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Determinants of Taxation Capacity and Effort: A Case Study of South Africa

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ABSTRACT

It is argued and debated across literature that effective tax system is without doubt one of the major factors that influences the economic growth and development of a country. Effective tax system is important to the economy as higher tax revenues reduce the aid-dependency of low economically developed countries. Tax systems also have a hand in influencing international investment decisions. It is also a common belief that effective tax system encourages good governance and improves state accountability. Effective tax system is integral for both the developing and developed countries, however, this study will focus on the analysis of a developing country as they are the victims of and are highly vulnerable to high budget deficits.

The study uses annual data covering period 1994-2015. The study tested for the unit root using the Augmented Dickey Fuller (ADF) and the results were stationary after first difference. VAR Granger Causality was employed to assess the causality between the variables. Diagnostic tests confirmed the absence of heteroscedasticity, serial correlation in our model and the model was correctly specified and normally distributed as confirmed by the Jarque-Bera test.

KEYWORDS: Taxation, Capacity, Effort, VAR and South Africa

INTRODUCTION

1.1. Background of the study

In most developed and developing countries around the globe tax revenue is a significant for the economic sustainability. Tax revenue is required by most government in order to pay for its spending and investments in the economy (EconomicsOnline, 2016). According to Rawa (2016) most government's main sources of revenue are from taxes, levies, fees, investment income and from the sales of goods and services. On the leading role are taxes collected from all corners of the economy that used to finance most government activities. The major concern for high taxes in most economies around the globe is countries need to spend more on public infrastructure, education, health services, security services and so on (Bird, Martinez-Vaquez , Benno, 2008). In order to finance all these activities, taxation is the main source of revenue (Addison and Levin, 2014).

However , gradaual increase in demand for governement services around the globe has left the governement without any option than to increase taxes and this was first noticed in USA . The historical evidence in developed nations such as USA suggests that when the capital is reduced taxes are increased, locked-in capital is liberated and, at least temporarily, the revenues from the tax rise (Moore, 2012). After the 1981 capital gains tax was increased from 20 to 24 percent in USA and federal capital gains tax revenues leapt from $29.4 billion in 1981 to $36.6 billion by 1983 (Moore, 2012). Nevertheless, the difference in tax revenue across the world have been a topic widespread debate in the relevant literature. Narrowing the case to South Africa, the government taxes are categorized as follows, secondary tax on companies / dividends (1.2%), Specific excise duties (3.5%), Customs duties (4.8%), Fuel levy (4.9%), Other direct and indirect taxes (5.3%), Company income tax (19.8%), VAT (26.4%) and Personal income tax (34%) (Moyane and Fuzile, 2014).

As reported by StatsSA (2015), total revenue collected in South Africa in 2013/2014 fiscal year amounts to R742.6 billion which marks a 10.6 % increase (R68.5 billion increase) from 674.1 billion in 2012/13 fiscal year. This shows an increase in taxes in South Africa which stood in marked contrast to 2009/10 where tax revenue contracted by four percent soon after a 2008/09 global financial crisis (ClubSA, 2016). Increase in taxes have been rendered good for revenue creation for the government but the case is different when tax payers are concerned. As indicate earlier, at most 34 % of the government revenue comes from personal income taxes. Furthermore, the South African government still looks to raise revenue by a further R15 billion in 2017/18 fiscal year (Munusamy & Merten, 2016). This is caused by slow economic growth, ever increasing debt and higher interest rates. Nonetheless, according to BBC News (2016)

(BBCnews, 2016) tax increases affect property sales, tobacco, fuel, capital gains and environmental levies. South Africa one of the most developed economy in Africa is struggling with shrinking growth, unemployment running at 25 percent, and widespread poverty (BBCnews, 2016). In this regard increase in taxes is found to be not a favorable way to raise revenue for the government. As indicated by Infoplease (2015) government has the mandate to determine taxes, which gives it greater control over its revenue. Federal, state, and local governments can mandate higher taxes and increase their revenues. Households and businesses have the more difficult task of selling their labor, goods, and services in order to raise revenue. In turn, raising taxes is one of the ways in which most governments take when trying to raise funds.

In emerging economies such as South Africa, increasing taxes is another cause of an increase in inflation. For example, increase in corporate tax leads to increase in cost of production which in turn leads to increase general price level caused by cost push inflation (Merwe 2004:14). Under these assumptions, the study aims to provide empirical evidence on the determinants of taxation capacity in South Africa. Taxable capacity is that maximum amount which the economy is in a position to bear towards the expenses of public authorities without having a really unhappy and down-trodden existence and without dislocating the economic, organization too much (Stamp, 2010). The level of taxes has pros and cons depending on the motive and nature of the government. In the past decade, vast numbers of papers, describing monetary policy instruments have been written and most of them presented opposing views on the capacity of taxation which is favorable for the economy (Brzoza-Berzezia, 2011). Taxes are necessary for a government to run. Without taxes, a government would not be able to hire employees or pay for any social programs (Hamel, 2013). Money from taxes finances infrastructure development such as roads, water systems, parks and public transportation. Social programs such as Social Security, Medicaid and Medicare would not be possible without taxes.

On the other hand, Hamel (2013) postulates that increased taxation tends to discourage economic activity and limit economic growth. In this regard higher taxes and the less money leads to citizens having less to spend on goods and services and lower consumption leads to less revenue for business. When businesses make less money, they hire fewer workers and may fire workers to maintain profitability Hamel (2013). Governments often pass tax cuts or give out tax refunds in periods of economic hardship to spark economic activity, though tax cuts can humper those who rely on public programs like Social Security and infrastructure spending.

In this regard, there is no clear consensus on taxation capacity and the debate is still going on across the world. The study aims to cover the gap that exist in literature by comprehensively and empirically analyze the macroeconomic determinants of taxation capacity in South Africa.

1.2. Problem statement

Fiscal deficit is the one major challenge faced by many developing countries over the past decade. Rapid expansion in government expenditure is one major reason behind large increase in fiscal imbalance. However, in order to fund all government activities taxes are considered the main source of revenue. Taxes allow governments to fund most of its programs for economic developed through fixed capital. Nevertheless, there should a balance between taxation capacity, government spending and economic development. In South Africa, approximately 34% of the government total revenue comes from personal income tax and taxes are considered the largest provider of government revenue. In order for economic development and growth to take place most governments in developing nations should invest more into the economic system. High investments mean high taxes and high taxes results in low consumption and les production due to increase in cost of production via corporate taxes. Due to above-mentioned deficiency, South Africa is struggling with budget deficits though experienced economic transformation. Thus, it is of paramount importance to determine the effective macroeconomic factors that affect taxation capacity and determine effective taxation system. If there is no clear understanding on taxation capacity and government spending to enhance economic development and growth the economy is yet to face budget deficits and high taxes. Therefore, the study will try to cover the gap in literature by providing a far reaching critical assessment on the relationship between taxation capacity and macroeconomic determinants in South Africa.

1.3. Research questions

What are the major macroeconomic determinants of taxation capacity in South Africa?

Do taxes positively or negatively affects economic growth in South Africa?

1.4. Objectives of the study

The primary objective of the study is to analyze the macro-economic determinants of taxation capacity in South African context from 1994-2015

The study aims:

1. To analyze the linier relationship between macro-economic determinants and taxation capacity in South Africa.
2. To analyze the effects of taxes on economic growth in South Africa.
3. To make relevant policy recommendations centered on the findings of the study.

1.5. Working hypothesis

In the effort to realize the objectives of the study based on the research questions, the following working hypothesis will be tested:

H_0: Macroeconomic variables in South Africa have no significant effect on taxation capacity in South Africa.

H_1: Macroeconomic variables in South Africa have significant effect on taxation capacity in South Africa.

1.6. Significance of the study

As reported by StatsSA year by year taxes are the major sources of revenue for the South African government over the past decade. Personal income tax is on the highest contributor of tax revenue in South Africa. Increase in government expenditure leads to increase in taxes hence reducing welfare of tax payers in South Africa. In addition, increase in corporate taxes increases production costs which in turn implicates investments and triggers inflation as a result of costs increase in the production sector. In most cases increase in cost of production leads to job retrenchments and company closure in extreme cases which leads to increase in unemployment. This paves way to thoroughly analyze macro-economic determinants of taxation capacity in South Africa. Taxes are now considered one major powerhouse of economic development in South Africa. Therefore, if macroeconomic policies are set in a way to raise revenue for the government and minimizing taxes can increase the welfare of South Africans citizens, firms and non-government Hence the need the relationship between taxes and macroeconomic variables can be a major breakthrough in production sector which in turn leads more job creation and economic growth at large. Therefore, the study is of paramount importance as one major objective of the SARB is economic growth in South Africa.

1.7. Limitations of the study

Data on taxes such as tax on companies / dividends, Specific excise duties, Customs duties, Fuel levy, Other direct and indirect taxes, Company income tax, VAT and Personal income tax respective macro-economic variables is not readily available and reported differently by various institutions, this might render findings of the study inaccurate from a certain angle. Not easily availability of certain data due to national security can as well act as limit the accuracy of the findings of the study.

1.8. Scope of the study

The study is based on secondary time series data published in South Africa and from Statistics South Africa (StatsSA), Reserve Bank of South Africa (SARB) and Department of Trade and Industry (DTI). The study will cover the period from 1994-2015 and confined on the economy in South Africa, which has nine provinces with various tax payers.

LITERATURE REVIEW

2. Introduction

Attempts to mobilize more tax revenue for low-income countries are now at the top of the global development agenda. It is argued and debated across literature that effective tax system is without doubt one of the major factors that influences the economic growth and development of a country. Effective tax system is important to the economy as higher tax revenues reduce the aid-dependency of low economically developed countries. Tax systems also have a hand in influencing international investment decisions. It is also a common belief that effective tax system encourages good governance and improves state accountability. Effective tax system is integral for both the developing and developed countries, however, this study will focus on the analysis of a developing country as they are the victims of and are highly vulnerable to high budget deficits.

The government should be cautious and give a careful thought before it can increase or decrease its taxes. Increasing taxation can have the following effects: Increased taxation among other things may have adverse supply-side effects by placing a burden to an already struggling private investment which will undermines growth. Adam and O'Connell (1997) argued that on top of taxation having adverse supply-side effects taxation generally affects the composition of investment which can prove to be a big problem for economic growth.

Despite of the negative effects increasing taxes might pose to the economy, South Africa needs to significantly increase tax revenues to be in a position to finance its anti-poverty and other development programmes. With the recent chaos of "fees must fall" and other pressing government expenditures such as health and social services expenditure the only way the government will be able to meet such is through a well-managed tax system. It important that tax-revenues may need if needs be to grow faster than national income.

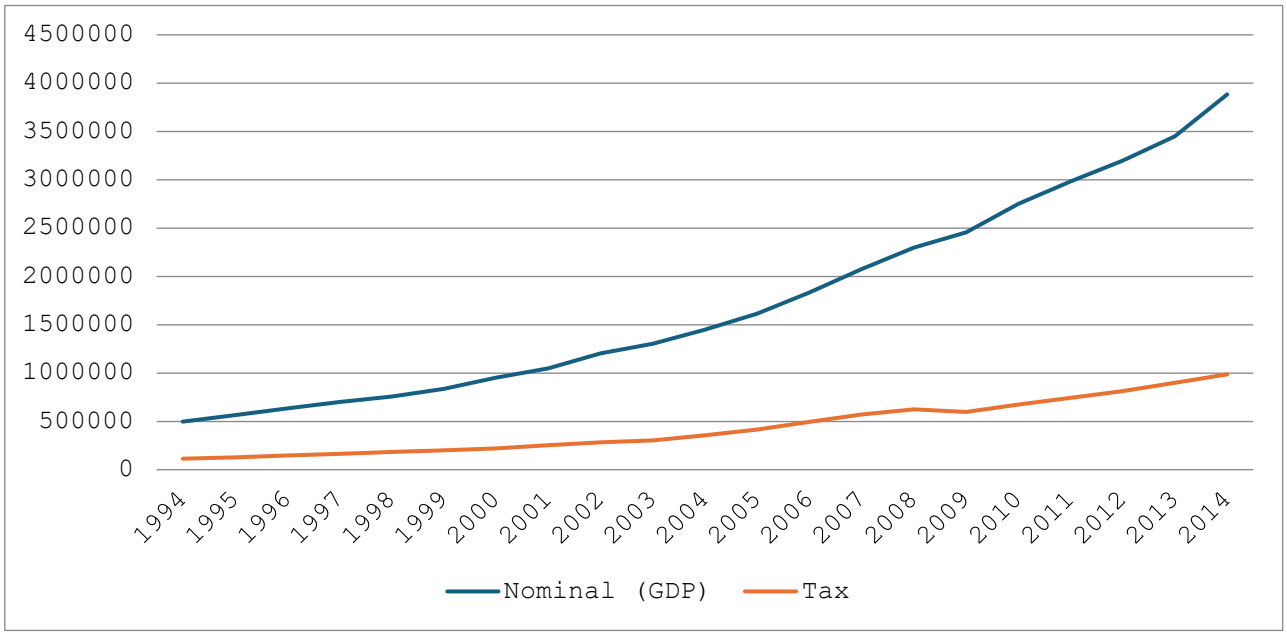
This chapter of the study presents both the theoretical and empirical literature on the determinants of tax capacity and tax effort in South Africa.

2.1. Tax revenue performance

Tax revenue is defined as compulsory transfers to the government for public purposes with an exclusion of transfers such as fines and penalties. Developing countries struggles much to raise enough funds to finance its development. A common belief is that tax revenue is a major or principal source of government revenue. Taxes are levied not only for revenue purposes but also to address issues of inequality, resource allocation and for economic stability purposes. Kaldore (1963) argues that it is necessary for a country that seeks development to collect more taxes than the normal 10-15 percent collected in many developing countries.

South Africa collected about R986.3 Billion in 2015 which was about 9.6% growth in total revenue in comparison to the revenue collected in 2014 (Stats SA, 2015). This revenue performance was due to an extraordinary drive by SARS on compliance (SARS, 2015).

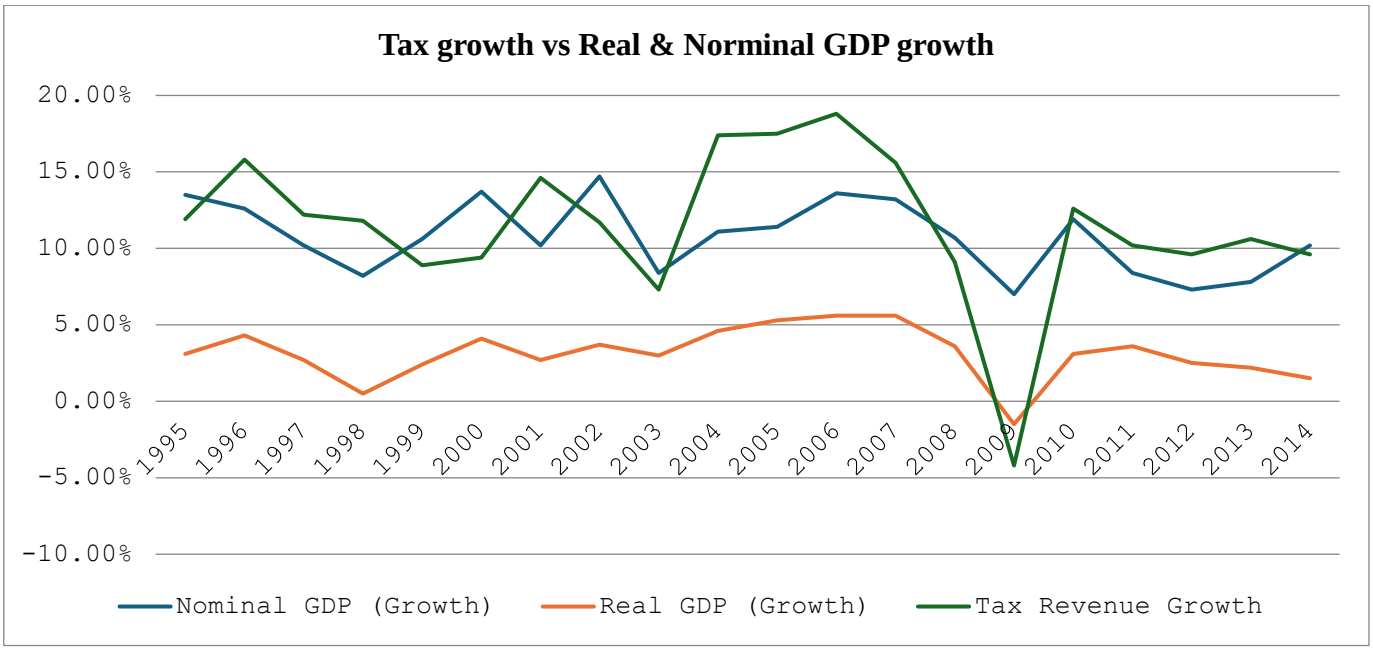
SA tax revenue vs Nominal GDP



Source: StatsSA

The above figure shows the relationship of tax revenue performance and nominal GDP in the past 20 years between 1994 and 2014. The graph shows that a direct relationship exists between nominal GDP and tax revenue as both curves have an increasing slope. It also shows that South Africa's revenue performances have improved over the years.

Of note to look at is also how South Africa's Nominal GDP, Real GDP has grown in relation to tax revenue growth. A figure below shows in percentages the growth of the three variables from 1995-2014.



Source: StatsSA.

2.2. Major taxes in South Africa

The major types of taxes that exist in South Africa, what they mean, their rates and conditions as provided by SARS are presented below

2.2.1. Income tax

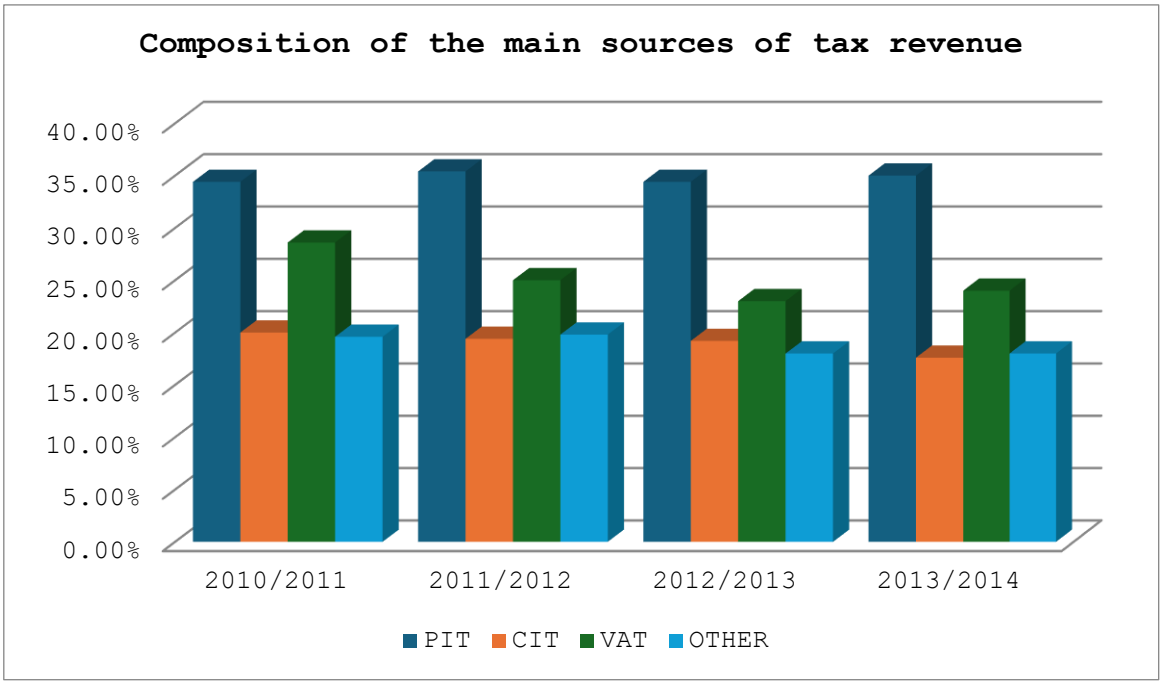
Income tax is the normal tax that is supposed to be paid on the taxable income of individuals. This is the type of tax that is imposed on the net profits from companies, their net gains, and other income. This is the main source of government income and is imposed by the Tax Act No. 58 of 1962. In South Africa this kind of a tax is paid by people under the age of 65 and who earns more than R75 000, for those who are 65 years or older the tax threshold increases to R116150 (SARS, 2016).

2.2.2. Value Added Tax (VAT)

Value added tax (VAT) which is currently set at 14% and is included in prices of many goods and services. Foreign visitors and consumers are not exempted from paying VAT on purchased goods. This is a sales tax based on the rise in the value of the product in each and every stage in its manufacturing and distribution process. The cost of the tax is then therefore added to the final price and will eventually be paid by whosoever consumes it.

2.2.3. Excise Tax

This is a type of tax imposed on high volume of daily consumable products for example petroleum, tobacco and alcohol. The primary reason for imposing such tax is to raise revenue for the government at the same time reducing consumption of certain products which are considered hazardous to health or environment.



Source: StatsSA, 2015

The contribution of Company income tax (CIT) to the total revenue in South Africa declined from 20% in 2010/11 fiscal year to 18.9% in 2014/15 fiscal years. This was due to a higher personal income tax (PIT). The contribution of Personal Income Tax (PIT) in 2014/15 fiscal year was 36%. The Contribution of Value added Tax saw an increase from 25.7% in 2011/12 fiscal year to 265% in 2014/15 (SARB, 2015).

2.3. Determinants of tax capacity and tax effort

Tax capacity is the maximum tax revenue that can be collected by a country given its institutional, social, and demographic and economic characteristics, while tax effort can be viewed as the relation between actual revenue and tax capacity. Tax effort can also be defined as the ratio between tax capacity and actual revenue. Teera & Hudson (2004: 23), Imanm and Jacobs (2007 :15) argues that tax revenue tends to depend more on the level of development of a country, trade openness, population growth and density, real per capita income and also by the structure of the economy which include the size of the formal and informal sector.

2.3.1. Level of economic Development

The best measure of economic development of a country is its GDP per capita figures. The explanatory variable GDP per capita is expected to have a positive sign because as a country grows or develops its formal sector increases in relative terms. Tanzi (1987) argues that economic development has the ability to bring about an increase in demand for public expenditure and a larger supply of taxing capacity to meet such demand (Musgrave, 1969). Chelliah (1997) argues out that economic development which is reflected by a higher per capita income reflects and indicates a higher capacity for people to pay taxes as well as the a capacity to levy and collect

them. Chelliah (1997) notes that taxable capacity is directly influenced by the ability of people to pay tax and also by the ability of the government and responsible authorities to collect. Tanzi (1987) also points out that the growth in income will among other things results in countries being more urbanized. Urbanization has an effect of increasing demand for public services while simultaneously facilitating tax collection.

2.3.2. Fiscal deficits and debt

Many developing countries are characterized with high public spending which has generated a huge fiscal deficit, leading to an escalated share of public debt relative to gross domestic product (Tanzi & Blejer, 1988). With a large debt burden a government will have to raise revenue good enough to finance it. In the event that the cost and interest on the debt surpasses net borrowing plus the possible reduction in non-interest expenditure, the government must therefore increase taxation. It is clearly shown that public debt has a hand in determining the extent to which a country may take advantage if their taxable capacity (Tanzi, 1987: 13). On the other hand a high public debt which is beyond the ability of the country to pay may create disequilibrium or macro-economic imbalances that may cause a reduction in tax level. Holding all other things constant a high public debt would tend to raise the tax level (Tanzi, 1992:18).

2.3.3. Population Density

The causality between population density and tax revenue is not easy to point out. However, it is agreed across many literatures that the higher the density of the population the higher tax base. It will be the duty of the tax authority to intensify their efforts to collect taxes at a less costly method as compared to a largely spaced population country. Longoni (2009) argues that population growth's impact on tax revenue is two-fold in the sense that it depends on whether the population is characterized with employed or unemployed majority. In the case of unemployed majority population become insignificant and negatively related to tax revenue and it becomes significant when the majorities are employed and can add to the tax base.

2.3.4. Trade Openness

Norregaard and Khan (2007) believe that trade openness is one of the major determinants of taxation. Aizenman and JinJarak (2009) argue that the effect of changing the size of international trade is two-fold that is it has two opposite effects on taxes. The first effect is that increased trade openness is expected to lower taxes collected on imports and exports, thus it will have an inverse impact on taxes and fiscal revenue. On the other hand, normally trade openness is associated with more economic growth; we then therefore expect economies to grow at a faster pace as trade openness increases and as a result more taxes will be collected as the tax base will increase brought about by an increase in economic growth. The second effect normally outweighs the first therefore; trade openness has a positive impact on total fiscal revenue and taxes.

2.3.5. Institutional and governance quality

This is arguably the most essential factors in the determination of adequacy tax collection (Gupta, 2007). Countries will only be able to get a substantial amount of tax only if the tax collection process is efficient. The two major measures of institutional and governance quality which are "bureaucracy quality index" and "corruption index" are expected to have a significant impact on tax collection. Both bureaucracy index and the corruption index ranges from 1 to 6 with "1" representing highest corruption and lowest bureaucracy quality and "6" entails highest bureaucracy quality and lowest corruption.

2.3.6. Share of Agriculture to GDP

Tanzi (1992) argues that agriculture is a considered a salient feature in relation to the structure of the economy. How a country is structured will have an impact on the level of taxation. It is not easy and almost impossible to tax the agricultural sector, it is therefore expected that as the share of agriculture to GDP increases, collected taxes in percentage of GDP decreases due to a smaller tax base (Piancastelli, 2001:78).

2.3.7. Imports

Governments impose restrictions on imports for many reasons which include protecting domestic small firms that cannot fight fierce competition from international firms; they also impose restrictions in the form of imposing tariffs to get revenue. Many developing countries get their revenue much from the border post where they earn import duties, importers do not just enter with foreign goods in the country for free they are charged a tarrif which is a tax on imported goods. The more the imports the more the tax revenue hence we expect imports to be positively related and significant to tax revenue

2.3.8. Share of Mining and Manufacturing to GDP.

In contrasts to the impact of agriculture share to GDP on tax revenue the share of mining and manufacturing to GDP is expected to have a positive impact on tax revenue. Longford (2009) asserts that manufacturing and mining sectors are the most taxed industries in all economies and hence an increase in their production positively impacts the revenue. Many developing countries do not have a well-functioning manufacturing sector and are highly characterized with more agricultural sector as was mentioned by Rostow stages of growth. This is the more reason why he thinks developing countries remain underdeveloped as they do not have a capacity to raise enough tax revenue for further growth (Todaro and Smith, 2002:29). In South Africa the mining sector has been performing well as South Africa is one of the countries rich in natural resources, however, it has seen its mining sector performance declining due to rampant strikes that saw many mining temporarily shut-down in 2012 onwards (StatsSA, 2013).

2.4. Empirical literature on the determinants of tax revenue

Many studies have been conducted in an attempt to assess tax performance across various countries. Most studies used tax share in GDP as the dependent variable with different combinations of various explanatory variables.

Storsky and WolderMariam (1997) did a review on tax revenue performance in SSA countries and found that tax performance varied across SSA countries and revenue trends were not uniform. Some countries showed period of increased tax revenue shares while others showed the negative trend where tax revenue share were declining. This difference in tax revenue performance was cited to different country's characteristic that is difference in the way countries handle and manage the explanatory variables. Ghura (1998) did an analysis on the macroeconomic and structural policy determinants and corruption level on a panel data for 38 countries in SSA for two years during period 1995-1996. The findings showed that an increase in the level of corruption had a negative impact on the tax revenue. As corruption increased tax revenue decreased. Agbeyegbe, Stotsky and WolderMariam (2006) did a study in SSA countries and their findings showed that import duties are still a significant source of revenue for these countries. Mahdavi (2008) made use of a revised model with quite a number of explanatory variables based on 43 transition countries during 1973-2002. According to Mahdavi (2008) tax revenue is positively related to the degree of international trade, the level of development (GDP per capita), relative size of the urban population and literacy rate. However, he believed that an increase in foreign aid, population density and inflation lowered tax revenue.

Lotz and Morss (1967) made use of the data of both the developed and developing countries inorder to get the ratio of tax revenue to gross national product (GNP). Lotz and Morss (1967) used openness and per capita income as the explanatory variables and the results showed that both variables were statistically significant. Tanzi (1987) used data of developing countries only and found out that per capita income effect positively and is significant.

Chelliah (1975) through using the data of 47 countries between the period 1969 and 1971 regressed the tax share in gross national product on agriculture share, mining and export share. He found mixed results; negative and significant effect of agriculture share, mining and export was found to be positive and significant.

Mushtaq and Baksh (2010:12) used a time series data during 1975 and 2010 from the Bureau of Statistics in Pakistan. They empirically analysed the determinants of tax revenue by regressing tax revenue on numerous explanatory variables such urbanization as population size, GDP and trade openness. Population size, GDP and urbanization were taken in logarithms the reason being that these variables are considered to have a non-linearity relationship with tax revenue. Mushtaq and Baksh (2010:13) found out that GDP, trade openness and urbanization were significant and positively related to tax revenue. However population was found to have a negative impact on tax revenue implying that as population increases tax revenue is expected to decrease. They base their argument on that the majority of the population in Pakistan is not employed and hence do not contribute anything on tax revenue. Longoni (2009) also estimated the same results and found out that GDP is significant and positively related to tax revenue

Bird (2008) studied tax performance of Latin American countries and his findings showed that Latin American countries performed below par as compared to other developing countries as they showed consistently lower tax effort.

Bahl (2003) used the data of OECD and low income countries to explain the determinants of tax revenue. He made use of manufacturing share of GDP, openness and the rate of population growth and the results showed that all variables were positive and statistically significant.

2.5. Conclusion

It is has been seen that different researchers believes differently on how the explanatory variables impact the tax revenue performance and tax capacity of countries. However, it was agreed across many literatures that GDP, trade openness and imports share are significant and positively related to tax revenue with agricultural share being negatively related and insignificant.

This study will fill some gaps in the area of tax revenue determinants for the policy makers and coming researchers. Above filling the literature the study addresses the issue in-depths by taking into account necessary control variables and times series and econometrically models it.

METHODOLOGY

3. Introduction

This chapter of the study presents the research methodology on the determinants of tax capacity and tax effort in South Africa. Different factors effect tax revenue performances differently and this research seeks to identify factors which significant and those which are not.

3.1. Model Specification

The researcher acknowledges that there are a number of factors that influences tax revenue however for the scope of this study will employ only three explanatory variables. Exclusion of other variables is justified because of the unavailability of data and this will give future researchers on the same literature an opportunity to include them.

$$\mathbf{TAX} = \mathbf{f}(\mathbf{IMP}, \mathbf{GDPPC}, \mathbf{UNEMPL}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{3.1}$$

Where Tax is revenue in percentage of GDP and is our dependent variable, IMP is imports of goods and services; GGPPC is the constant GDP per capita (2010 rand prices) and UNEMPL stands for the official unemployment rate in South Africa.

Equation 3.1 can be econometrically modeled as follows:

$$Tax_t = \beta_0 + \beta_1 IMP_t + \beta_2 UNEMPL_t + \beta_3 GDPPC_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.2$$

3.2. Expected signs prior

We expect the sign of $\beta_1$to be positive as increase in imports is thus expected to increase tax revenue, coefficient of β_2 is expected to be negative as increase in unemployment reduces taxes, coefficient of β_3 is expected to be positive as an increase in per capita income increases the tax base and hence tax revenue, and ε_t is the white noise error term which caters for other explanatory variables.

3.3. Estimation Techniques

The study will use E-views 9 packages because of its simplicity, Ordinary Least estimation will be used in E-views to estimate short and long run models to find the deterministic of tax capacity and tax effort in South Africa.

The study uses quantitative methods (econometric tests) to analyse the impact of the explanatory variables that is trade openness, share of agriculture, demographic factors and GDP per capita on tax revenue in South Africa. The study will employ the Granger-Causality to check the causality of the dependent variable and independent variables.

3.3.1. Preliminary Test

a. Stationarity (Unit root tests)

Granger and Newbold (1993) define a stationary time series as one with constant mean, constant variance and constant auto-variance for each given lag. In this study will perform a unit root tests to check the characteristics and behavior of the data. To test for unit root the Augmented Dickey Fuller (ADF) will be used because it removes all the structural effects in time series. The Kwiatkowsi-Phillips-Schmidt-Shin (KPSS) will be used as a complement to the ADF it is a confirmatory test for the results. The two tests often give the results and same conclusion cane be drawn however they suffer from the same limitations.

b. Cointegration test

The variables of the model will be classified as cointegrated if they are stationary either at level or after differencing them. This study will use the Engle Granger Cointegration analysis to tests for cointegration. If they are cointegrated it simply shows that there is a long run relationship between tax revenue, openness, GDP per capita, and demographic. If that is the case (cointegrated); we then use Error Correction Model (ECM) to correct for short-run disequilibrium.

c. Granger Causality Test

This will be employed to measure the causal relationship between tax revenue and the explanatory variables. This will show whether the causality is bidirectional (two ways) or one way. Most common method to test the causal relationship is Granger Causality test proposed by Granger in 1969.

3.3.2. Diagnostic Tests

a. Autocorrelation

It is very essential to test for autocorrelation when dealing with time series data since the error term may be serially correlated. The model will use the Lagrange Multiplier test (LM) to test for autocorrelation.

b. Heteroscedasticity

The study will use the White General Test (1980) to test for heteroscedasticity. The test assumes that the regression model is linear. Regression will produce residuals that need to be regressed to test the joint significance of the regression. In the event that we fail to reject the null hypothesis it shows that error terms are homoscedastic and rejection of the null hypothesis indicates heteroscedasticity.

c. Normality

The model will be tested for normality by applying the Jarque-Bera (JB) test. The assumption of normality is required.

d. Misspecification

The study will use the Ramsey Reset to test for misspecification. The model will become relevant if it is well specified.

e. Stability

If the model is not stable it will be difficult to interpret the regression results. The study uses the Chow (1960) and Quandt (1960) to check if the time series shows the existence of a structural breakpoint.

3.4. Sources of Data

The researcher will use secondary data to carry out the study. Data on tax revenue and all the employed explanatory variables will be obtained from South African Reserve bank (SARB) website where it can be accessed much easily. Using secondary data has an advantage of saving time and money that should be used on collecting data. It also provides larger and higher quality databases that would be unfeasible for an individual researcher to collect their own data due to time, location and money constraints. The data collected will be annual data from period 1995-2014.

3.5. Nature of the study

This study is quantitative in nature as it will be using quantities to evaluate the underpinning relationship between the variables. Quantitative data is the one that can be measured or quantified.

3.6. Conclusion

The chapter seeks to present the sources of data, estimation techniques, theoretical framework and model specification. To test for the long run relationship between the variables the

study make use of the Granger Causality and preliminary and diagnostic tests that is normality, heteroscedasticity, autocorrelation and misspecification were also explained and will be tested in the next chapter.

DATA PRESENTATION INTEPRETATION AND ANALYSIS OF RESULTS

4. Introduction

This chapter presents an analyzing and interpretation of results. Unit root tests for all variables are presented and Engle Granger two stage cointegration tests together with diagnostic tests results are provided. Eviews 9 package has been used for estimations.

4.1. Unit root test

This study employed the Augmented Dickey Fuller test (ADF) and the KPSS method was also employed as a confirmatory test for unit root test. The following table shows ADF results at level for all variables.

Table 4.1. ADF Tests in Levels

Variable	ADF t-statistic	Critical value ADF (5%)	Critical Value ADF (10%)	Conclusion
Tax	-0.212369	-3.61	-3.24	Non-stationary
GDPPC	-1.993873	-3.61	-3.24	Non-stationary
IMPO	-2.207626	-3.61	-3.24	Non-stationary
UNEMPL	-6.582068	-3.61	-3.24	Stationary

The results shows that tax, GDPPC and imports are non-stationary at levels as the ADF t-statistic is less than the critical value at both 5% and 10% levels. However, unemployment is stationary at levels at both 5% and 10% level of significance as its test statistic value is greater than the critical value.

Because some variables are non-stationary at levels it would be necessary to difference them once to make them stationary as shown below

Table 4.2: ADF Tests after first difference

Variable	ADF t-statistic	Critical value ADF (5%)	Critical Value ADF (10%)	Conclusion
Tax	-4.420391	-3.61	-3.24	Stationary, I[1]
GDPPC	-3.502780	-3.61	-3.24	Stationary, I[1]
IMPO	-4.051644	-3.61	-3.24	Stationary, I[1]
UNEMPL	-3.683954	-3.61	-3.24	Stationary, I[0]

***stationary at 5%, **stationary at 10%**

All the variables become stationary after first difference at both 5% and 10% levels and we can therefore reject the null hypothesis that the residuals have a unit root. Variables are now stationary because the ADF t-statistic is greater than the critical at all levels of significance.

The KPSS Tests will be used as a confirmatory test to confirm the unit root results obtained from ADF.

Table 4.3 KPSS in levels

Variable	KPSS t-statistic	Critical value ADF (5%)	Critical Value ADF (10%)	Conclusion
Tax	0.197511	0.1460	0.1190	Not-stationary
GDPPC	0.144274	0.1460	0.1190	Not-stationary
IMPO	0.104654	0.1460	0.1190	Stationary
UNEMPL	0.064323	0.1460	0.1190	Stationary

***stationary at 5%, **stationary at 10%**

All the variables except tax are stationary at level using 5% level of significance as confirmed by the KPSS tests. The test statistic values for GDPPC, Imports, and Unemployment are greater than the critical value at 5% level. Overall, GDPPC and tax are not stationary at level using 10% level of significance as ADF statistic > than the critical ADF therefore we fail to reject the null hypothesis that the variables have a unit root

Table 4.4 KPSS at first difference

Variable	KPSS t-statistic	Critical value ADF (5%)	Critical Value ADF (10%)	Conclusion
Tax	0.113765	0.1460	0.1190	Stationary, I[1]
GDPPC	0.145277	0.1460	0.1190	Stationary, I[0]
IMPO	0.050944	0.1460	0.1190	Stationary, I[0]
UNEMPL	0.065724	0.1460	0.1190	Stationary, I[0]

***stationary at 5%, **stationary at 10%**

4.2. Tests for Cointegration

The results obtained from the stationary test using the ADF and KPSS tests on the residuals can help us conclude that the residuals are stationary. The null hypothesis can therefore be rejected since the ADF statistic is greater than the critical value at 5% level of significance and 10% level of significance. Since residuals are stationary it simply shows that the variables are cointegrated hence there is a long run equilibrium relationship between Tax, imports, unemployment and GDP per capita.

Table 4.5: Cointegration Tests

Variable	ADF T-Statistic	5%	10%	Conclusion
Residuals	-4.699269	-1.9539	-1.6096	Stationary

***stationary at 5%, **stationary at 10%**

4.3. Error Correction Model (ECM)

The ECM is the time series model that estimates the speed at which a dependent variable, Tax returns to its equilibrium after a change in the exogenous variables imports, GDP per capita and unemployment. It is also explained as a short run dynamics in the long run relationship. It is therefore a stochastic process by which the economy eliminates and corrects the equilibrium error (De Boef, 2000:29).

The error correction can be estimated as follows

$$\Delta \mathbf{TAX} = \boldsymbol{\alpha} + \boldsymbol{\beta_1}\Delta \mathbf{IMPORTS} + \boldsymbol{\beta_2}\Delta \mathbf{UNEMPLOY} + \boldsymbol{\beta_3}\Delta \mathbf{GDPPC} - \boldsymbol{\beta_4}\mathbf{RESID}(-\mathbf{1}) + \boldsymbol{U_t}$$

Table 4.6: Error Correction Model

VARIABLE	COEFFICIENT	STD ERROR	T-STATISTIC	PROB
C	22972.50	5710.083	4.023147	0.0007
GDPPC	18.98365	8.286595	2.290887	0.0336
Imports	0.189777	0.136836	1.386897	0.1815
Unemploy	2890.932	2559.084	1.129675	0.2727
Residual(-1)	-0.179907	-0.100934	1.782413	0.0907

Adjusted R-squared=0.518290 F-static= 5.1101 DW-statistic=0.7860

The error correction model table above shows us that GDPPC is significant at 5% level since its probability is less than 5% however unemployment and imports are statistically insignificant since their probability is greater than 5%. Though there is a long-run equilibrium amongst the variables, the random shocks knock the economy away from its equilibrium but moves back slowly. The adjusted r-squared which is less than the D-W statistic means we can accept the model. The coefficient of residual (-0.179902) means that about 18 percent of the disequilibrium will be corrected in the next period.

4.4. Granger Causality Test (VAR)

The granger causality test is carried out to check the direction of the causal relationship between the variables. In this research the researcher employed the VAR Granger causality /Block Exogeneity Wald Tests in which each and every variable at one point is a dependent variable.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/04/16 Time: 16:07
Sample: 1991 2015
Included observations: 23

Dependent variable: TAX

Excluded	Chi-sq	Df	Prob.
IMPORTS	1.742285	2	0.0251
UNEMPL	0.287728	2	0.1660
GDP	1.085247	2	0.0112
All	4.774926	6	0.5730

Dependent variable: IMPORTS

Excluded	Chi-sq	Df	Prob.
TAX	3.526983	2	0.1714
UNEMPL	0.329775	2	0.8480
GDP	3.096765	2	0.2126
All	8.723041	6	0.1898

Dependent variable: UNEMPL

Excluded	Chi-sq	Df	Prob.
TAX	0.337356	2	0.8448
IMPORTS	1.063316	2	0.5876
GDP	0.017041	2	0.9915
All	2.229134	6	0.8975

Dependent variable: GDP

Excluded	Chi-sq	Df	Prob.
TAX	1.778591	2	0.4109
IMPORTS	0.126024	2	0.4189
UNEMPL	2.863082	2	0.2389
All	5.787956	6	0.4474

The results show that GDP per capita cause taxation as the corresponding probability of GDP is less than 5%. However tax does not cause GDP as the probability corresponding to tax is more than 5% this will cause us to conclude that the causality between tax and GDP is unilateral. The VAR table also show unemployment does not cause GDP since its probability is greater than 5% and GDP does not cause unemployment because the probability is greater than 0.05 therefore the conclusion that could be drawn is that there is no causality between unemployment and GDP. Imports does Granger cause tax because its probability is less than 5% and the relationship is unilateral since tax do not seem to cause imports as confirmed by the VAR model.

4.5. Diagnostic tests

It is important to carry diagnostic test on the model because they validate the parameter evaluation of the outcomes achieved by the model. If there is a problem in the residuals of the estimated model then the model will not be efficient and the parameters will be biased.

Table 4.7: Diagnostic tests

Test	F-Value	P-Value	Conclusion
Autocorrelation (LM TEST)	5.836976	0.0523	No autocorrelation
Heteroscedasticity (WHITE TEST)	13.86100	0.4601	Homoscedastic
Normality (Jarque Bera Test)	1.263631	0.5316	Normally distributed
Specification (Ramsey Reset Test)	1.334	0.2633	Well specified

4.6. Interpretation of the diagnostic tests

Results from table 4.9 show that there is no presence of heteroscedasticity using the White General test because the t-statistic of 13.86100 at a probability of 0.4601. We fail to reject the null hypothesis and reject the alternative hypothesis since 13.86100 is greater than 3.01 the critical value at a 5% level of significance. The probability greater than 5% means the model is homoscedastic. Jarque-Bera Test was used for normality test. Gujarati (2002:148) if the computed p-value from the Jarque-Bera Test is sufficiently low; we can reject the null hypothesis that the residuals are normally distributed and accept the null hypothesis. From table 4.9 we fail to reject the null hypothesis since the p-value is significantly greater than 0.05 and conclude that the model is normally distributed. The test for serial correlation has been done using the Langrage Multiplier (LM) test. From the table it is clearly shown that the model does not suffer from serial correlation since the corresponding p-value is greater than 5% (0.05) and therefore we fail to reject the null hypothesis that there is presence of autocorrelation and thus we reject the alternative hypothesis. The Ramsey Reset tests confirms if whether the model is correctly specified or not (Gujarati 2002:60). The table shows that the model is correctly specified since the p-value is greater than 0.05 and therefore we fail to reject the null hypothesis and give a conclusion that the model is correctly specified.

4.7. Conclusion

The tests for autocorrelation, heteroscedasticity, misspecification and normality revealed that the model is good and suitable for policy application. The tax capacity and tax effort depends on the variables identified in the study and therefore policy makers for the purpose of raising tax revenue should carefully manage the identified variables together with the ones not included in this model due to data unavailability.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5. Introduction

This chapter presents the brief overview of the study and provides policy recommendations and concluding remarks backed with the results from the previous chapter. The overall aim of this study was to come up with the determinants of tax revenue in South Africa.

5.1. Overview of the study

Chapter one of this study; provided a background of the tax capacity and tax effort in South Africa, the problem statement, rationale of the study, limitations and research questions that were answered in the sequential chapters.

Chapter two provided a thorough literature review on the topic. The beginning of chapter 2 dealt with understanding of the tax revenue performance in South Africa with an analysis of the tax composition. Also the chapter provided the contributions of each and every tax source for the 2010-2014 fiscal years. It was identified that personal income tax was the major contribution followed by the value added tax in the chosen fiscal years. The chapter identified the determinants of tax effort which include but not limited to gross domestic product, share of agriculture in GDP, imports, mining, trade openness, unemployment among others. Not all of these factors impact tax capacity positively the chapter ended by conducting an empirical literature which helped in checking the significance of these variables. Across literature GDDPC was found to be positively related to tax revenue with agriculture being negatively and insignificant.

Chapter three provided the methodology, this is where the model was formulated and the estimation techniques identified. The study identified ADF test to check for unit root test, VAR granger causality to check for the causal relationship between the variables. Error correction model was identified to check for the short run disequilibrium and the diagnostic test were stated for validating the mode.

Chapter 4 presented the analysis of the results. The identified estimation techniques where used in the E-views package 9. The tests for unit ADF and KPSS confirmed and helped us reject the null hypothesis that the residuals are not-stationary. The cointegration was done by running the unit root of the residuals at level and saw that a long run relationship exists between the variables. The ECM was run to check for the short run dynamics. The diagnostic tests confirmed that the model is correctly specified, normally distributed with no evidence of heteroscedasticity and serial correlation and hence we can conclude that the model is good for policy recommendations.

5.2. Policy recommendations

Since many developing countries are struggling to raise necessary fiscal revenue the government of South Africa should encourage trade openness as imports were seen to be significant to tax revenue. Empirical literature has proved that imports are significant and are positively related to tax revenue.

The government should also promote economic growth as increasing level of developing increases the tax base which in turn will have a significant impact on tax revenue. Increased urbanization was also seen to have a significant impact on tax revenue and therefore more has to be done in promoting economic development.

The government should also come up with policies to encourage formal employment, which can contribute to the tax base. It was identified in the literature that unemployment has a negative impact on tax revenue. Population controls are necessary because empirical literature revealed that population tend to be insignificant especially if the population is characterized with people who are unemployed.

5.3. Area of further study

Future researchers who would like to research on this topic can use a panel data instead of the time series data. Those who would want to study the same topic could do so by incorporating many explanatory variables that this study failed to incorporate.

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APPENDICES

APPENDIX A: DATA

year	tax	imports	Unempl	gdp
1991	74339	245978	24.5	44610
1992	79449	259132	23.7	42754
1993	90707	277316	25.3	42386
1994	105612	321945	20	42849
1995	118956	376001	16.9	43267
1996	138057	408753	19.3	44193
1997	154063	430765	21	44420
1998	174353	439439	25.2	43720
1999	189680	402695	23.3	43826
2000	203541	424189	25	44735
2001	240749	425249	25.4	45075
2002	271410	447963	27.2	45798
2003	282551	484179	27.1	46287
2004	322561	559267	24.7	47605
2005	386516	620110	23.8	49335
2006	452668	733349	22.6	51331
2007	524932	802037	22.3	53334
2008	587347	824567	22.5	54322
2009	568424	678949	23.7	52838
2010	625467	752233	24.9	53823
2011	710091	841839	24.8	54968
2012	757250	877362	24.9	55543
2013	834153	921356	24.7	56147
2014	909277	916693	25.1	56343
2015	988893	965555	25.3	56304

APPENDIX B UNIT ROOT TESTS

Appendix B1: Unit root at level (ADF)

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.993873	0.5738
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: IMPORTS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.207626	0.4644
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TAX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.212369	0.9887
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: UNEMPL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.582068	0.0002
Test critical values:	1% level	-4.532598	
	5% level	-3.673616	
	10% level	-3.277364	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Appendix B2: Unit root after first difference (ADF)

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.502780	0.0627
Test critical values:	1% level	-4.416345	
	5% level	-3.502033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(IMPORTS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.051644	0.0213
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TAX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.420391	0.0099
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(UNEMPL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.683954	0.0506
Test critical values:	1% level	-4.571559	
	5% level	-3.690814	
	10% level	-3.286909	

*MacKinnon (1996) one-sided p-values.

Appendix B3: KPSS at levels

Null Hypothesis: GDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.144274
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: IMPORTS is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.104654
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: TAX is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.197511
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: UNEMPL is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.064323
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Appendix B3: KPSS are first difference

Null Hypothesis: D(GDP) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.145277
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(IMPORTS) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.050944
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(TAX) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.248765
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(UNEMPL) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.065724
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Appendix C: Cointegration

Null Hypothesis: SER01 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.374126	0.9826
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Appendix D: Error Correction Model

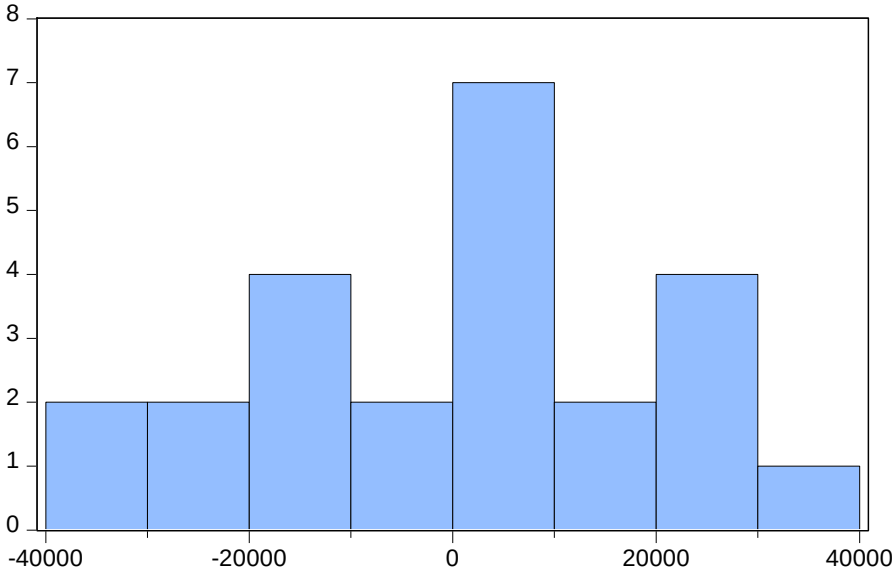
Dependent Variable: D(TAX)
Method: Least Squares
Date: 12/02/16 Time: 21:28
Sample (adjusted): 1992 2015
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22972.50	5710.083	4.023147	0.0007
D(GDP)	18.98365	8.286595	2.290887	0.0336
D(IMPORTS)	0.189777	0.136836	1.386897	0.1815
D(UNEMPL)	2890.932	2559.084	1.129675	0.2727
SER01-1	-0.179907	0.100934	1.782413	0.0907

R-squared	0.518290	Mean dependent var	38106.42
Adjusted R-squared	0.416877	S.D. dependent var	29258.62
S.E. of regression	22342.62	Akaike info criterion	23.04943
Sum squared resid	9.48E+09	Schwarz criterion	23.29486
Log likelihood	-271.5932	Hannan-Quinn criter.	23.11454
F-statistic	5.110696	Durbin-Watson stat	0.786035
Prob(F-statistic)	0.005742		

Appendix E: Diagnostic Tests

Appendix E1: Normality Test



Series: Residuals
Sample 1992 2015
Observations 24

Mean	1.52e-12
Median	2894.823
Maximum	31279.80
Minimum	-35655.19
Std. Dev.	20307.05
Skewness	-0.123785
Kurtosis	1.979274
Jarque-Bera	1.103172
Probability	0.576035

Appendix E2: Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.836976	Prob. F(2,17)	0.0523
Obs*R-squared	9.771058	Prob. Chi-Square(2)	0.0076

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/02/16 Time: 21:30
Sample: 1992 2015
Included observations: 24
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	315.1516	4721.494	0.066748	0.9476
D(GDP)	-2.973261	6.805235	-0.436908	0.6677
D(IMPORTS)	0.069570	0.114761	0.606214	0.5524
D(UNEMPL)	-234.6754	2130.939	-0.110128	0.9136
SER01-1	-0.069004	0.085495	-0.807117	0.4307
RESID(-1)	0.567576	0.246272	2.304667	0.0341
RESID(-2)	0.194320	0.263056	0.738702	0.4702

R-squared	0.407127	Mean dependent var	1.52E-12
Adjusted R-squared	0.197878	S.D. dependent var	20307.05
S.E. of regression	18187.25	Akaike info criterion	22.69332
Sum squared resid	5.62E+09	Schwarz criterion	23.03692
Log likelihood	-265.3199	Hannan-Quinn criter.	22.78448

Appendix E3: Heteroscedasticity

Heteroskedasticity Test: White

F-statistic	0.878848	Prob. F(14,9)	0.6004
Obs*R-squared	13.86100	Prob. Chi-Square(14)	0.4601
Scaled explained SS	4.253569	Prob. Chi-Square(14)	0.9937

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/02/16 Time: 21:31
Sample: 1992 2015
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.50E+08	4.20E+08	0.358171	0.7285
D(GDP)^2	251.3339	354.5790	0.708823	0.4964
D(GDP)*D(IMPORTS)	-18.45209	33.68542	-0.547777	0.5972
D(GDP)*D(UNEMPL)	208955.1	155381.9	1.344784	0.2116
D(GDP)*(SER01-1)	6.155919	10.95216	0.562073	0.5878
D(GDP)	616936.6	896566.0	0.688111	0.5087
D(IMPORTS)^2	0.155197	0.334405	0.464099	0.6536
D(IMPORTS)*D(UNEMPL)	-5486.809	3434.532	-1.597542	0.1446
D(IMPORTS)*(SER01-1)	-0.068567	0.098836	-0.693745	0.5054
D(IMPORTS)	-1512.869	3542.123	-0.427108	0.6793
D(UNEMPL)^2	-7367599.	35130081	-0.209723	0.8386
D(UNEMPL)*(SER01-1)	-1113.150	2876.547	-0.386974	0.7078
D(UNEMPL)	1.56E+08	1.99E+08	0.784140	0.4531
(SER01-1)^2	0.044330	0.062544	0.708776	0.4964
SER01-1	-1600.015	8157.812	-0.196133	0.8489

R-squared	0.577541	Mean dependent var	3.95E+08
Adjusted R-squared	-0.079616	S.D. dependent var	3.99E+08
S.E. of regression	4.15E+08	Akaike info criterion	42.79504
Sum squared resid	1.55E+18	Schwarz criterion	43.53133
Log likelihood	-498.5405	Hannan-Quinn criter.	42.99038
F-statistic	0.878848	Durbin-Watson stat	2.207719
Prob(F-statistic)	0.600352		

Appendix E5: Misspecification

Ramsey RESET Test
Equation: UNTITLED
Specification: D(TAX) C D(GDP) D(IMPORTS) D(UNEMPL) (SER01-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.154807	18	0.2633
F-statistic	1.333580	(1, 18)	0.2633
Likelihood ratio	1.715321	1	0.1903

F-test summary:

	Sum of Sq.	df	Mean Squares

Test SSR	6.54E+08	1	6.54E+08
Restricted SSR	9.48E+09	19	4.99E+08
Unrestricted SSR	8.83E+09	18	4.91E+08

LR test summary:

	Value	df
Restricted LogL	-271.5932	19
Unrestricted LogL	-270.7355	18