereas a unit increase in agriculture decreases revenue collections by approximately 2.8 units (in line with Karagöz, 2013: Garg et al., 2017). The negative impact of agriculture on revenue collections is not surprising, as the government issues subsidies for agricultural production. Also, it seems politically infeasible to tax the agricultural sector as this might discourage production and hamper food security. Moreover, given the low prices and profits in the agricultural sector, the government would collect little revenue, that is to say, the costs of taxing the agricultural sector would outweigh the benefits. Manufacturing and industry share in GDP are found to have a strong negative impact on revenue mobilisation though statistically insignificant in explaining variations in revenue mobilisation.

### 5.2.5. Residual diagnostics

To ensure that the model is valid, we ran residuals tests. Performing residual diagnostics has become a requirement in econometric analysis. Figure 13 displays the output from the Jarque-Bera normality test.

Figure 13: Normality test results




From figure 13 we can see that the kurtosis is 2.80, which is approaching the recommended value of 3.7. The corresponding Jarque-Bera p-value is 83%, greater than 5% and indicating that the data is normally distributed. Notwithstanding, we performed further residual diagnostics, presented in Table 5.

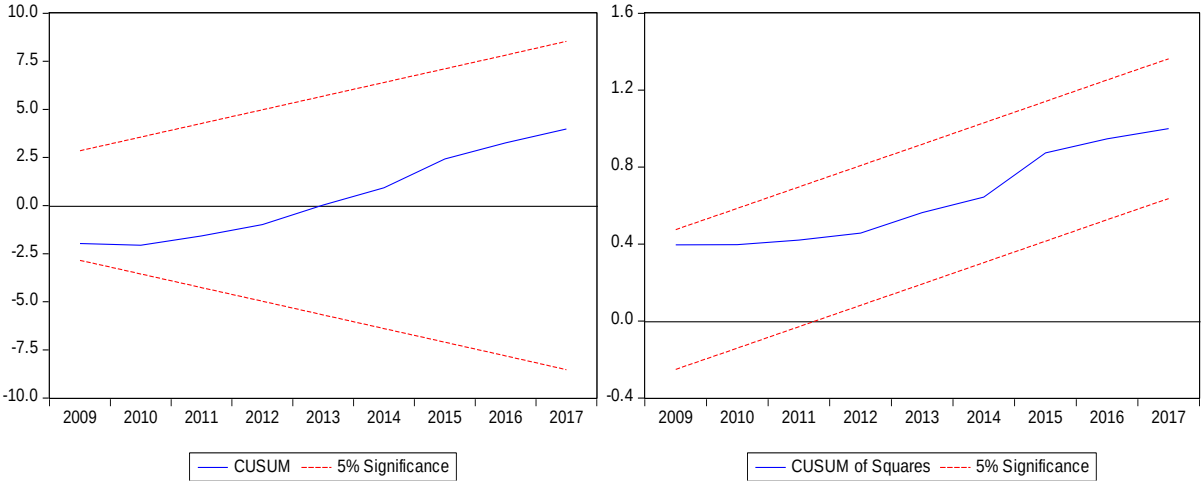
Table 5: Residual tests results

| Serial correlation (Breusch-Godfrey) | | Heteroscedasticity (Breusch-Pagan-Godfrey) | | Heteroscedasticity (Harvey) | |
|---|---|---|---|---|---|
| Obs.*R | Prob. Chi (1) | Obs.*R | Prob. Chi- | Obs.*R | Prob. Chi |
| 1.13 | 0.29 | 16.37 | 0.06 | 10.90 | 0.28 |

Source: author's computations

As can be seen in Table 5, the model does not suffer from serial correlation nor heteroscedasticity. This is because; the corresponding p-values are greater than 5%, which leads to a rejection of the null hypothesis. The corresponding p-values for both serial correlation and heteroscedasticity are 29% and 28%, respectively. Lastly, we performed residual stability tests to ensure that the model is stable. We followed the OLS approach to achieve this goal, presented in figure 14.

Figure 14: OLS Cusum Stability test results




It is unquestionably clear from figure 14 that the model is stable overtime. Both the cusum and cusum of squares tests confirm this. Given these residual diagnostics, we can confidently confirm that the model is indeed valid.

### 5.2.6. Robustness tests

To ensure that the results in Table 4 are robust, we ran alternative specifications. The results are presented in Table 6. Robustness checks are usually conducted to ensure that the initial model is consistent and robust. To achieve this goal, we introduced three control variables to our initial model, that is: labour force participation rate, employment-population ratio and corruption index. Furthermore, we add/drop certain variables to see if there are any significant alterations to the estimated coefficients.

Table 6: Robustness tests results

| Dependent variable: Tax-GDP Ratio | | | | |
|---|---|---|---|---|
| | Model (1) | Model (2) | Model (3) | Model (4) |
| C | 3.33 | -1.21 | -13.01 | 11.50 |
| TOP | -2.40<br>(1.53) | -1.79<br>(1.36) | 1.93<br>(2.03) | |
| POPG | -3.91<br>(1.12)* | -3.93<br>(1.12)* | - | -2.25<br>(0.95)** |
| GOV | 0.66<br>(0.82) | 0.76<br>(0.80) | - | 0.29<br>(1.07) |
| GDPP | 7.89<br>(4.96) | 7.18<br>(4.88) | - | - |
| INF | 0.24<br>(0.03)* | 0.23<br>(0.03)* | 0.01<br>(0.06) | 0.10<br>(0.05)** |
| AGR | -2.90<br>(0.95)* | -3.22<br>(0.88)* | -0.57<br>(2.45) | |
| MAN | -2.00<br>(2.27) | - | -6.93<br>(3.59)*** | -8.30<br>(2.24)* |
| SERV | - | - | | - |
| DUM | -0.79<br>(0.73) | -0.28<br>(0.46) | -1.58<br>(0.73)** | -1.45<br>(0.75)*** |
| COR | - | - | 3.90<br>(3.49) | - |
| LFPR | - | - | 0.60<br>(0.17)* | - |
| EMPL | - | - | - | 9.39<br>(4.68)*** |
| Adj. $R^2$ | 0.94 | 0.94 | 0.84 | 0.75 |
| F-stat | 121.10 | 138.90 | 14.85 | 14.10 |
| DW-stat | 1.78 | 1.67 | 1.89 | 1.88 |
| No of Obs. | 58 | 58 | 22 | 27 |
| Tank | 9 | 8 | 8 | 7 |

| | | |
|---|---|---|
| TOP - trade openness | GDPP - GDP per capita | MAN - manufacturing/GDP |
| POPG - population growth | INF - Inflation rate | SERV- services/GDP |
| GOV - Good governance | AGR - agriculture/GDP | COR- corruption score index |
| DUM – 2008 dummy | EMPL – employment/population | LFPR – labour force participation |

Asterisks in parentheses *, **, *** indicate significance at 1%, 5% and 10%, respectively. Technique used is 2SLS (Robust S.E are in parenthesis)

In model (1) and (2), we omit both manufacturing and services share in GDP. The results remain consistent, yet trade openness becomes insignificant. The value of adjusted $R^2$ falls from the initial 95% in Table 4 to 94%, insinuating that the omittance of manufacturing and services shares in GDP makes the model slightly less compatible with the data. In model (3),

we replace GDP per capita, population growth and governance with labour force participation rate and corruption index, respectively. Inflation becomes negative whereas trade openness becomes positive, albeit statistically insignificant. The corruption index is found to have a strong positive impact on revenue mobilization though statistically insignificant. The intuition is that, tax morality, which is the willingness of taxpayers to pay taxes, is usually supressed by high corruption levels and poor service delivery. Thus, as the corruption score and service delivery improve, so does citizens' willingness to pay taxes. It should be noted however, that taxes are a compulsory contribution to the government, hence there is no direct link between the amount of taxes paid by taxpayers and the benefit derived from such contributions.

Hence, the state of corruption and service delivery can only affect tax collections in the short run, as taxpayers will eventually be forced to pay their outstanding taxes in the long run. Notwithstanding, the effects of the labour force participation rate on revenue mobilisation are found to be weakly positive and statistically significant. This shows that the government could collect higher tax revenues from personal and corporate income taxes through increased economic activity and labour participation. In addition, given that South Africa has made huge investments in human capital through the fee-free higher education system, such human capital can benefit the country in the form of increased tax revenues in the long run. However, this can happen only and only if sufficient jobs are created in the labour market to absorb existing inventories in human capital.

Nonetheless, in model (4), we replace the labour force participation rate with employment-population ratio. We find that employment-population ratio has a strong positive and statistically significant impact on revenue mobilization. Furthermore, the impact of employment-population ratio on revenue mobilization is relatively greater and statistically significant than that of the labour force participation rate. These findings imply that the employment-population ratio is better at explaining variations in revenue mobilizations than the labour force participation rate, at least in South Africa. Additionally, this supports the earlier discussions that South Africa can benefit significantly from human capital, if and only if current inventories in human capital are depleted.

We can observe from Table 6 that our initial estimates in Table 4 are consistent and robust. This stems from the fact that the values and signs of coefficients in Table 6 are not altered

significantly when adding or deducting control variables. Likewise, we perform residual diagnostics for all the models. The results are provided in Table 7.

Table 7: Diagnostic analysis results

| | **MODEL (1)** | **MODEL (2)** | **MODEL (3)** | **MODEL (4)** |
|---|---|---|---|---|
| Heteroscedasticity (B-P-G) | 0.10 | 0.15 | 0.30 | 0.45 |
| Heteroscedasticity (Harvey) | 0.29 | 0.33 | 0.19 | 0.71 |
| Serial correlation (B-G) | 0.39 | 0.20 | 0.17 | 0.88 |
| Kurtosis | 3.14 | 3.14 | 1.98 | 1.82 |
| P-value (Jarque-Bera) | 0.88 | 0.97 | 0.59 | 0.44 |

Source: author's computations

It is reasonably clear from Table 7 that all models are free from serial correlation and heteroscedasticity. The data also, is normality distributed, though model (3) and (4) are somewhat skewed. The corresponding p-values, both for serial correlation and heteroscedasticity are fairly significant.

### 5.2.7. Tax effort indices

Table 8 shows the tax effort index calculated from the 2SLS estimates in Table 4. The shaded cells indicate periods in which tax effort indices were equal and above one. That is to say, they signal periods in which South Africa performed well above its potential tax capacity while the unshaded cells indicate periods in which South Africa fell short of its potential capacity. As can be seen in Table 8, the highest tax effort index was 1.10 in 1963 before hitting a record low of 0.92 in 2002. Interestingly, on average, the tax effort index is 1.00, implying that actual tax capacity equals potential tax capacity. It is also evident that, in most periods, South Africa performed well above its potential tax capacity. This is indicated by the values above and equal to 1. As indicated in Table 4, the driving forces behind South Africa's tax capacity are GDP per capita, agriculture share in GDP, population growth, inflation and trade openness. This is consistent with Teera and Hudson (2004) as they found that upper middle-income and high-income OECD countries are making better use of their tax bases to increase revenue.

Table 8: Tax Effort Index for South Africa

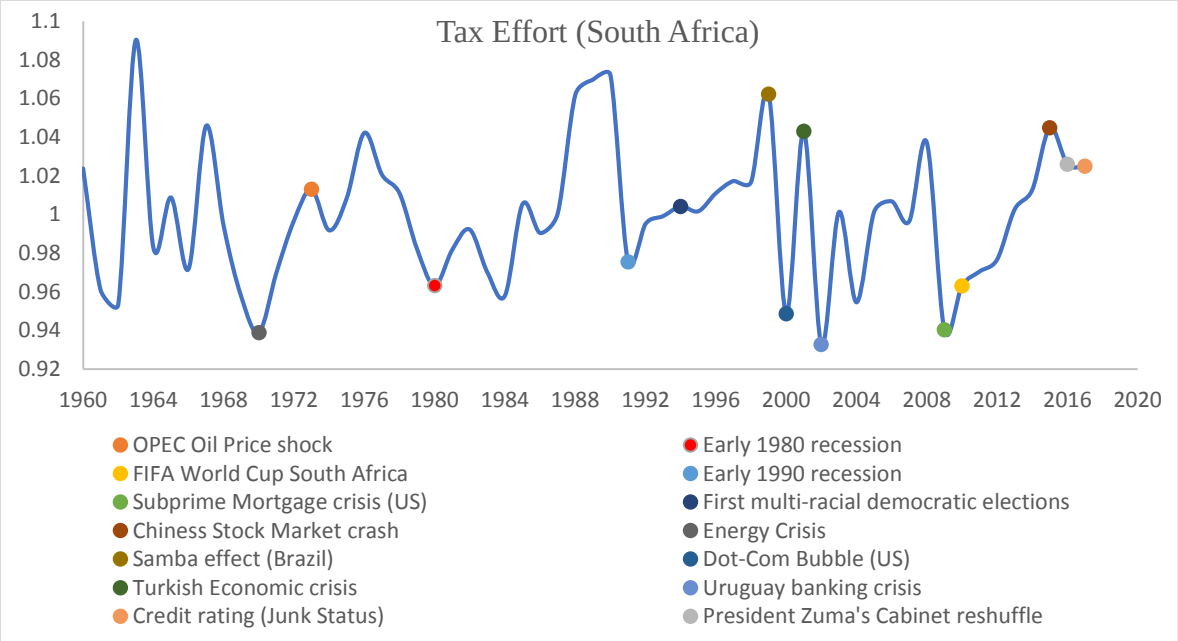
| Period | Actual Tax Capacity | Potential Tax Capcity | Tax Effort | GDP Per capita | | Period. | Actual Tax Capacity. | Potential Tax Capcity. | Tax Effort. | GDP Per capita. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 14,60 | 14,26 | 1,02 | 316 | | 1990 | 24,00 | 22,38 | 1,07 | 8430 |
| 1961 | 13,90 | 14,47 | 0,96 | 324 | | 1991 | 22,20 | 22,76 | 0,98 | 9451 |
| 1962 | 13,90 | 14,58 | 0,95 | 336 | | 1992 | 21,20 | 21,30 | 1,00 | 10377 |
| 1963 | 15,70 | 14,40 | 1,09 | 363 | | 1993 | 21,00 | 21,02 | 1,00 | 11623 |
| 1964 | 15,30 | 15,57 | 0,98 | 388 | | 1994 | 21,80 | 21,71 | 1,00 | 12870 |
| 1965 | 15,60 | 15,46 | 1,01 | 413 | | 1995 | 21,60 | 21,56 | 1,00 | 14320 |
| 1966 | 15,40 | 15,85 | 0,97 | 438 | | 1996 | 22,40 | 22,15 | 1,01 | 15782 |
| 1967 | 16,10 | 15,39 | 1,05 | 475 | | 1997 | 22,30 | 21,92 | 1,02 | 17122 |
| 1968 | 15,90 | 16,00 | 0,99 | 500 | | 1998 | 23,30 | 22,91 | 1,02 | 18162 |
| 1969 | 15,90 | 16,61 | 0,96 | 548 | | 1999 | 23,40 | 22,03 | 1,06 | 19493 |
| 1970 | 16,20 | 17,25 | 0,94 | 585 | | 2000 | 22,00 | 23,19 | 0,95 | 21657 |
| 1971 | 17,00 | 17,53 | 0,97 | 631 | | 2001 | 23,40 | 22,43 | 1,04 | 23481 |
| 1972 | 17,50 | 17,55 | 1,00 | 695 | | 2002 | 22,60 | 24,23 | 0,93 | 26778 |
| 1973 | 18,50 | 18,26 | 1,01 | 841 | | 2003 | 21,80 | 21,77 | 1,00 | 28632 |
| 1974 | 18,70 | 18,85 | 0,99 | 1011 | | 2004 | 22,30 | 23,36 | 0,95 | 31370 |
| 1975 | 18,70 | 18,54 | 1,01 | 1113 | | 2005 | 24,10 | 24,07 | 1,00 | 34281 |
| 1976 | 19,50 | 18,71 | 1,04 | 1229 | | 2006 | 25,20 | 25,03 | 1,01 | 37899 |
| 1977 | 19,40 | 19,01 | 1,02 | 1333 | | 2007 | 25,50 | 25,59 | 1,00 | 42863 |
| 1978 | 19,50 | 19,29 | 1,01 | 1495 | | 2008 | 25,50 | 24,58 | 1,04 | 47512 |
| 1979 | 20,00 | 20,36 | 0,98 | 1745 | | 2009 | 23,20 | 24,67 | 0,94 | 49682 |
| 1980 | 20,00 | 20,76 | 0,96 | 2271 | | 2010 | 23,30 | 24,19 | 0,96 | 53823 |
| 1981 | 19,60 | 19,96 | 0,98 | 2575 | | 2011 | 24,00 | 24,73 | 0,97 | 58559 |
| 1982 | 20,30 | 20,46 | 0,99 | 2857 | | 2012 | 23,90 | 24,47 | 0,98 | 62297 |
| 1983 | 20,20 | 20,82 | 0,97 | 3193 | | 2013 | 24,30 | 24,23 | 1,00 | 66952 |
| 1984 | 20,30 | 21,19 | 0,96 | 3658 | | 2014 | 24,40 | 24,09 | 1,01 | 71064 |
| 1985 | 22,30 | 22,18 | 1,01 | 4129 | | 2015 | 25,60 | 24,50 | 1,04 | 74663 |
| 1986 | 22,30 | 22,51 | 0,99 | 4734 | | 2016 | 25,70 | 25,05 | 1,03 | 79066 |
| 1987 | 21,50 | 21,49 | 1,00 | 5416 | | 2017 | 25,30 | 24,68 | 1,02 | 83393 |
| 1988 | 22,30 | 21,00 | 1,06 | 6363 | | **Average** | **20,77** | **20,77** | **1,00** | **18777** |
| 1989 | 23,50 | 21,97 | 1,07 | 7479 | | | | | | |

Source: author's computations

5.2.7.1.Trends in Tax Effort

Figure 15 shows trends in tax effort for South Africa. It is apparent in figure 15 that the tax effort index is time variant. This may be attributable to major political and economic events that took place over the estimation period.

Figure 15: Trends in Tax effort for South Africa




Source: Author's computations

Global economic events such as the energy crisis and Chinese stock market crash often have spill-over effects which have downstream impact on tax performance for South Africa. For example, the 2008 subprime crisis left majority of economies in bad economic shape, following declines in output, high unemployment rates, consequently, declines in income levels. Considering that a major component of tax revenue is income tax, a decline in income levels would reduce tax revenues by a significant amount, thus undermining tax effort. Nonetheless, the tax effort index gained momentum in early 2010 amid the FIFA World Cup hosted by South Africa. Following this, the tax effort index took a knock in the late 2016 following a combination of major political decisions and economic events, to name a few, the cabinet reshuffle and downgrade of the country's investment status by Rating Agencies.

5.3.Part B

This sub-section details findings for tax buoyancy estimates. These include unit root tests, cointegration tests, regression estimates and residual diagnostics. The initial data is provided in figure 16. The data spans from 1995 -2017. As one can see in figure 16, some of the

variables including total revenue growth, GDP growth, custom duties and import value seem to have been hit by the 2008 shock. To account for this, we included a 2008 dummy to our model. Even more, some of the variables, GDP growth and total revenue growth in particular, seem to be stationary whereas others (i.e. VAT, private consumption, custom duties and import value) seem to have a trend. However, to confirm this, we performed formal stationarity tests. In figure 17, we visualize the data in 1st difference.

Figure 16:Raw data

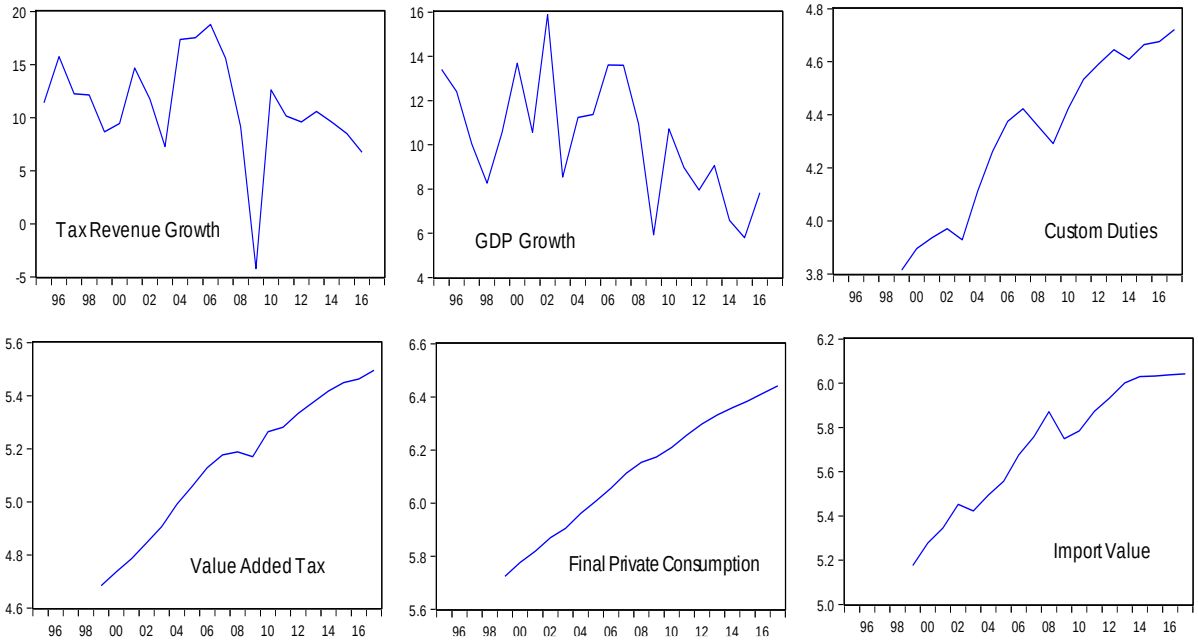
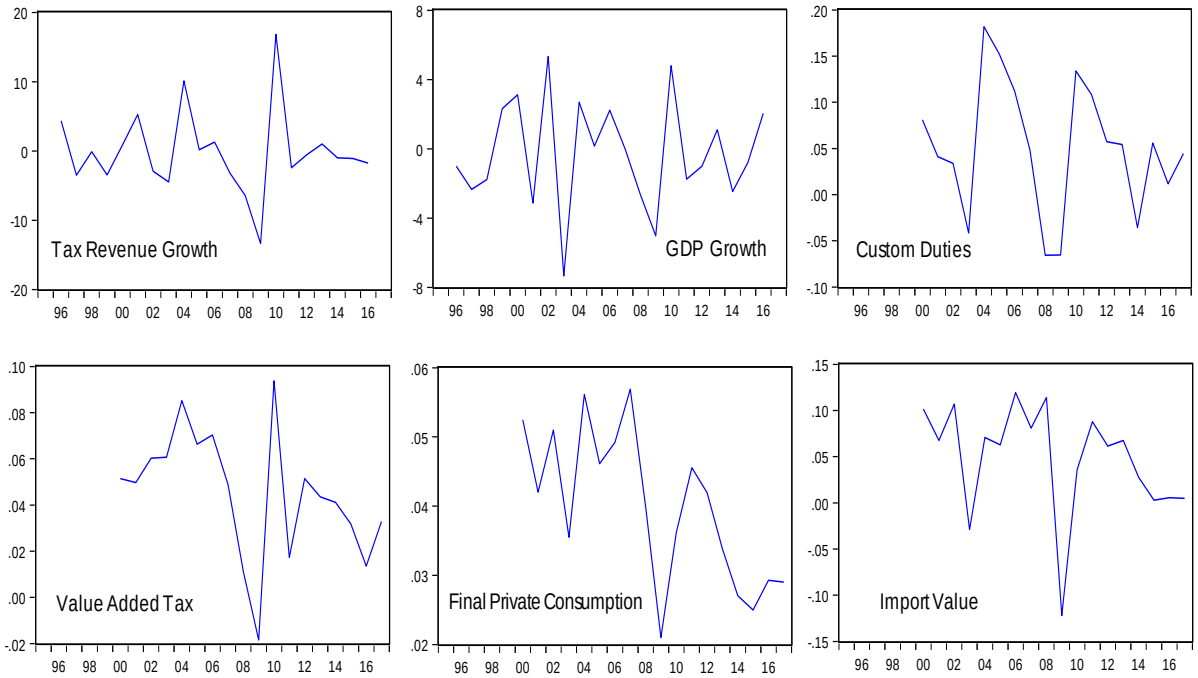



Figure 17: Differenced data



### 5.3.1. Stationarity analysis

The formal stationarity tests results are discussed in this sub-section. It is sufficient to note, however, that performing stationarity tests is not a formal requirement in the ARDL technique. We performed them however, for consistency and formality 'sake. The results are provided in Table 9.

Table 9: Stationarity tests results

| Variable | Augmented Dicker Fuller test | | | | Phillip-Perron test | | |
|---|---|---|---|---|---|---|---|
| | Intercept | Trend and intercept | Order of integration | | Intercept | Trend and intercept | Order of integration |
| VAT | -2.04 | -1.20 | | | -2.16 | -1.20 | |
| D(VAT) | -3.64** | -4.35** | \| (1) | | -3.64** | -4.35** | \| (1) |
| TREV | -3.30** | -3.56*** | \| (0) | | -3.32** | -3.54*** | \| (0) |
| PCONS | -3.69** | -0.18 | \| (0) | | -4.34* | 0.12 | \| (0) |
| GDPG | -3.15** | -3.99** | \| (0) | | -3.10** | -3.99** | \| (0) |
| IMPV | -1.93 | -1.88 | | | -2.38 | -1.91 | |
| D(IMPV) | -4.08* | -3.89** | \| (1) | | -4.09* | -5.39* | \| (1) |
| CUST | -1.17 | -2.84 | | | -1.17 | -2.11 | |
| D(CUST) | -3.18 | -5.74* | \| (1) | | -3.08** | -2.98 | \| (1) |
| Critical values | | | | | Critical values | | |
| 1% | -3.86 | -4.57 | | | -3.86 | -4.57 | |
| 5% | -3.04 | -3.69 | | | -3.04 | -3.69 | |
| 10% | -2.66 | -3.29 | | | -2.66 | -3.29 | |

VAT – value added tax revenue
TREV – total tax revenue growth
PCONS – private household consumption
GDPG – GDP growth
IMPV – import value
CUST- custom duties

Asterisks in parentheses (*, **, ***) indicate significance at 1%, 5% and 10%, respectively.

Based on the results given in Table 9, total revenue growth, private household consumption and GDP growth are found to be stationary at level. Import value, custom duties and VAT are stationary after first difference. Given that the variables are integrated in different orders and that the sample size is small, the ARDL Bounds test to cointegration was the most appropriate technique to apply.

### 5.3.2. Cointegration and Buoyancy Estimates

Table 10 provides results for the cointegration test, as well as short run and long run tax buoyancy estimates for South Africa. The regressions consisted of a series of equations including Eq (6), (7) and (8). The critical value bounds suggested by Pesaran and Shin (2001) are included in the Table 10. The results provided in Table 10 show that a long-run relationship exists between VAT revenue and private consumption expenditure by households and between total revenue growth and the growth of the economy. The null hypothesis of no cointegration is thus rejected against the alternative hypothesis of cointegration. This is because; the t-statistics in both models are greater than the critical lower and upper bounds at the 5% significance level.

Table 10: ARDL Bounds test to Cointegration results

| Estimation | | T-stat | ^Ho | ECM | DUM | SRC | LRC |
|---|---|---|---|---|---|---|---|
| | | | | | | **Buoyancy** | |
| VAT & PCONS | | 6.19** | **Reject** | -0.51*** | -0.14* | 0.69*** | 1.35* |
| TREV & GDPG | | 6.80** | **Reject** | -0.99* | -2.53 | 0.82*** | 0.82*** |
| CUST & IMPV | | 1.48 | **Accept** | - | -0.21 | -0.41 | 1.42* |
| | | | | - | | | |

Critical Value Bounds

| Significance | I0 Bound | I1 Bound |
|---|---|---|
| 10% | 4.04 | 4.78 |
| 5% | 4.94 | 5.73 |
| 2.5% | 5.77 | 6.68 |
| 1% | 6.84 | 7.84 |

VAT – value added tax
TREV – total tax revenue growth
PCONS – private household consumption
SRC – short run coefficient
GDPG – GDP growth
IMPV – import value
CUST- custom duties
LRC – long run coefficient

Asterisks in parentheses (*, **, ***) indicate significance at 1%, 5% and 10%, respectively

We find no long-run relationship between custom duties and import value. Thus, we expect no speed of adjustment from the custom duties model. For VAT and total revenue growth, the speed of adjustment to equilibrium is 51% and 99%, respectively. Furthermore, the speed of adjustment was found to be negative and statistically significant. A tax buoyancy above unity implies that tax revenues growth at the same pace as the economy or relevant base whereas a tax buoyancy below unity insinuates that tax revenues grow at a slower pace than the economy or relevant base.

The total tax revenue buoyancy estimate is 0.82 both in the short-run and long-run. This implies that, in South Africa, the growth in tax revenues did not match the growth of the economy. The estimated tax buoyancy for VAT is 0.69 in the short-run and 1.35 in the long-run. This means that, VAT revenues are growing at a faster rate than changes in consumption expenditure by households, at least in the long run. Likewise, customs duties are found to growth at a higher pace than variations in import value. The estimated tax buoyancy for custom duties is -0.41 in the short-run, which is quite disappointing, albeit in the long-run the estimate is above unity (1.42). All tax buoyancy estimates (except short run custom duties) are found to be statistically significant.

### 5.3.3. Residual diagnostics

Table 11 provides results for residual diagnostics tests. It is sufficient to note that performing diagnostic checks has become a standard procedure in econometric analysis.

Table 11: Residual diagnosis results

| | **Serial Correlation** | **Heteroscedasticity (Breusch-Pagan)** | **Heteroscedasticity (Harvey)** | **P-value (Normality)** | **Kurtosis** |
|---|---|---|---|---|---|
| VAT & PCONS | 0.08 | 0.22 | 0.00 | 0.70 | 2.09 |
| TREV & GDPG | 0.23 | 0.91 | 0.62 | 0.06 | 3.80 |
| CUST & IMPV | 0.54 | 0.64 | 0.04 | 0.95 | 2.62 |

VAT – value added tax
TREV – total tax revenue growth
PCONS – private household consumption
GDPG – GDP growth
IMPV – import value
CUST- custom duties

Source: author's computations

It is apparent in Table 11 that the models for total revenue and custom duties are free from serial correlation and heteroscedasticity. Moreover, the Jarque-Bera normality test confirms that the data is normally distributed given the p-values above 5%. The kurtosis for both models are reasonably high, approaching 3.7. As per Harvey test, the model for VAT suffers from heteroscedasticity though the Breusch-Pagan test contradicts this. The result on heteroscedasticity is thus inconclusive. The model, however, is free from serial correlation and the data is normally distributed.

## 5.4.CONCLUSION

This study was aimed at determining the revenue generating potential for South Africa. The findings obtained in this study clearly show that South Africa's revenue performance has

been fairly satisfactory overtime. This stems from the fact that the tax effort index has been equal to and above one in most periods. Additionally, on average, the tax effort index is 1, implying that actual tax capacity matches potential tax capacity. Notwithstanding, the regressions performed were found to be robust and free from potential risks of serial correlation and heteroscedasticity. Based on 2SLS findings, the determinants of tax capacity for South Africa are GDP per capita, agriculture share in GDP, trade openness and inflation and population growth. The South African tax system was also found to be fairly buoyant, although there is still room for improvement. The ARDL results indicate that VAT revenues and custom duties grow at a faster pace than the growth in final household consumption and import value, respectively. Total tax revenue growth, however, still falls behind. This is because, the long-run buoyancy estimate was found to be less than unity, implying that automatic stabilizers haven't been successful in generating additional revenues during economic booms. Nonetheless, given that South Africa's tax-GDP ratio of 27% is way above international benchmarks and that the findings obtained in this study are satisfactory, we can firmly conclude that South Africa performs relatively well in domestic revenue mobilization. The government and its agencies (e.g. SARS, SARB, National Treasury etc) are efficiently and effectively mobilising the available domestic resources to collect state revenues, though there is still room for improvement, more especially in tax administration. Steenekamp (2007) found that South African tax authorities outperform comparable countries in domestic revenue mobilization and some few years later, much of this remains in place.

## 5.5.POLICY IMPLICATIONS

Household incomes and population growth were found to be major determinants of tax capacity in South Africa. Thus, for the government to generate value from its rapidly growing population, investments in human capital need to be in place. Also, given that South Africa is characterised by an open economy in which trade taxes and barriers are relatively low, the government should focus more on improving personal and corporate income tax collections as well as consumption taxes, VAT to be specific, as little revenues would be generated from investments in trade taxes. Given the findings and conclusion, this study recommends that the government address labour market rigidities to enable the system to absorb unemployed skilled individuals. It is certainly clear that tax rates have hit their record high and also, that raising tax rates beyond acceptable levels will destroy the generators of revenue. Thus, this study cautions against increases in tax rates in the near future as they will discourage economic activity in the form of labour, output and investment, as Laffer (1921) pointed.

Even worse, higher tax rates often induce tax avoidance and evasion, creating about their own problems than solutions. Thus, an optimal solution to raising tax revenues is broadening the tax base, thereby lowering tax rates in the long run. Fortunately, as stated earlier, South Africa is abundant in human capital, and if such human capital is to be absorbed by the labour market, the tax base would expand to an appreciable extent, yielding sufficient revenues for government to meet its expenditure requirements. Apart from broadening the tax base, the government can work on addressing issues of corruption and service delivery. Such issues affect tax morality, consequently tax payments and collections. In the presence of high corruption levels and poor service delivery, tax authorities are often pressurised to issue tax incentives and reliefs, which are costly in nature.

Hence, to enhance the willingness of taxpayers to pay taxes, that is tax morality, corruption and poor service delivery should be addressed through proper inquiry into state activities and by holding political officials accountable. This will help reduce delays in tax payments in the form of dividends withheld taxes and base shifting. Also, this will reduce the monetary cost of collecting taxes. Lastly, the government can also review perfectly inelastic taxes such as sin tax and gambling tax. Although the goal behind such taxes is usually to encourage certain behaviour, the taxes can also be utilised to generate additional revenues. Given the large volume in foreign exchange transactions, the introduction of a tobin tax, specifically for hedging and arbitrage motives, can also be seen as a means for generating additional tax revenues for the South African government.

## 5.6.RESEARCH GAP

Future studies can investigate the determinants of tax buoyancy for South Africa. Additionally, one can look into assessing the different approaches to calculating tax buoyancy, thereby ranking them in terms of efficiency and accuracy. Notwithstanding, recent studies have analysed tax buoyancy while incorporating different phases of the economy such as expansions and contractions. Thus, one can follow the pattern of assessing whether the tax system is more buoyant during expansions or contractions, within a South African context. As for tax capacity and tax effort, earlier studies have covered this topic broadly. However, different studies seem to have utilised different control variables and econometric techniques. Hence, future studies can explore other variables that can possibly serve as determinants of tax capacity for South Africa.

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## 7. APPENDIX

Table 12: Description of variables and data sources

| Variable | Description | Data source |
|---|---|---|
| Tax-GDP ratio | The tax-to-GDP ratio is a ratio of a nation's tax revenue relative to its gross domestic product (GDP), or the market value of goods and services a country produces. | South African Reserve Bank |
| Trade openness | Trade Openness is the sum of imports and exports normalized by GDP. | World Development Indicators |
| GDP per capita | GDP per capita is a measure of a country's economic output that accounts for its number of people. This is obtained by dividing the country's gross domestic product by its total population. | South African Reserve Bank |
| Agriculture share in GDP | Agricultural GDP is the Gross Domestic Product (GDP) coming from the agricultural sector. | South African Reserve Bank |
| Governance | The governance indicator examines concomitant qualities of democratic and autocratic authority in governing institutions. | PolityIV |
| Population growth | Population growth refers to change in the size of a population, which can be either positive or negative over time, depending on the balance of births and deaths. | World Development Indicators |
| Inflation | The inflation rate is the annual percentage change in the price level. | Inflation.eu |
| Manufacturing share in GDP | Manufacturing GDP is the Gross Domestic Product (GDP) coming from the manufacturing sector | South African Reserve Bank |
| Services share in GDP | Services GDP is the Gross Domestic Product (GDP) coming from the services sector. | South African Reserve Bank |

| | | |
|---|---|---|
| Corruption Perceptions Index | The Corruption Perceptions Index (CPI) is an index published annually by Transparency International since 1995 which ranks countries "by their perceived levels of public sector corruption". | Transparency International |
| Employment-population ratio | It is calculated by dividing the number of people employed by the total number of people of working age. | World Development Indicators |
| Labour force participation rate | Labour force participation rate is defined as the section of working population in the age group of 16-64 in the economy currently employed or seeking employment. | World Development Indicators |
| VAT | VAT is a consumption tax levied on goods and services. | National Treasury |
| Private household consumption | Household final consumption expenditure is the market value of all goods and services, including durable products, purchased by households. | South African Reserve Bank |
| Import value | Value of imported goods as appraised by the customs and used as the basis for assessing the amount of import duty and other taxes. | South African Reserve Bank |
| Custom duties | Customs Duty is a tax imposed on imports and exports of goods | National Treasury |