

**UNIVERSITY OF KWAZULU-NATAL**



**A MACRO-ECONOMETRIC ANALYSIS OF ECONOMIC GROWTH AND  
UNEMPLOYMENT IN POST-APARTHEID SOUTH AFRICA**

by

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**2015**

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## ABSTRACT

This study seeks to determine whether Okun's Law is valid for the South African economy, using time series data for the period 1994 to 2014. The data used is split into two periods, 1994q1 to 2003q4 and 2004q1 to 2014q4. Using the OLS model, it measures the extent of the relationship between unemployment and economic growth rate in South Africa, and the country's unemployment growth elasticity. The data were accessed from the South African Reserve Bank and Stats SA.

The stationarity of the variables was analysed by applying unit root tests via the Augmented Dickey-Fuller test (ADF), the Phillips-Perron (PP) test, and the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS) test. The study used an ordinary least square (OLS) model in analysing the simple differenced version and dynamic version of Okun's law, and the vector autoregressive (VAR) model to examine interdependencies between unemployment, economic growth, government consumption expenditure and adjustment to equilibrium. The Error Correction Model (ECM) was used to analyse the short-run impact of GDP growth on unemployment, as well as the speed of adjustment.

The results indicate a short run and long run relationship between unemployment rate and GDP growth rate in time periods, 1994q1-2003q4 and 2004q1-2014q4, suggesting that Okun's law is valid for the South African economy. With a 1 percent increase in GDP, unemployment can decrease by 0.13 percent, *ceteris paribus*.

The research culminates in important policy recommendations, highlighting the relationship between unemployment and economic growth in the spirit of the National Development Plan.

**Keywords:** Unemployment, Economic growth, and Okun's law.

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## **CHAPTER ONE: INTRODUCTION**

### **1.1. BACKGROUND OF THE STUDY**

Economic growth is an important macroeconomic objective of all countries. It determines economic prosperity and reduces income inequalities as well as poverty levels. South Africa's economic performance has been highly vulnerable during the apartheid era due to trade restrictions and sanctions. The country's economic growth was expected to improve substantially after the democratic transition in 1994, resulting in political, social, and economic transformation. In 1995, South Africa was part of the World Trade Organization, and performed trading activities globally. However, a decade later, South Africa's economic performance did improve, but remained lower than expected and was thus unable to reduce poverty and create adequate employment opportunities for a rising population (Du Plessis and Smit, 2006; Smet, 2013).

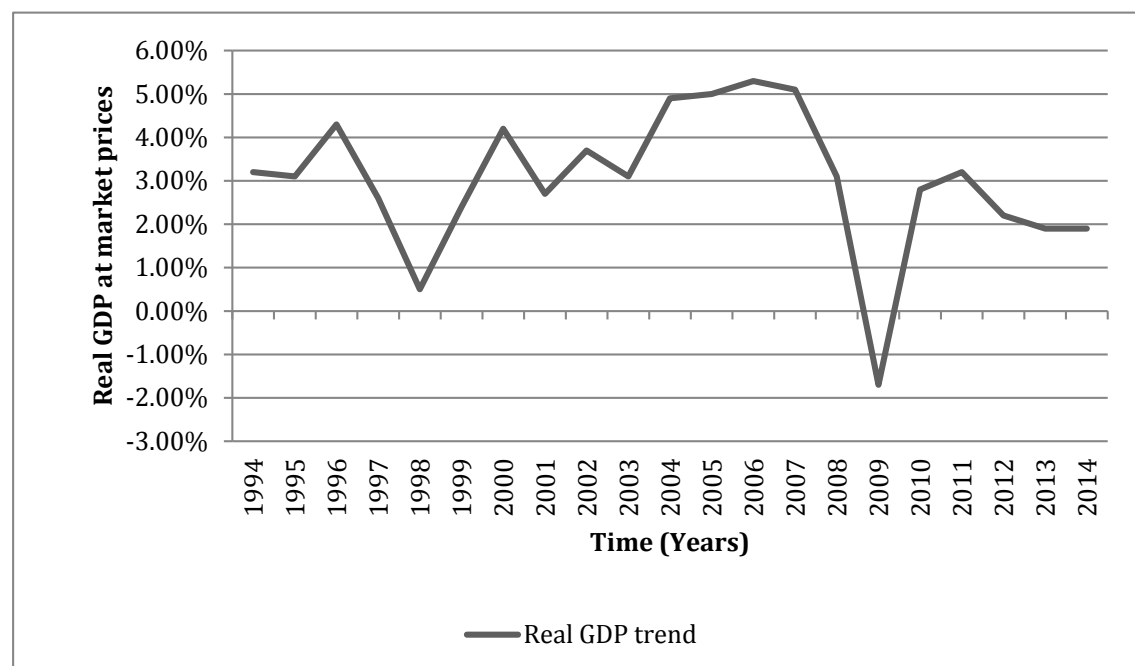
South Africa's growth rate during the 1960s was approximately 6 percent, whereas the employment rate and population growth rate was on average 3 percent per annum. The growth rate declined to approximately 2 percent between 1970 and 1980. Subsequently, there has been a decrease in the income per capita of the country, which led to income inequalities that have contributed to poverty and poor living conditions. There is a strong association between unemployment and poverty rates of the country. Thus, increasing economic growth and generating employment will result in decreased poverty levels and better living conditions (May, Budlender, Mokate, Rogerson, and Stavrou, 1998).

The South African economic growth rate averaged at 0.8 percent during 1985-1994, and improved to 3.0 percent in 1995-2004 (post-apartheid). However in the next years (2005-2015), the performance has been rather low, as the country recorded an average annual growth rate of around 2.8 percent (Du Plessis and Smit, 2006; Stats SA, 2014d; Trading Economics, 2015).

According to Arora (2005) South Africa's economic growth depends largely on three important factors, namely, policies to sustain total factor productivity (TFP) growth, reduced unemployment, and enhanced capital investments.

The average annual GDP growth in South Africa from 1994 to 2014 was 3.06 percent. Figure 1.1 shows that GDP growth in South Africa has always been positive from 1994 to 2008 until the recession hit the economy in 2009 when the growth rate plummeted to – 1.7 percent.

**Figure 1.1: Real GDP Growth Rate in South Africa from 1994-2014 at constant 2010 prices**



Source: Stats SA (2014d) and Trading Economics (2015)

GDP growth rate in the South African economy improved from -1.7 percent following the crisis of the economic recession in 2009 to approximately 1.9 percent in 2014. The highest recorded growth rate in the country was 5.3 percent in 2006 (Stats SA, 2015a; Trading Economics, 2015). IDC (2013) states that South Africa's economic growth rate is strongly correlated with that of the global economic performance, and hence the decline in economic

growth in 1998 and 2008 following the East Asian crisis and the global economic crisis respectively.

The tertiary sector, which is mainly dominated by the banking and financial sector, accounted for 69 percent of South Africa's GDP in 2012, which increased from 60 percent in 1994. The secondary sector, which is mainly dominated by the manufacturing sector, contributed to 27.7 percent of the country's GDP in 1994 and has dropped to 19 percent in 2012. This reflects some de-industrialization of the South African economy. The primary sector is made up of fishing, agriculture, and mining, and has maintained an 11.8 percent contribution towards GDP in 1994 and 2012 (IDC, 2013; SARB, 2014).

South Africa's GDP growth rate was expected to decrease from 1.9 percent in 2013 to 1.5 percent in 2014 due to a surplus of labour and load shedding by Eskom. Mahadea (2012) states that from the Keynesian perspective, investment should increase income, output, as well as the employment levels thus decreasing unemployment. In order to improve investment and growth, the savings rate in the country needs to improve.

The South African economy needs to grow at approximately 6 percent per annum in order to reduce unemployment rates and in doing so, investment needs to grow above 25 percent of GDP. According to the Twenty Year Review (2014), the country's public investment increased from under 15 percent of GDP in 1993 to approximately 20.4 percent of GDP in the second quarter of 2015 (SARB, 2015Q2). There was a substantial decline of GDP to 19 percent due to the global economic crisis in 2008. This was further adjusted to 19.2 percent of GDP in 2013. On average, most of the decrease in investment was in the public investment whilst private investment during the same period remained fairly constant (May et al, 1998).

Investment varies strongly with changes in domestic savings. Domestic savings as a percentage of GDP decreased from 30 percent in the 1980s to 17.7 percent of GDP in 1994, and to 14.9 percent in 2014 (SARB, 2015q2).

During the 1980s and 1990s, the country's slowdown in economic growth was attributed to the decrease in investment and savings (May et al, 1998).

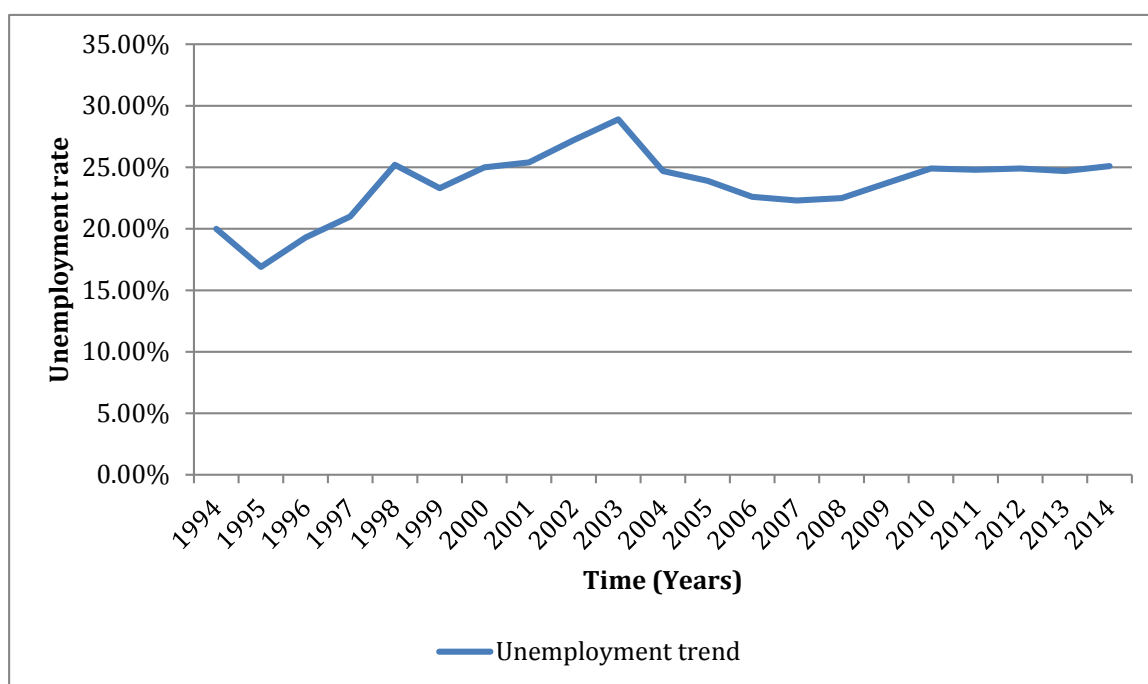
Household spending increased in 2014 by 0.5 percent whereas the household debt to income ratio was 78.2 percent in that year, compared to 59 percent in 1998 (SARB, 2015q2). This indicates that consumers are saving less and consuming more, possibly by contracting more debt that might impact adversely on consumption and investment in the long run with rising household debt servicing costs (Mahadea, 2012).

Employment and unemployment are closely related to GDP growth. Osinubi (2005) defines unemployment as a state of "joblessness" with the factor of production being labour. Economic growth can be used as a macroeconomic tool to reduce the unemployment rate.

According to Schwab (2014), the South African labour market faces high inefficiency due to the lack of tertiary skills and education. The labour market efficiency and higher education in South Africa is positioned at 113<sup>th</sup> and 86<sup>th</sup>, respectively, out of the 144 economies according to the World Competitiveness Report.

South Africa's unemployment rate moved from 22 percent in 1994 to 25 percent in 2014 and to 25.5 percent in 2015. Furthermore, 93 000 jobs were lost in the manufacturing industry and 73 000 jobs were lost in the agricultural industry in 2014 (Stats SA, 2015a). The trends in unemployment from 1994 to 2014 are illustrated in Figure 1.2:

**Figure 1.2: Official Unemployment Trend in South Africa from 1994-2014**



Source: South African Reserve Bank, SARB (2015)

Unemployment in South Africa poses a critical challenge for the South African economy. The official unemployment rate is over 25 percent whilst the expanded unemployment rate is 35.1 percent which includes discouraged workers (Stats SA, 2015a). According to Parsons (2013), a large cohort of discouraged work seekers represent the youth in their early 20s. Statistics from the International labour organization (ILO) confirm that South Africa has the 8<sup>th</sup> largest unemployment rate in the world (International Labour Organization, 2015).

There is no “quick fix” solution to stem or reverse the rising unemployment rates in the ‘market’ period with imposed rigidities. High unemployment contributes to crime, a decline in quality of life, decline in health, lack of confidence in the government, and an increasing tax burden on a minority of the population, amongst others. This leads to a deterioration of the economy as a whole (Lee, 2004).

Research confirms that economic growth is partly determined by labour-displacing investment and structural changes in the economy (Thirwall, 2013).

This in turn relates to high unemployment rates since the labour market is not flexible enough to adjust to the changes (Castells-Quintana and Royuela, 2012). Furthermore, studies confirm that the changes to labour legislation after democracy in 1994 improved access to employment by people from the designated sectors (Castells-Quintana and Royuela, 2012).

According to the Annual Labour Market Bulletin (2014), education is a means through which individuals could acquire new skills in order to adapt to changes in the labour market and hence enhance the employability.

Arthur Okun pioneered a study that correlated unemployment rate and economic growth in 1962. The findings of the study implied that a 1 percent increase in unemployment rate led to a 3 percent decrease on GDP growth. However subsequent studies have indicated that GDP will decrease by 2 percent. Okun's Law proposes an inverse association between the unemployment rate and economic growth rate (Knotek, 2007).

Okun's law postulates a significantly stronger relationship between unemployment and GDP growth during the recessionary period. However, following an economic upswing, unemployment tends to maintain its natural rate. When unemployment is below its natural level, the economy tends to face higher inflationary rates due to the rise in income levels (Knotek, 2007).

Abdulla (2012) posits that in order to raise households' standard of living, it is important to scrutinize the correlation between unemployment and GDP growth. When the GDP growth rate is above its natural rate, this is an opportune time to create more jobs in the country.

The South Africa government has implemented policies during the 1980s and 1990s to decrease costs of capital compared to labour, thus enabling firms to raise the demand for skilled workers relative to unskilled workers. The rising costs associated with finding jobs resulted in declining standards of living for people with low skills and increased poverty. This resulted in low levels of investment in human capital, thus impacting on marginal workers being



unemployed (May et al, 1998).

The transition from apartheid to democracy ushered renewed strategies by the South African government to address unemployment and improve economic growth. The Growth, Employment and Redistribution Policy (GEAR) was conceptualized by the ANC government in 1996 to guide economic policy for the next ten years. The GEAR strategy failed as South Africa did not achieve an economic growth rate of over 5 percent by 2000. Instead, the average economic growth rate between the years 1994 to 2000 yielded a dismal 2.5 percent and a loss of approximately 500000 jobs (Finnemore, 2009).

In 2006, a new economic accord called “Accelerated and Shared Growth Initiative for South Africa” (ASGI-SA) was introduced. Due to several factors such as increased FDI into South Africa, economic growth rates of over 5 percent was achieved in 2006 (Kumo, 2012). The National Development Plan (NDP) introduced in 2012, aimed to reduce unemployment to 14 percent in 2020 and address the situation of poverty in South Africa. Its main objective was to develop educational and training interventions to increase employment opportunities targeting skills needed in the labour market (Smet, 2013).

The South African government has increased its investment in infrastructure by R844 billion in 2014 in order to create jobs and improve economic growth. Furthermore, the government has also initiated an agricultural policy action in 2014 to create approximately one million employment opportunities by the end of 2030 (Gordhan, 2014).

Against the backdrop of the literature review, this study will investigate the link between unemployment and economic growth in South Africa as well as some selected variables that impact on unemployment in the country.

## **1.2. OBJECTIVES OF THE STUDY**

The purpose of the empirical analysis is to examine whether Okun's Law is valid for the South African economy. The study aims to identify the extent of the association between unemployment rate and economic growth in South Africa and proposes appropriate interventions to address the challenges related to unemployment and economic growth. The objectives of the study are as follows:

- To determine the magnitude of Okun's coefficient for the South African economy, post 1994;
- To determine the existence of a statistically significant inverse relationship between unemployment rate and GDP growth in post-apartheid South Africa;
- To determine the unemployment growth elasticity in South Africa, post-apartheid.

## **1.3. RESEARCH QUESTIONS**

In the assessment of the above-mentioned, the subsequent research questions have been framed:

- What is the magnitude of Okun's coefficient for the South African economy post-1994?
- Is there a negative association between unemployment rate and GDP growth in post-apartheid South Africa?
- What is the unemployment growth elasticity in South Africa, post-apartheid?

## **1.4. RESEARCH HYPOTHESES**

In order to meaningfully test the significant relationships impacting on the objectives and research questions framed for the study, the hypotheses are set out as follows.

- $H_0$ : There is an insignificant relationship between economic growth and unemployment in post-apartheid South Africa.
- $H_1$ : There is a significantly negative relationship between economic growth and unemployment in post-apartheid South Africa.

## **1.5. IMPORTANCE OF THE STUDY**

Unemployment contributes to the understanding of a country's economy and the development of that economy and its level of development/under-development. Economic growth of a country is made up of growth in real output of an economy over time. The demand for labour is a derived one, based on the demand for the output produced. With a growth in output, more income is generated. The significance of economic growth lies in its contribution to prosperity of the community, when more labour is engaged in production, which leads to an increase in income and in job creation, the obverse of unemployment. The growth elasticity of employment over the period 1994-2008 in South Africa is found to be positive but low (Mahadea and Simson, 2010). Therefore, unemployment is largely linked to economic growth rates in a country (Andrei, Vasil, and Adrian, 2009).

Decline in a country's level of productivity is one of the major causes of unemployment. Furthermore, unemployed individuals are unable to produce output in the country, thus affecting its overall economic growth rate. The cost of lost output contributes to considerable downfall in the GDP growth rate in an economy (Dornbusch, Fischer, and Startz, 2011). Decreased GDP growth, resulting from lost production, eventually leads to a cut in employment levels and thus the unemployment rate begins to rise. This study thus takes into

consideration the impact of GDP growth rate on the rate of unemployment in South Africa.

Various empirical studies have been undertaken on the relationship between GDP growth and unemployment in other countries. While some studies revealed a negative relationship between the stated variables, other studies have revealed a positive relationship. This study will evaluate the relationship between economic growth and unemployment in post-apartheid South Africa covering the period 1994-2014, as well as determine the unemployment growth elasticity in the country.

The study will apply a regression of unemployment on other macroeconomic variables namely, fixed investment and government consumption expenditure, to examine the relationship between them (Dornbusch, Fischer, and Startz, 2011). It will also determine the relationship between unemployment and GDP growth in South Africa as an emerging economy. High unemployment rates contribute to low standards of living and poverty. Recommendations relating to the strategies that address poverty and other structural challenges facing the South African economy are anticipated as outcomes of the proposed study.

## **1.6. SCOPE OF THE STUDY**

The study of the relationship between unemployment and GDP growth in post-apartheid South Africa will apply time-series data for periods 1994 to 2014. This time period is chosen to measure how South African economic reforms were initiated two decades into democracy. The study will analyse the impact of GDP growth, foreign direct investment, and public expenditure on unemployment in South Africa.

## 1.7. RESEARCH DESIGN AND METHODOLOGY

In keeping with the objectives outlined for the study, the research methodology will involve the use of secondary data.

The economic growth rate is calculated by using the data on GDP growth rate from Stats SA, while the data on unemployment rate, government consumption expenditure, and fixed capital formation investment is accessed from the South African Reserve Bank.

While the GDP growth rate data are available on a quarterly basis from the Stats SA database, the data on unemployment obtained from the South African Reserve Bank database are not, until 2008. Therefore, the 'interpolation method' was used to convert the annual and bi-annual data to ensure that data for the periods 1994 to 2008 are in quarterly format. The model is estimated using the Ordinary Least Square Method (OLS) after the time series are checked and corrected for non-stationarity. The statistical package for data analysis in this study is Stata 13.

The study will adopt the *difference version* of Okun's Law, this method is simple, accurate, and will involve the direct application of the original dataset. The study will further evaluate the *dynamic version* of Okun's law by including additional explanatory variables.

The research will commence by examining the time-series properties of the variables taken in logarithmic terms. This is to scrutinize whether or not the time series encounters stationarity. Stationarity of the variables will be examined by conducting the unit root tests such as the Augmented Dickey-Fuller test (ADF), the Phillips-Perron test (PP), and the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS). The three unit root tests are considered to avoid inadequate results.

Thereafter the test for co-integration using the Engle-Granger test of co-integration will follow. The study also makes use of the Error Correction Model

(ECM) to check whether the results obtain from the OLS regression are spurious. Finally, the Granger causality test is used to examine the casual relationship between unemployment and GDP growth in post-apartheid South Africa.

## **1.8. LIMITATIONS OF THE STUDY**

One of the limitations of the study is that secondary data is used to realise the objectives of the study. However, as the data relied upon is from authentic and reliable sources, this method of data collection will mitigate the extent of the limitation. Moreover, utilizing secondary data for macroeconomic studies is the only way to conduct such studies. After using the 'interpolation method', all data are presented in quarterly form for the periods 1994-2003 and 2004-2014, thus enabling adequate data points. The study also intended to examine the impact of the youth wage subsidy on unemployment, however owing to insufficient data and its recent introduction, this variable was not considered. After all, the youth wage subsidy is offered only since 2014, as a new labour incentive phenomenon.

## **1.9. STRUCTURE OF THE STUDY**

Chapter 2 highlights the theory of unemployment and economic growth. A broad qualitative analysis of the theories behind unemployment, growth, and the link between unemployment and economic growth is presented. An overview of similar studies is discussed and the outcomes and results of such studies are presented.

Chapter 3 examines the quantitative association between unemployment and economic growth in South Africa by specifying the model for the study. This chapter further includes the data sources, estimation techniques, and the prior expectations of the variables.

Chapter 4 presents the research design methodology adopted for the study. It demonstrates the objectives of the study, the empirical analyses, the research hypotheses, and the statistical tests chosen for the study.

Chapter 5 covers the findings of the study in response to the objectives of the study and research questions. Conclusions and recommendations as well as implications for further research are thereafter presented.

## **1.10. CONCLUSION**

This chapter presented a framework and an overview of the study, setting out its importance as well as the research objectives, hypotheses and limitations of the study. Chapter two will present literature related to unemployment and economic growth. The chapter will also review the theoretical framework, as well as the empirical and macroeconomic approaches to unemployment and economic growth.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1. INTRODUCTION**

Gross domestic product (GDP) is used to measure the economic growth rate of a country since it captures information on all annual output and household income levels. Therefore, the living standards of individuals across South Africa can be explained by the growth rate of the real GDP in the country. The compounding effect, as stated by Roşoiu & Roşoiu (2014), can be utilized to examine the gaps in growth rates between countries.

The unemployment rate in post-apartheid South Africa has been fluctuating throughout the studied periods. Statistics indicate that unemployment has been increasing from 1994 (16.9%) to 2003 (28.9%). Thereafter, unemployment began to drop until 2010, reaching 24.9% and increased rapidly thereafter. The relatively high and persistent unemployment rates in the recent years pose a huge social threat to the economy. The official narrow unemployment rate in South Africa is currently 25.5%, which includes those individuals who are unemployed and searching for work. These two groups together make up economically active. The expanded unemployment rate is 35.1% in 2015, which represents those that are economically active as well as discouraged individuals (StatsSA, 2015a; Parsons, 2013). According to the International Labour Organization (ILO) in 2015, South Africa is projected to have the 8<sup>th</sup> largest unemployment rate in the world (International Labour Organization, 2015; fin24, 2015).

The unemployment situation is worsening in South Africa, and the government has thus far, not found a lasting significant solution to combat the rising unemployment rates. The high unemployment rate contributes to social problems, such as crime, quality of life, and children's education, which in turn adversely affects the economy as a whole (Lee, 2004; Parsons, 2013).

The main objective of the study is to examine the relationship between



unemployment rate and real gross domestic product (GDP) for the economy of South Africa (post-apartheid). This chapter will review the theoretical framework, as well as the empirical and macroeconomic approaches to unemployment and economic growth.

## **2.2. THEORETICAL FRAMEWORK**

Economic growth signifies a rise in real GDP over time. This includes the value of goods and services that is adjusted for changes in price. In order to ensure a positive growth rate, the economy needs to increase real GDP. The amount of output produced depends on the amount of inputs, such as labour and capital. Hence a rise in employment will produce more output, resulting in a positive economic growth (Arico, 2001).

From a theoretical perspective, there is a positive relationship between employment and economic growth, thus indicating an inverse association between unemployment and GDP growth. The Phillips curve posits that higher employment is associated with higher price levels (Arico, 2001). The Phillips curve thus shows an inverse relationship between inflation and unemployment rate. Further, increased employment, results in inflation and thus higher levels of inflation will be associated with lower unemployment rate.

## **2.3. THEORIES OF UNEMPLOYMENT**

Economists have advanced several theories related to unemployment over the years. Some of the important theories are presented below.

### **2.3.1. The Classical economic theory**

Classical economists assumed that supply of goods or service generates its own demand, and hence leads to no involuntary unemployment as put forward by Say's law. This results in full employment and perfect competition conditions, whereby the demand and supply of a good will always remain at

full employment equilibrium levels. However, when an economy is in full employment, frictional unemployment still exists in the form of voluntary unemployment due to individuals searching for better jobs. When the economy is at full employment, unemployment is at its natural rate in the classical sense (Mouhammed, 2011; Kholer, Lakay, Rhodes, Saayman, Schoer, Scholtz; Thompson, 2010).

Furthermore, Classical economists assumed that trade unions demanding too high wages and minimum wage legislation would be the only factors that would result in unemployment in the labour market, and decreased wages and tax cuts together with price flexibility will lead to increased employment levels. Ayoyinka (2008) indicates that Classical economists did not take into account the realities of wage inflexibilities that arise from trade union decisions and hiring practices in developing countries, which may lead to unemployment.

### **2.3.2. The Keynesian economic theory**

According to Brunner and Meltzer (1978), unemployment arises when supply of labour exceeds the demand for labour, thus resulting in fluctuations in wage and price levels which in turn causes disequilibrium in the labour market. According to the Keynesian theory, unemployment in the labour market is caused largely because of insufficient effective demand (Mankiw, 2014).

The Keynesian theory is based on the Marshallian assumption that cyclical changes in wage and price levels shift the demand for labour, where a recession will result in an increase in real wage when prices decrease and an expansion results in the decrease of real wage when an economy operates near or above its full employment output level (Brunner and Meltzer, 1978).

The Keynesian theory further indicates that in order to decrease unemployment, government should implement policies that increase the demand for labour by increasing government expenditure and encouraging

private investment which in turn have multiplier effects to stimulate growth in income, output, and employment (Ayoyinka, 2008).

### **2.3.3. The Neoclassical theory**

The neoclassical theory is a combination of the Keynesian and the classical perspective of unemployment in improving the Phillips Curve when evaluating the link between unemployment and inflation (Cooley and Quadrini, 1999).

Phillips derived an inverse relationship between unemployment and real wage rate in his study conducted in 1958, whereas Solow and Samuelson used Phillips study to analyse the relationship between unemployment and inflation in the 1960s. The findings of their study indicate a negative relationship between the two variables (Kholer et al, 2010).

Several other studies confirm an inverse relationship between unemployment and economic growth. Full employment equilibrium is achieved by using inflation to reduce real wage thus increasing the demand for labour, assuming money illusion and misperceptions (Kholer et al, 2010; Mankiw, 2014).

### **2.3.4. The Monetarist theory**

The monetarist theory of unemployment is similar to that of the Classical view of unemployment in that it assumes minimum interventions in the economy. The Monetary theory of unemployment is based on the research of Milton Friedman, in which equilibrium unemployment is assumed to exclude transitory friction including price adjustments. Friedman suggested eliminating the minimum wage laws and interventions by labour unions (Jingya and Jie, 2011). Similar to the Classical school, the monetarist view assumes that the economy is self-regulating and will always function at the natural full employment equilibrium.

## **2.4. ECONOMIC GROWTH AND UNEMPLOYMENT**

Economic growth and unemployment are major policy objectives of a country. Accordingly, government policies play a critical role in shaping its economic growth and creating employment.

### **2.4.1. The concept of economic growth and unemployment**

Economic growth is influenced by both physical capital and human capital as well as by 'intangibles', such as the rule of law, quality of governance corruption, technological progress and entrepreneurship (Al-Habees & Rumman, 2012; Mankiw, 2014). According to Osinubi (2005), the economic growth of a country proportionately improves over time as outputs rise. As indicated in the previous chapter, South Africa registered positive employment growth during the entire post-apartheid period, except during the recessionary year, 2009.

The unemployment rate in South Africa is extremely high and is officially recorded to be at 25.5 percent in 2015, while the expanded unemployment rate is 35.1 percent, as indicated earlier. This is regarded as amongst the highest in the world (StatsSA, 2015). Unemployment is a serious matter as it triggers adverse social outcomes in the country, such as high crime rate, income irregularities, and poverty. In South Africa, many graduates and secondary school dropouts are unable to find stable jobs (Kingdon & Knight, 2004; Johnson, 2015).

Osinubi (2005) defines unemployment as a state of "joblessness", when labour, as a factor of production, cannot be fully utilized to make a value-adding contribution to national output. Economic growth can be used as a macroeconomic tool to reduce the unemployment rate. However, economic growth must be used in tandem with other policy measures in order to decrease unemployment because it cannot solely overcome all factors affecting unemployment.

Unemployment as a narrow definition consists of those individuals who are unemployed and are actively seeking employment. The broad definition of unemployment includes individuals that are unemployed and available to work, but are not actively seeking employment as they are regarded as discouraged workers. The narrow definition of unemployment was adopted as the official definition from 1998 as opposed to the broad definition. This is because the narrow definition conforms to the ILO requirement and is used by over 80 percent of countries. The broad definition is not often used as it is difficult to obtain information on whether individuals are actively seeking employment or not (Osinubi, 2005).

Discouraged workers include individuals who are not currently taking the necessary action to find employment due to factors such as poverty, long durations of unemployment, and cost of searching for jobs (Kingdon & Knight, 2001). The increasing unemployment rate in South Africa has become a social and political issue. The number of discouraged workers in South Africa was recorded to be approximately 2.4 million during mid-2014 (StatsSA, 2014).

Fields (2000) states that South Africa's supply of labour exceeds the demand for labour. Furthermore, the labour market demands high skilled workers relative to unskilled workers, which leads to structural unemployment. This type of unemployment is partly associated with a lack of relevant human capital in the country.

The number of unskilled workers in South Africa increased from 1.8 million in 1994 to 3.8 million in 2014 (StatsSA, 2014). According to South Africa's recent Quarterly Labour Force Survey (released on 27/10/15), only 6.4 million were employed out of 19.8 million, under the age of 35; whereas 9.5 million (out of 16.3 million) were employed between the age of 35 and 64. The rising youth unemployment in South Africa might be a ticking bomb for the country, and thus poses a serious challenge in the post-apartheid era (StatsSA, 2015d).

According to Schwab (2014), the South African labour market faces inefficiency due to the unsatisfactory training and lack of tertiary skills and education. The labour market efficiency rate and higher education in South Africa are positioned at 113<sup>th</sup> and 86<sup>th</sup> respectively out of the 144 economies surveyed according to the World Competitiveness report 2014. Therefore to reduce the high unemployment rate in South Africa, the education and human capital amongst individuals should be increased.

#### **2.4.1.1. Unemployment and Investment**

According to the National Development Plan (2012), investment is a critical factor that promotes economic growth and generates employment. Capital investment has a direct impact on the economy, thus affecting unemployment. The impact on the economy and unemployment depends largely on the amount of capital investment and the favorableness of the business entrepreneurship environment, as well as the conditions under which the investment is made. Furthermore, foreign direct investments depend largely on the motivation of investors, business strategies, and rules of the game for capital accumulation (Ayoyinka, 2008; Iacovoiu, 2012; Johnson, 2015).

According to Iacovoiu (2012), net investments have a positive impact on employment generation through enhancing economic growth while gross investment, used by the depreciation funds to replace used assets, maintains existing jobs and does not generate any new employment. Iacovoiu (2012) further states that investments that require labour intensive activities will ensure a higher demand for labour and decrease unemployment, while investment in new technology will not generate high levels of new employment, but will rather improve the working conditions of current employees and enhance their productivity. Empirical evidence indicates that capital investment and FDI helps diminish unemployment by creating more job opportunities for the host country directly, thus enhancing its economic growth (Lings, 2014).

Several studies reveal an inverse relationship between unemployment and investment. For example, Kurtovic, Siljkovic, and Milanovic (2015) conducted an empirical research on the impact of foreign direct investment (FDI) on unemployment in countries across the Western Balkans for period 1998-2012. The study used panel data collected from the World Bank database. Unemployment was the dependent variable, while FDI was the independent variable.

The study first examined the stationarity of the variables included in the model and found both variables to be stationary. The study then revealed that the variables are cointegrated using the Pedroni test. The vector error correction model (VECM) indicated a long run correlation between the observed variables, and the Granger causality test implied a causal interrelationship between unemployment and FDI.

Another related study conducted by Maqbool, Mahmood, Sattar, and Bhalli (2013) analysed the determinants of unemployment in Pakistan, using unemployment as the dependent variable, and population, FDI, GDP, inflation, and external debt as the explanatory variables. The study used an Autoregressive distributed lag (ARDL) model, with data collected from World Bank. The study found an inverse link between unemployment and GDP, as well as an inverse link between unemployment and FDI. The overall result inferred an inverse link between unemployment and FDI over the selected period, which is in line with expectations and related theory.

#### **2.4.1.2. Unemployment and government consumption expenditure**

Government procurement of goods and services depends on a country's fiscal policy. Holden and Sparrman (2014) refer to various studies that confirm that a firm's output contributes to the GDP growth rate of a country. In order to increase output, firms' demand for labour increases and therefore diminishes unemployment. However, if reducing government expenditures leads to

increased private sector productivity and output, employment may still grow with expansions in economic growth.

Enhancing the level of government expenditure may lead to the generation of employment opportunities if unemployed labour is absorbed in the mainstream economy, thus reducing the levels of unemployment. Tax cuts coupled with increased government expenditure will contribute to individuals improving disposable income and consumption, which in turn may generate multiplier effects to enhance income, output, and employment (Holden and Sparrman, 2014).

Empirical research also confirms an inverse relationship between unemployment and government expenditure. For example, Holden and Sparrman (2014) conducted a study on the impact of government expenditure on unemployment for 20 OECD countries for periods 1980 to 2007. The study used a panel data approach and found a significant negative impact of government spending on unemployment. The study found that 1 percent increase in government consumption leads to a 0.3 percent decrease in unemployment. The findings are consistent with the underlying theory, which implies that since government consumption contributes to GDP, this will have an inverse impact on unemployment.

#### **2.4.1.3. Employment Elasticity**

Jingya and Jie (2011) describe employment elasticity as the capacity of the economy to absorb the labour force when it is experiencing output expansions. When inclusive economic growth increases by one percent, the number of available jobs increases accordingly and vice versa. A higher employment growth elasticity means that as economic growth increases, this leads to employment expansions. In the case of South Africa, the growth employment elasticity over the period 1994-2008 was positive but low (Mahadea and Simson, 2010).



Furthermore, a positive rate of employment elasticity means that economic growth creates job opportunities, thereby contributing to a reduction in the unemployment in a country. In contrast, according to Jingya and Jie (2011), negative employment growth elasticity has two main effects. The first is known as the 'crowding-out' effect, which is a decrease in employment and a rise in unemployment arising from a positive growth rate of the country that displaces labour. The second effect is known as the 'absorptive' effect, which shows that growth rates lead to an increase in employment. The higher the rate of employment elasticity, the greater is the effects of absorption on employment, and vice versa.

#### **2.4.2. The nature of unemployment**

Unemployment can be seen as a voluntary action in terms of added leisure time where the individual will decide not to work due to the unfavorable working conditions and wage rate. It could also be viewed as an involuntary action where individuals are willing to work at a given low wage rate but are unable to find employment. Unemployment in developing countries such as South Africa was found to be involuntary due to people who are willing to work and actively searching for job opportunities, but cannot find one (Kingdon & Knight, 2001; Osinubi, 2006).

In South Africa and many other developing countries, self-employment through informal sectors, such as unregistered street vendors, is common. The income levels of informal traders may be low and therefore individuals remain in the labour market, whilst in search of better job opportunities in the formal sector. Some individuals may decide to continue their search for formal sector jobs while others choose not to do so. Therefore, it could be deduced that there is a negative correlation between income and unemployment. However, barriers to entry in the informal sector may lead to involuntary unemployment (Kingdon & Knight, 2001).

Tshabalala (2014) states that the unemployment rate in South Africa has increased significantly after the African National Congress (ANC) came into power after the first democratic elections in 1994. Unemployment is the root

cause of many other socio-economic problems in South Africa, such as poverty and income inequalities.

### **2.4.3. Structural Unemployment**

During the apartheid era, the mining and agricultural sectors employed less paid under-skilled labour thus contributing to the lack of structural reforms in the South Africa economy. The country anticipated structural reforms post 1994, and hoped for a rise in economic growth. However, post-apartheid economic growth and structural transformations did not meet expectations of policy makers at that time (Bhorat, Hirsch, Kanbur, and Ncube, 2013).

South Africa has moved production from the agricultural sector to the manufacturing sector, thus increasing output productivity. However, income inequality and poverty in the country are still rising rapidly. The manufacturing sector demand for skilled workers increased, while the demand for unskilled workers decreased. Since the country has mostly unskilled or low skilled workers, the unemployment rates have increased over the years (Bhorat et al, 2013).

Okun's law was initially formulated to test the relationship between unemployment (comprising of mainly cyclical and frictional) and economic growth in developed countries. South Africa faces structural unemployment, and the results from testing Okun's law in the country may differ from that of other studies conducted elsewhere.

Structural unemployment arises when there is a mismatch between skills demanded and skills supplied. It is associated with changes in the labour demand patterns resulting in imbalances in the labour market, thus leading to the loss of output and increased cost to the person unemployed (Bangane, 1999). A major problem in South Africa regarding structural unemployment is the acute skills shortage, and hence structural unemployment is a critical issue in the country.

#### **2.4.4. The relationship between unemployment and economic growth**

The theoretical relationship between unemployment and economic growth arose from the endogenous growth theory during the 1980's, which started off by using the Solow-Ramsey model to allow for economic analysis. Unemployment is a major part of labour economics, which is formulated from the different views of Monetary and Keynesian economists as well as the views of Robert Lucas and new Keynesian economics (Arico, 2001).

According to Arico (2001) and Neto and Silva (2013), the equilibrium theory of unemployment was first formulated by Pissarides' in 1990 with a framework to analyse short-run and long run unemployment trends. Pissarides' further analysed the relationship between long-run growth and unemployment using profits and hiring costs of firms and found a positive relationship between the two variables. This is known as the "Capitalization Effect", which indicates that when there is no friction in the labour market, firms will hire more workers when economic growth improves.

Arico (2001) cites that Aghion and Howitt formulated a different model in 1994 dealing with the same issue, which used the "creative destruction" technique. This method was found to be more complex than that of Pissarides' framework, where unemployment was positively related to low economic growth and negatively related to high economic growth.

Arico (2001) also posits that Acemoglu (1997) developed a method of analysing a similar relationship using a model with unemployment together with technological change and used coordinate failures as well as strategic compliance strategies.

Harrod in 1939 and Domar in 1947 initiated the relationship between economic growth and unemployment. The Solow growth model and Ramsey Cass-Koopmans model were based on factor substitutability, inelastic input

supply, and a flexible production function coefficient. The neoclassical model was based on the assumptions of efficient allocations of resources. The neoclassical growth model included technological change as an exogenous variable in determining the relationship between unemployment and economic growth, but resulted in heterogeneity. This was due to the model not considering long-run unemployment (Arico, 2001 & Neto and Silva, 2013).

Economists therefore initially focused their attention on the Harrod-Domar model to analyse the labour markets and exogenous growth in determining the relationship between unemployment and economic growth. The Harrod-Domar model is explained below.

#### **2.4.4.1. The Harrod-Domar Model**

According to Mahadea (2003), low economic growth is related to the gap between investment and savings, as well as the gap between imports and exports. To ensure an increase in economic growth, foreign capital inflow is vital in line with the Keynesian theory of investment and short-run economic growth. Furthermore, the simple Harrod-Domar model using the Keynesian framework includes economic growth as the dependent variable, which is directly related to average savings and indirectly related to the incremental capital-output ratio.

Domar (1946), cited by Mahadea (2003), shows that the savings and incremental capital-output ratio (ICOR) are fundamental factors in determining the investment growth, where the ratio can be used to solve for savings-income ratio to give economic growth. Mahadea (2012) shows that from an optimistic view, in order to create 500 000 jobs, annually, South Africa needs a growth rate of approximately 6 percent.

**Table 2.1: Average Investment and Average real GDP Growth rate in South Africa for period 1994-2014**

Year	Investment (%GDP)	Real GDP Growth	ICOR <sup>1</sup>
<b>1994-2000</b>	16.2	2.9	5.6
<b>2001-2010</b>	18.6	3.4	5.5
<b>2011-2014</b>	19.3	2.3	8.4

Source: Stats SA (2014d) and IMF (2015)

During periods 1994 to 2000, SA would have had to invest approximately 34 percent of its GDP to attain a 5 percent growth mark, which is above the actual investment of percentage GDP of 16.2 percent for the period. It is evident, however, that the investment began to grow to an average of 18.6 percent in the period 2001-2010 and further to an average of 19.3 percent in the period 2011-2014 (Table 2.1), while ICOR (incremental capital output ratio) increased from 5.5 to 8.4 during the same period.

The National Development Plan (NDP) aims to decrease unemployment from 25.2 percent in 2014 to 14 percent in 2020 and to 6 percent in 2030 by creating approximately 11 million jobs by the end of 2030. In order to achieve their targets, the South African economy needs to grow at a 5 percent level or more to reduce unemployment (Budget Review, 2014).

The NDP targets a GDP growth rate of approximately 5.4 percent in less than 20 years. The average annual GDP growth rate is 2.3 percent for periods 2011-2014 (Budget Review, 2014).

With an 8.4 percent ICOR (Table 2.1), the SA economy has to invest a minimum value of approximately 42 percent of its GDP over 2011-2014 to attain a 5 percent or more growth rate. However, the actual investment of percentage GDP is 19.3 percent, which is much less than the targeted value.

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<sup>1</sup> ICOR =  $\frac{\text{Actual Investment}}{\text{Actual increase in GDP}}$

#### 2.4.4.2. Okun's Law

Okun (1962) initially determined the labour market factors that affect the output levels of the United States economy. Productivity, hours of work, and labour participation were assumed to affect the output in United States. Okun (1962) further combined these labour market variables as a single variable calling it unemployment. This is because each of the above stated labour market variables have an effect seen in the rate of unemployment in the economy. Therefore, Okun (1962) used unemployment as a proxy variable for all of the above stated labour market variables. According to Okun's (1962) model, there is a 4 percent unemployment rate as the 'price stable', which is now referred to as non-accelerating inflation rate of unemployment (NAIRU).

Okun (1962) made use of two different methods when initially analysing the association between unemployment and output for the United States economy. The results of these two methods were similar to one another. He started his analysis with *the first-difference* method, using quarterly change in unemployment, ( $U$ ), as the dependent variable and quarterly change in gross national product (GNP), ( $Y$ ), as the independent variable. The study included data from the second quarter of 1947 to the fourth quarter of 1960. The results of this analysis are presented in the equation below:

$$U = 0.3 - 0.3Y \quad (2.1)$$

This shows that a 1 percent increase in the US GNP will result in a 0.3 percent decrease in unemployment, and a 1 percent decrease in the US GNP results in a 0.3 percent increase in unemployment. There is therefore a clear inverse relationship between unemployment and GNP in the US economy. According to Okun's results, the relationship ratio between output and rate of unemployment is 3:1, showing that a 1 percent increase in unemployment leads to a 3 percent decrease in GNP. Okun (1962) then made use of the *gap version* in analysing the relationship between output and unemployment, which considers the gap between potential output and actual output. The results were found to be approximately the same.

Okun's Law is underpinned by a statistical relationship that may not be constant over time, especially when an economy faces structural changes. Certain empirical research shows different Okun's coefficients across different countries (Malta, 2013).

Villaverde and Maza (2009) and Bankole and Fatai (2013), state that Okun's Law is important for theoretical and empirical reasons. The theoretical side shows that Okun's Law is the root of the Keynesian model and the Phillips curve, when deriving the aggregate supply curve, and is known as the 'rule of thumb' in forecasting. The empirical side is the study of the relationship between unemployment and growth output to obtain the Okun's coefficient (Kreishan, 2011).

Okun's Law shows that unemployment will increase further during a recession and would decline during an expansion. There are two versions of the original Okun's Law. The first is the differenced version, which shows the relationship between the change in GDP growth rate,  $\Delta Y_t$ , and the change in unemployment rate,  $\Delta U_t$ , and is given by equation (2.2) (Central Bank of Malta, 2013).

$$\Delta U_t = \beta_0 - \beta_1 \Delta Y_t + e_t \quad (2.2)$$

The Okun's coefficient is represented by  $\beta_1$  and is expected to be negative because increasing growth rate is associated with decreasing rates of unemployment;  $-\frac{\beta_0}{\beta_1}$  is the output growth rate with constant unemployment rate.

The second version is the gap version, which examines the relationship between unemployment rate ( $U_t$ ) and the output gap ( $Y_t$ ), and is given by equation (2.3)

$$U_t - U_t^* = \alpha(Y_t - Y_t^*) + e_t \quad (2.3)$$

Where  $U_t^*$ ,  $Y_t^*$ , and  $e_t$  represent the log of unemployment, the log of potential GDP, and the error term respectively.

Several economists have expanded Okun's Law, including two new versions (Knotek, 2007). The first new version is the Dynamic version, which is similar to the difference version which considers lagged output and current output which can influence unemployment, and is given by equation (2.4).

$$\Delta U_t = \beta_0 - \beta_1 Y_t + \beta_2 \Delta Y_{t-1} + \beta_3 \Delta U_{t-1} + e_t \quad (2.4)$$

Where  $\Delta U_{t-1}$  is unemployment lagged once, and  $\Delta Y_{t-1}$  is GDP growth lagged once.

The second new version is known as the '*Production-Function version*', which combines the theoretical production function with the gap version (Knotek, 2007). For the purpose of this study, the simple *differenced version* of Okun's law and the *dynamic version* of Okun's law are analysed.

## **2.5. MACROECONOMIC FACTORS RELATED TO UNEMPLOYMENT**

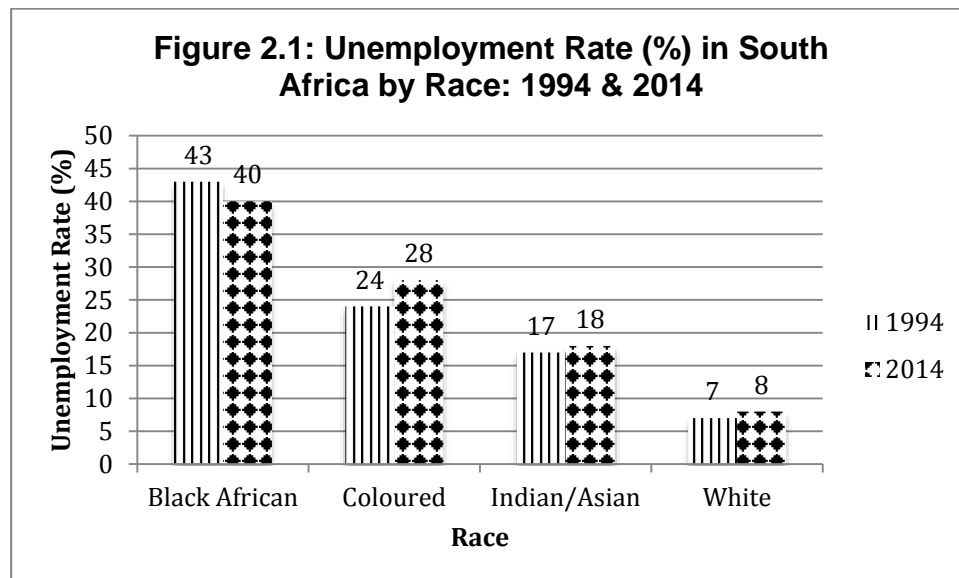
Unemployment is the root cause of macroeconomic problems in South Africa. Some of the macroeconomic problems are as follows:

### **2.5.1. The Labour Market**

Employment has increased by approximately 6.2 million from 1994 to 2014 while the labour force participation increased by 8.7 million over the same period, thus resulting in an increase of unemployment by 2.5 million (Stats SA, 2014d). Furthermore, The labour force participation has increased from



approximately 11.4 million in 1994 to approximately 20.1 million in 2014 (Stats SA, 2014d).



Source: Stats SA (2014d)

According to Stats SA (2014d), Black African unemployment decreased from 43 percent in 1994 to 40 percent in 2014, Coloured unemployment has increased from 24 percent to 28 percent, Indian/Asian from 17 percent to 18 percent, and White from 7 percent to 8 percent.

In 2014, approximately 3 904 489 people had less than a matriculation education, 710 622 had a matriculation pass and 70 650 had tertiary education. Employment of white workers has shifted towards skilled work from 1994 to 2014 and black employment shifted towards semi-skilled and skilled during the period. In 1994 and 2014, the highest unemployment rates were recorded for black African who had tertiary education, while lowest in both years were recorded for the white population with tertiary qualifications (Stats SA, 2014d).

**Table 2.2: Unemployment by level of Education and Age with  
Percentages averaged from 2010 to 2013**

	From Unemployed to Employed (%)	From Employed to Unemployed (%)
<b>Total</b>	11.2	4.3
<b>Highest Educational Level:</b>		
Primary Education	14	5.7
Secondary Education (not completed)	11.1	6.1
Secondary Education (Completed)	9.9	3.7
Tertiary Education	12.1	1.2
<b>Age:</b>		
Youth (15-34 years)	10.2	6.4
Adults (35-64 years)	13.4	2.9

Source: Stats SA (2014a)

Table 2.2 indicates that overall, more individuals moved from being unemployed to employed (11.2 percent) than from being employed to unemployed (4.3 percent). More youth became unemployed (6.4 percent) relative to adults (2.9 percent) and more adults have been employed during the observed period (Stats SA, 2014a).

The labour force participation rate of youth has declined from 52.7 percent to 48.1 percent over the periods 2008 to 2014, and the adult labour force participation rate has decreased from 69,1 percent to 68.5 percent (Stats SA, 2014a).

In the last quarter of 2014, unemployment in SA was recorded to be the highest in the Free-State at 32.2 percent, while it was recorded to be the lowest in Limpopo at 15.9 percent with Gauteng and KZN around the natural

rate of unemployment at 24.6 percent and 20.8 percent respectively (Stats SA, 2014d).

### **2.5.2. Structural change and flexibility**

Structural change is the long-run fundamental shift in the productivity and employment activities across different sectors (from primary to service sectors) to bring about change in the economic development (Memedovic and Lapadre, 2009).

The main factor contributing to unemployment of skilled workers according to Gupta and Du Toit (2009) is the fixed cost associated with hiring these workers. The South African labour market faces long-run changes in technology as well as in the structure of the economy. The South African economy has increased the use of skilled labour intensive activities and decreased the use of unskilled labour intensive activities, as well as replaced workers with new technology, all of which increase unemployment (Mahadea, 2012).

## **2.6. PREVIOUS POLICIES TO ALLEVIATE UNEMPLOYMENT IN SOUTH AFRICA**

During the economic transition in 1994, South Africa was in a disadvantaged position in terms of black individuals not having sufficient education to qualify for job vacancies. Employment creation was a huge problem for the new South African government post-apartheid. Furthermore, South Africa was faced with large skill-based technological change as a developing nation. These factors amongst others have led to high and persistent unemployment in the country. Some of the policy responses implemented by the post-apartheid South African government over the years in an attempt to decrease unemployment in the country are presented.

The South African government has implemented a tight fiscal and monetary policy to aid with the rising unemployment rates during the post-apartheid period. Following the pressures put forward by various international financial investors and the International Monetary Fund (IMF), in 1996 government decided to introduce the Growth, Equity, and Redistribution (GEAR) programme in an attempt to decrease fiscal deficit, promote economic growth, and create employment (Pollin, Heintz, Epstein, and Ndikumana, 2007).

Government had subsequently implemented the Accelerated and Shared Growth Initiative for South Africa (ASGI-SA) programme in 2005 in an attempt to expand the public infrastructure and improve growth of tourism and agriculture. ASGI-SA also intended to reduce taxes and promote economic growth, thus helping to reduce poverty. ASGI-SA also aimed to reduce labour costs, thus increasing the demand for labour and reducing unemployment (Pollin et al, 2007).

According to Kingdon and Knight (2005), the two broad policies implemented by the South African government, amongst others, were skills development and public work programme (PWP). Government has also recently implemented a youth wage subsidy scheme to encourage youth employment, and it is in the process of implementing the 2012 National Development Plan (NDP). As indicated earlier, the NDP aims to reduce unemployment from a high 27 percent in 2011 to 14 percent in 2020 and to a low 6 percent in 2030, and envisions an average GDP growth rate of approximately 5.4 percent during the 2011-2030 period.

### **2.6.1. Skills Development Programme**

Skills development is an important component of decreasing unemployment in South Africa because its unemployment is largely caused by a skills mismatch (Parsons, 2013). Unemployment is the lowest amongst educated individuals and highest among those with little education. Lack of skills has contributed to unemployment in the country; therefore by improving the education and skills

levels, an individual will increase the probability of being employed (Kingdon and Knight, 2005; Lings, 2014).

The South African government has implemented the National Skills Act in 1998 and created various Sector Education Training Authorities (SETAs) in 1999, to which firms are required to pay a partly refundable skills levy to ensure training of their employees. In order for the firms to obtain the levy amount back, they should provide evidence of employee skills training. The Act has led to the development of Further Education and Training (FET) institutions to provide training to employees to acquire more skills. However, SETA has found that large amounts of levy were unclaimed (Kingdon and Knight, 2005). Many SETAs are riddled with inefficiencies and are found to be failing in empowering the learners with marketable skills (Herbst and Mills, 2015).

#### **2.6.2. Public Works Programme (PWP)**

Public works programme (PWP) is an important part of the government policy framework to generate job opportunities and hence reduce unemployment in South Africa (Kingdon and Knight, 2005). The South African government has invested approximately R20 billion on the programme over a 5-year period up until 2007, with a goal of creating over 1 million job opportunities over the same period (Pollin et al, 2007).

The programme further aimed to improve the infrastructure of the economic, social, and environmental activities. The PWP has certain disadvantages; namely, it does not sufficiently decrease unemployment and poverty in the country, and all employment that is created by the policy lasts for a limited period of time (Pollin et al, 2007). In short, the PWP does not create sustainable long-term employment.

### **2.6.3. Other Regulatory Framework in South Africa**

According to Blumenfeld (2014) structural unemployment in South Africa is partly due to the lack of skills among labour. This may be a legacy of apartheid as it previously only offered black individuals poor quality of education. However, this was reformed in 1994, but remains quite complex. Current educational amendment policies will only be effective in the labour market if there is a serious culture of learning among the youth and adults in the country.

The South African employment plan (2014) revealed that the problem associated with labour supply is the mismatch between skills demanded and skills acquired. In dealing with this problem, government has implemented fiscal policies, such as adopting a countercyclical approach for management and allocation of resources at macro level, which can be used to create more jobs and protect those currently employed. This approach has the potential to enhance job creation in the public sector and generate more low-skilled jobs in social programmes, therefore decreasing unemployment.

Blumenfeld (2014) states that over 1.1 million South African youth enter the labour force every year whereas only about 200 000 new jobs are created annually and 100 000 existing jobs become vacant due to annual retirement, thus leaving approximately 800 000 youth unemployed. While the youth wage subsidy is offered since 2014 to address this problem, it may be too early to assess its impact on overall unemployment. People are unable to find employment due to the high costs associated with hiring new employees, and with firing non-performing labour (Parsons, 2013).

## **2.7. EMPIRICAL RESULTS RELATED TO UNEMPLOYMENT AND ECONOMIC GROWTH**

Okun undertook a study of the relationship between unemployment and GDP growth for the US economy in 1962. As indicated earlier, Okun (1962) found

that a 1 percent increase in unemployment leads to a 3 percent decrease in GDP growth. Studies conducted by modern economists, however, state that the relationship takes on other magnitudes apart from a ratio of 3:1. There have been various empirical studies conducted on the relationship between unemployment and economic growth in different countries using different econometric methods.

Knotek (2007) analysed the relationship between unemployment and current output, past output, and past unemployment using a lag model to indicate the past values. The study made use of the difference version, gap version, and the dynamic version of Okun's law in analysing the stated relationship. Knotek (2007) indicates that the changes in the value of Okun's coefficient are linked to the business cycle in the United States. This indicates that the coefficient magnitudes tend to be smaller during a recession and higher during an expansion. The study found that the current relationship decreased in magnitude over time, while the lagged model magnitude increased over time.

Moazzami and Dadgostar (2009) conducted an analysis on Okun's law using quarterly data from 13 OECD countries for the period 1988 to 2007. The researchers used cyclical unemployment as the dependent variable and output as the independent variable. The variables were in log form, making it easy to interpret the coefficient values. The study allowed for any possible structural break during the 1980s. All variables were found to be stationary after conducting a unit root test using the Dickey-Fuller method. The Lagrange multiplier test was used to test for the presence of autocorrelation. There was no evidence of autocorrelation in the residual terms. The study found that a 1 percent decrease in unemployment resulted in an increase in output between 2.6 percent to 4.7 percent.

In another study conducted by Sodipe and Ogunrinola (2011) on the relationship between employment and economic growth in Nigeria, the OLS method of estimation was used. Data was obtained from the Central Bank of Nigeria, the National Bureau of Statistics and the Nigerian Institute of Social and Economic Research. The study included two linear regression models.

The first model included employment as the dependent variable, and the explanatory variables comprised real GDP, Foreign Private Capital (FPC), and Government Consumption Expenditure, whereas the second model replaced the linear model with real GDP (absolute value of GDP) as an explanatory variable with a logarithmic model using GDP growth rate (percentage) as an explanatory variable. The study also included two logarithmic regression models with the same variables as the linear model.

The researchers checked for the existence of unit root in the variables by conducting an Augmented Dickey-Fuller Test (ADF). The test found that only GDP growth rate and FPC were stationary, while the other variables were non-stationary. However, the other variables became stationary by running the first difference of these variables. Furthermore, the research used the Hodrick-Prescott filter to de-trend the series to ensure stationarity of the variables.

The OLS linear regression revealed there was a negative sign on the real GDP coefficient, which is not in line with the expectations; however, once real GDP is replaced with GDP growth rate, the relationship becomes positive. The  $R^2$  value of the linear model, including GDP growth rate, with a value of 0.9969, is almost the same as the linear model including real GDP as an explanatory variable, with a value of 0.9963.

The OLS logarithmic regression outcome revealed that both log models have their expected signs, i.e. positive signs, for real GDP and GDP growth rate. However, the study revealed that the  $R^2$  value of the log model with GDP growth rate as the explanatory variable was higher at 96 percent as compared to the model that contained GDP as the explanatory variable, which was 89 percent. The study further indicated that the elasticity of employment growth is positive and significantly different from zero, therefore indicating that economic growth cannot be negatively related to employment in the case of Nigeria.



Kreishan (2011) conducted a study on the relationship between economic growth and unemployment in Jordan using Okun's law. The data of the study was captured from the Central Bank of Jordan's annual report, Department of Statistics, and the Jordanian labour force for period 1970- 2008.

The study first tested the series for stationarity. The author used the ADF test of stationarity. The model included a dependent variable (real output), an explanatory variable (unemployment rate) and an error term (white-noise disturbance term). The ADF test results revealed that unemployment and real output are non-stationary. As a consequence, the regression results are based on the first difference of the log of the variables.

The study further conducted a co-integration test based on the co-integration regression Durbin-Watson statistics, which produced a result that is statically different from zero, i.e. 0.89, at a 5 percent significance level. Kreishan (2011) further conducted an ADF test on the residuals and found the existence of co-integration. Therefore, there is a long-run relationship between the two variables. The simple regression results reveal a slope coefficient of -0.30, which is insignificant. The adjusted  $R^2$  value is 12.5 and the F-statistic value is 5.3; this revealed that there is no strong relationship between the two variables, indicating that Okun's law did not hold in Jordan.

Arewa and Nwakanma (2012) investigated the relationship between unemployment and real GDP growth for the Nigerian economy using the Gap version of Okun's law. The study used quarterly data for period 1981 to 2011 obtained from the Nation Bureau of Statistics. In this study, the researchers used real GDP growth rate as the dependent variable and unemployment rate as the explanatory variable.

In analysing the stated relationship, the researchers used the Vector-Autoregressive (VAR) model. The value of Okun's coefficient was found to be -0.23. However, this value was statistically insignificant, and hence the researchers concluded that Okun's law is not valid for the Nigerian economy for the specified period.

Khan, Saboor, Mian, and Anwar (2013) studied the relationship between unemployment and real GDP in Pakistan for periods 1976-2010 using annual time-series data obtained from the World Bank and the State Bank of Pakistan. The study first used the ADF and PP test to analyse the stationary level of the variables. The independent variable is unemployment and the dependent variable is real GDP. The results reveal that the variables are stationary. The study then used Hodrick-Prescott filter with the purpose of removing trends from the series, which eliminates cyclical movement, resulting in real GDP/output and unemployment being de-trended.

Real GDP in the first two lags indicates partial autocorrelation; therefore the study incorporated the first two auto regressor terms thus modifying the model to be statistically significant. In doing so, the results reveal that as unemployment increases by one point, real GDP growth rate will rise by approximately 0.36 points. The Durbin-Watson test revealed a value of 2 therefore showing no autocorrelation present in the residual terms, which was confirmed by the correlogram test.

A more recent study was conducted by Alamro and Al-dalaien (2014) on the relationship between unemployment and economic growth in Jordan for the period 1980-2011. The study analysed the gap version of Okun's law using an autoregressive distributed lag (ARDL) model. The results found a weak negative correlation between unemployment and economic growth in Jordan, indicating that a 1 percent increase in economic growth leads to a decrease in unemployment by 0.007 percent.

A study conducted by Buba and Ishak (2014) on the association between real GDP and unemployment in Nigeria for periods 1997-2011 used real GDP data from the World Bank and unemployment data from the National Bureau of Statistics. The dependent variable was unemployment rate, while the explanatory variables included real GDP and inflation, all of which were in logarithm terms and were analysed using an autoregressive distributed lag (ARDL) model.

The study first tested whether variables are stationary using the Augmented Dickey Fuller (ADF) test and the Phillips-Perron (PP) test of stationarity. Inflation was found to be stationary while unemployment and real GDP were non-stationary; however, after differencing the variables once, these variables became stationary. The study then tested for co-integration using the Autoregressive Distributive lag method, which found that the variables are co-integrated at 5 percent significance level, thus indicating that it is possible to obtain long-run relationships.

The study found that a 1 percent rise in inflation decreases unemployment by 0.870 percent in the long run, and a 1 percent rise in real GDP increases unemployment by 1.1351 percent. This result is not in line with the expectations. However, Buba and Ishak (2014) state that this outcome is valid for the Nigerian economy since the governor of the central bank there indicates that the direct relationship occurs due to low employment opportunities available in the manufacturing sectors and the country's high reliance in the oil sector, which employs less workers.

The short-run ECM results reveal a similar positive relation between unemployment and real GDP, and the adjustment towards equilibrium in 53 percent annually at a 1 percent significance level.

Another recent study was conducted by Nikolli (2014) on the relationship between unemployment and economic growth in Albania for period 1992-2012. The difference version of Okun's law and the gap version of Okun's law were used in analysing the stated relationship. The study included annual data on unemployment and real GDP collected from the World Bank database. Real GDP was used as the dependent variable while unemployment was used as the independent variable.

The results of the study implied that a 1 percent increase in unemployment decreases real GDP by 1.11 percent, and hence indicating that Okun's law is valid for the Albanian economy.

Tombolo and Hasegawa (2014) undertook a study on the analysis of Okun's law for the Brazilian economy over the period 1980 to 2013 using seasonally adjusted quarterly data. The study used the OLS methodology, using unemployment as the dependent variable and GDP growth rate as the independent variable. The study incorporated the differenced version of Okun's law when analysing the stated relationship. The study found Okun's coefficient to be  $-0.091595$ . This indicates an inverse relationship between unemployment and economic growth. The researcher concluded that Okun's law is valid for Brazil's economy over the specified period.

Lancaster and Tulip (2015) conducted a similar analysis on the link between unemployment and economic growth in Australia for period 1960 to 2015 using quarterly data. The study adopted the differenced version of Okun's law, using unemployment as the dependent variable and economic growth and change in real unit labour as the explanatory variables. The study yielded an Okun's coefficient value of  $-0.27$  together with an adjusted R-squared value of  $0.43$ . Here again there is an expected inverse relationship between the two variables, and hence the researchers concluded that Okun's law is valid for the Australian economy.

Dixon, Lim, and Van Ours (2015) evaluated Okun's law for 20 OECD countries in the European region for the period 1985 to 2013. The study used unemployment as the dependent variable and output as the independent variable. The study found a significant Okun's coefficient value of  $0.54$ , indicating a positive relationship between unemployment and output; hence Okun's law is invalid.

While some studies follow the original evaluation of the stated relationship by Okun (1962) by using unemployment as the dependent variable, other studies analyse this association using GDP growth as the dependent variable. Most of the studies conclude that Okun's law is valid, while relatively few studies found that Okun's law is invalid for the economy over the selected periods.

In the light of the above studies, a summary is presented below. The various studies identified above used different additional explanatory variables. Furthermore, each study makes use of different methodologies in different countries. Kreishan (2011), Khan et al (2013) and Nikolli (2014) computed the analysis of Okun's law using Real GDP as the dependent variable and unemployment as the explanatory variable for Jordan, Pakistan, and Albania respectively. The first two studies concluded that Okun's law is invalid for the respective countries for the selected period, whereas, Nikolli (2014) found Okun's law to be valid for the Albanian economy over the selected period.

The study conducted by Kreishan (2011) on the Jordanian economy was for the period 1970-2008 using the OLS methodology. Alamro and Al-dalaien (2014) computed a similar study for the Jordanian economy during 1980-2011 using the ARDL model with unemployment as the dependent variable and GDP growth as the independent variable. The study found a significantly weak negative relationship between the variables, and concluded that Okun's law is valid over the selected period for the Jordanian economy.

Buba and Ishak (2014), and Dixon et al (2015) computed the analysis of Okun's law using unemployment rate as the dependent variable and GDP growth as the explanatory variable for Nigeria and 20 OECD countries respectively. Both of these studies found a significantly positive relationship between economic growth and unemployment, and hence concluded that Okun's law is invalid for the respective countries over the selected period.

Lastly, Tombolo and Hasegawa (2014), and Lancaster and Tulip (2015) computed a similar analysis for Brazil and Australia respectively. They found a significant negative relationship between unemployment and economic growth using the former as the dependent variable and the latter as the explanatory variable. The researchers concluded that Okun's law is valid for the respective countries.

Since the initial analysis of the relationship between unemployment and GDP growth by Okun (1962) used unemployment as the dependent variable and

GDP growth as the independent variable, this study similarly follows the original study by using unemployment as the dependent variable and economic growth as the explanatory variable. Furthermore, unemployment is a major challenge in South Africa, thus making the study important and relevant.

## **2.8. GAPS IDENTIFIED IN EXISTING RESEARCH**

Although several studies investigated the relationship between unemployment and economic growth in South Africa, none of these examined Okun's law using both, the *differenced version* and the *dynamic version* together, and analysed the unemployment elasticity. This study will include a comparison between the findings of the *differenced version* and *dynamic version* of Okun's law, as well as analyse the employment growth elasticity. Therefore, the study implements a different approach and methodology, while analysing the impact of more variables included in the model, thus resulting in an extension of previous research conducted in South Africa.

These additional factors differ from previous research conducted in South Africa, and hence constitute the gaps that will be addressed and the contributions of this study. GDP growth is critical for the creation of new employment and hence the reduction of unemployment. This study will lend clarity to the relationship in the South African context.

## **2.9. CONCLUSION**

Various empirical studies have shown a significantly negative relationship between unemployment and economic growth in developing countries globally, which corresponds to the theory of Okun's law. However the magnitudes differ from one country to another, which indicate differences in the response to labour market activities across countries. Other studies have

indicated an unexpected positive correlation between the two variables that contradicts some of the research findings. The expected negative relationship implies that economic growth enhances job creation thus reducing unemployment.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1. INTRODUCTION**

The research design and the procedures adopted in the investigation of the relationship between the variables impacting on unemployment and economic growth in South Africa form the content of this chapter. It also describes the procedure adopted to gather data sources as well as the steps followed in realizing the objectives of the study. Finally, the econometric analysis techniques are presented.

The objectives of the study are stated briefly below.

### **3.2. OBJECTIVES OF THE STUDY**

The main objectives of the research are summarized as follows

- To determine Okun's coefficient for the South African economy;
- To determine whether there is a statistically significant relationship between unemployment rate and economic growth in post-apartheid South Africa; and
- To determine the unemployment elasticity in South Africa covering the period 1994-2014;

Major impediments to South Africa's economic progress result in the country's high unemployment and declining economic growth rates.

### **3.3. SECONDARY DATA SOURCES**

The proposed study of the relationship between unemployment and economic growth in South Africa utilizes time-series data for periods 1994 to 2014. This time period is chosen to determine the impact of South African economic reforms two decades since attaining democracy. The economic growth is



calculated using the GDP growth rate, obtained from Stats SA, while the data related to unemployment, government consumption expenditure, and fixed investment are accessed from the South African Reserve Bank. The final consumption expenditure by general government includes all government current expenditures for purchasing goods and services i.e. compensation of employees, expenditure on national defense and security, and government military expenditure. All data collected are at constant 2010 prices.

While the GDP growth rate data are available on a quarterly basis from the Stats SA database, the data on unemployment obtained from the South African Reserve Bank database are not, until 2008. Therefore, the 'interpolation method' was used to convert the annual and bi-annual data to ensure that data for the periods 1994 to 2008 are in quarterly format. The model will be estimated using the Ordinary Least Square Method (OLS) and the Vector Autoregressive Method (VAR). The statistical package Stata 13 was considered appropriate for application in this study.

The study adopts the basic static *difference version* of Okun's Law as well as the expanded *dynamic version* of Okun's Law. This method is considered simple, accurate, and involves the direct application of the original dataset.

### **3.4. THEORETICAL FRAMEWORK AND MODEL SPECIFICATION**

Okun's Law studies the relationship between unemployment and a country's output. The gap version, as stated in the literature review chapter, shows that for every percentage change in GDP growth rate, a consequential change is expected in the unemployment rate.

The study initially assesses the *difference version* of Okun's law, which describes the relationship between changes in the unemployment rate and changes in GDP growth. This framework is known as the static version of Okun's law. The study then expands the *difference version* by including

additional explanatory variables, and this version is known as the *dynamic version* of Okun's law.

#### 3.4.1. Model Specification

The research methodology initially utilizes a simple *differenced version* framework of Okun's Law to analyse the relationship between unemployment and economic growth in South Africa by using the following function:

$$U_t = f(Y_t, e_t) \quad (3.1)$$

Where  $U_t$  is the unemployment rate,  $Y_t$  is the GDP growth, and  $e_t$  is the stochastic error term respectively.

In the *differenced version*, the model focuses on two variables affecting the study; the dependent variable is the change in unemployment rate while the explanatory variable is the change in GDP growth rate. Estimating a non-linear model makes it easier to interpret the elasticity. The model is thus given by equation (3.2).

$$\ln\Delta U_t = \alpha_0 + \alpha_1 \ln\Delta Y_t + \mu_t \quad (3.2)$$

Where  $\ln\Delta U_t$  represent the log of change in unemployment rate,  $\ln\Delta Y_t$  represents the log of change in GDP growth, and  $\mu_t$  represents the stochastic error term.

However, Okun's law has been critiqued by economists over the years due to the exclusion of various important explanatory variables from the model, and this may lead to biased estimate results (Ayoyinka, 2008). Therefore this study will further expand on the simple static differenced version framework of Okun's Law to examine the relationship between unemployment and economic growth in South Africa by including lagged variables of unemployment rate and GDP growth rate, and two additional control variables that may affect the unemployment rates of the country. This approach is

known as the *dynamic version* of Okun's law and is expressed by the following function:

$$U_t = f(Y_t, Y_{t-1}, U_{t-1}, GCE, FI, e_t) \quad (3.3)$$

Where:

$Y_t$  - Represents the GDP growth rate,

$Y_{t-1}$  - Represents the GDP growth rate lagged once,

$U_t$  - Represents the unemployment rate,

$U_{t-1}$  - Represents the unemployment rate lagged once,

$GCE$  - Represents the government consumption expenditure,

$FI$  - Represents the South Africa's fixed capital formation investment, and

$e_t$  - Represents the stochastic error term.

Okun's law analysed using the *dynamic version*, as discussed in the literature review chapter, is very similar to that of Okun's law analysed using the *differenced version*, and indicates that current GDP growth and past GDP growth affects the unemployment rate of a country. The *dynamic version* includes further control variables in the model, and therefore does not only capture the coexistent association between unemployment and economic growth, thereby reducing the possibility of biased estimates (Knotek, 2007).

In analysing Okun's law using the *dynamic version*, the dependent variable is the change in unemployment rate while the independent variables include the change in GDP growth rate, the change in GDP growth rate lagged once, the change in unemployment rate lagged once, the change in government consumption expenditure, and the change in fixed investment. Estimating a non-linear logarithmic model (Equation 3.4) makes it easier to interpret the elasticity:

$$\ln\Delta U_t = \alpha_0 + \alpha_1 \ln\Delta Y_t + \alpha_2 \ln\Delta Y_{t-1} + \alpha_3 \ln\Delta U_{t-1} + \alpha_4 \ln\Delta GCE_t + \alpha_5 \ln\Delta FI_t + \mu_t \quad (3.4)$$

In this equation,  $\alpha_0$  is a constant that represents the intercept term,  $\alpha_1$  is the corresponding coefficient of the change in GDP growth rate variable which is also known as Okun's coefficient and is expected to be negative indicating that in the long run, economic growth should lead to decreasing unemployment rates (Saiku et al, 2014).

In equation (3.4), the stochastic error term,  $\mu_t$ , includes the effects of all factors that are not included in the model. The delta ( $\Delta$ ) attached to each variable represents the change in each variable.

#### **3.4.1.1. Ordinary Least Square methodology**

The study uses the Ordinary Least Square (OLS) methodology in analysing the *difference version* and the *dynamic version* of Okun's law. The OLS method is a linear modeling technique that analyses the relationship between the dependent variable, in this case unemployment, and all explanatory variables included in the model i.e. GDP growth, government consumption expenditure, and fixed investment. The objective of the OLS method is to minimize the residual sum of squares (Moutinho & Hutcheson, 2011; Gujarati and Porter, 2009).

#### **3.4.1.2. Vector Auto-regression Methodology**

In analysing the inter-relationship between unemployment and economic growth in the *dynamic version* of Okun's law, the study uses the VAR (Vector Autoregression) method. This method is used to examine two variables i.e. unemployment and economic growth (GDP growth), thus justifying the two equations illustrated below:

$$\ln U_t = \nu_0 + \sum_{i=1}^k \nu_i \ln U_{t-i} + \sum_{i=0}^k \omega_i \ln Y_{t-i} + \sum_{i=0}^k \alpha_i \ln GCE_{t-i} + \sum_{i=0}^k \beta_i \ln FI_{t-i} + \varepsilon_t \quad (3.5)$$

$$\ln Y_t = \theta_0 + \sum_{i=0}^k \theta_i \ln U_{t-i} + \sum_{i=1}^k \gamma_i \ln Y_{t-i} + \sum_{i=0}^k \phi_i \ln GCE_{t-i} + \sum_{i=0}^k \varphi_i \ln FI_{t-i} + \eta_t \quad (3.6)$$

$$\ln GCE_t = \mu_0 + \sum_{i=0}^k \mu_i \ln U_{t-i} + \sum_{i=1}^k \rho_i \ln Y_{t-i} + \sum_{i=1}^k \tau_i \ln GCE_{t-i} + \sum_{i=0}^k \sigma_i \ln FI_{t-i} + e_t \quad (3.7)$$

$$\ln FI_t = \lambda_0 + \sum_{i=0}^k \lambda_i \ln U_{t-i} + \sum_{i=1}^k \pi_i \ln Y_{t-i} + \sum_{i=0}^k \xi_i \ln GCE_{t-i} + \sum_{i=1}^k \chi_i \ln FI_{t-i} + z_t \quad (3.8)$$

Here again  $\nu_0$ ,  $\theta_0$ ,  $\mu_0$ , and  $\lambda_0$  represent the constant intercept terms of equation (3.5), (3.6), (3.7) and (3.8) respectively, while  $\nu_i$ ,  $\theta_i$ ,  $\mu_i$ , and  $\lambda_i$  represent the coefficient terms on the lagged unemployment rates in equations (3.5), (3.6), (3.7) and (3.8) respectively;  $\omega_i$ ,  $\gamma_i$ ,  $\rho_i$ , and  $\pi_i$  represents the coefficient terms on the lagged GDP growth rates in equations (3.5), (3.6), (3.7) and (3.8) respectively;  $\alpha_i$ ,  $\phi_i$ ,  $\tau_i$ , and  $\xi_i$  represents the coefficient values on lagged government consumption expenditure in equations (3.5), (3.6), (3.7) and (3.8) respectively;  $\beta_i$ ,  $\varphi_i$ ,  $\sigma_i$  and  $\chi_i$  represents the coefficient values on fixed investment in equations (3.5), (3.6), (3.7) and (3.8) respectively; and  $\varepsilon_t$ ,  $\eta_t$ ,  $e_t$ , and  $z_t$  are corresponding stochastic error terms in equations (3.5), (3.6), (3.7) and (3.8) respectively.

Equation (3.5) indicates that current unemployment is affected by current and past values of GDP growth, current and past values of government consumption expenditure; current and past values of fixed investment and past values of unemployment levels; simultaneously in equation (3.6), GDP growth rate is affected by current and past levels of unemployment, current and past values of government consumption expenditure and current and past values of fixed investment and past values of GDP growth rate.

Equation (3.7) indicates that government consumption expenditure is affected

by current and past levels of unemployment, current and past values of GDP growth rate, past values of government consumption expenditure as well as current and past values of fixed investment. Finally, equation (3.8) indicates that fixed investment is affected by current and past levels of unemployment, current and past values of GDP growth rate, current and past values of government consumption expenditure and past values of fixed investment.

An important factor of a VAR model is determining the number of lags in the model. For the purpose of this study, the number of lags used in the model are determined by the Akaike Information Criterion (AIC), the Schwarz's Bayesian Information Criterion (SBIC), and the Hannan and Quinn Information Criterion (HQIC) (Verbeek, 2012). The AIC can be defined by equation (3.9) below:

$$AIC = \ln(\hat{\sigma}) + \frac{2k}{T} \quad (3.9)$$

The SBIC can be defined by equation (3.10):

$$SBIC = \ln(\hat{\sigma}^2) + \frac{k}{T} \ln T \quad (3.10)$$

The HQIC can be defined by equation (3.11):

$$HQIC = \ln(\hat{\sigma}^2) + \frac{2k}{T} \ln(\ln(T)) \quad (3.11)$$

Where:

- $\hat{\sigma}$  Represents the estimated co-variance,
- $T$  Represents the number of observations, and
- $k$  Represents the number of freely estimated parameters.

### **3.5. THE HYPOTHESES OF THE STUDY**

According to Christensen (1994:115-116) an empirically tested hypothesis is the best predictor or a tentative solution to a problem. It predicts the relationship that exists among the variables, or predicts tentative solutions to the problem.

In order to test significant relationships, the hypotheses for this study are set out as follows:

- $H_0$ : There is no significant negative relationship between unemployment and economic growth in South Africa.
- $H_1$ : There is a significant negative relationship between unemployment and economic growth in South Africa.
- $H_0$ : There is no significant negative relationship between unemployment and government consumption expenditure in South Africa.
- $H_1$ : There is a significant negative relationship between unemployment and government consumption expenditure in South Africa.
- $H_0$ : There is no significant negative relationship between level of fixed capital formation investment and unemployment in South Africa.
- $H_1$ : There is a significant negative relationship between level of fixed capital formation investment and unemployment in South Africa.

In order to test the hypotheses highlighted, the data are analysed and presented, using Stata13.

### **3.6. RESEARCH FRAMEWORK**

The research examines the time series properties of the variables taken in logarithmic terms. This is to scrutinize whether or not the time series encounters stationarity. Stationarity of the variables is examined by conducting the unit root tests such as the Augmented Dickey-Fuller test (ADF), the Phillips-Perron test (PP) test, and the Kwiatkowski-Phillips-

Schmidt–Shin (KPSS) test. The two unit root tests are considered to avoid inadequate results.

Thereafter the test for co-integration adopts the Engle-Granger test of co-integration. Finally, the study engages the Error Correction Model (ECM) and conducts a causality test using the standard Granger causality test.

### **3.6.1. Stationary Analysis: Unit Root Testing**

The unit root test of stationarity was derived by Dickey and Fuller in 1979 and is known as the classical formal test for stationarity (Wooldridge, 2013).

According to Wooldridge (2013), stationary series do not change over time and the correlations do not alter over a time period. If the variable is stationary, it is concluded to be  $I(0)$ , which means integrated of order zero, and if the first difference form produces stationary time series it is known as  $I(1)$  which means first difference stationary. The unit root test is a classic formal test for stationarity derived by Dickey and Fuller in 1979. Trend stationarity exists if the variation in the dependent variable is stationary, after accounting for any time trends in the model.

Wooldridge (2013) states that variables tend to fluctuate over time; for example, improvements in technology leads to raising the output levels, therefore economic theory shows a causal relationship between economic series that change over time. Non-stationary variables are those variables that increase over time. Hence there are various problems associated with non-stationary variables as the standard errors tend to be biased. Spurious regression occurs when regressing two series of non-stationary variable simultaneously and the output has no real significance (Mahadeva & Robinson, 2004). Therefore it is essential to conduct a unit root test to evaluate the stationarity of the variables to eliminate any such biasness in the regressions.



Wooldridge (2013) shows that when conducting the ADF and PP unit root tests, the null hypothesis indicates the variable has a unit root such that the variable is non-stationary, whereas the alternate hypothesis represents the case where the variable is stationary—thus the rejection of the null hypothesis will conclude that the series is stationary.

$$H_0: \theta = 1 \quad (\text{Unit root i.e. selected variable is non-stationary})$$

$$H_1: |\theta| < 1 \quad (\text{Selected variable is stationary})$$

According to Mahadeva and Robinson (2004), there are various limitations associated with the unit root test; for example, it is difficult to differ between the highly autoregressive model and the difference-stationary model, and in small samples it tends to be difficult to notice the difference between trends and difference-stationary data. Therefore, the unit root tests are helpful but are not accurate.

Syczewska (2010) shows that when conducting the KPSS unit root test, the hypotheses tested are opposite to that of ADF and PP tests in that the null hypothesis being tested is stationary and the alternate hypothesis is non-stationary, given by the following:

$$H_0: \quad \text{Stationary}$$

$$H_1: \text{unit root (i.e. non-stationary)}$$

According to Mahadeva and Robinson (2004), there are various limitations associated with the unit root test; for example, it is difficult to differ between the highly autoregressive model and the difference-stationary model, and in small samples it tends to be difficult to notice the difference between trends and difference-stationary data; therefore the unit root tests are helpful, but not accurate.

The KPSS test was first introduced by Kwiatkowski et al in 1992, and the hypotheses are set opposite to that of the ADF and PP tests. The ADF and KPSS tests are used jointly in determining whether or not a series is stationary. KPSS includes three components, namely, the deterministic trend, a random walk, and a stationary error term (Syczewska, 2010).

### 3.6.2. Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP)

Metes (2005) shows that the ADF test is an autoregressive unit root test developed to generate tests of the null hypothesis,  $H_0: \theta = 1$ , against the alternate hypothesis,  $H_1: \theta < 1$ , testing whether or not the series is stationary. Metes (2005) further posits that the ADF test includes 3 different aspects, namely:

1. The series with no drift:  $Y_t = \theta Y_{t-1} + \varepsilon_t$
2. The series with drift and no trend:  $Y_t = c + \theta Y_{t-1} + \varepsilon_t$
3. The series with drift and trend:  $Y_t = c + dt + \theta Y_{t-1} + \varepsilon_t$

The ADF tests whether  $(\theta = 1)$  or  $(\theta < 1)$  is quite alike to the regular t-statistic test (Metes, 2005). ADF tests include lagged regressions in the model and it is important to determine how many lags are included in the model because if not stated, the model will simply add it to the error term and hence the DF results will be futile (Metes, 2005). Metes (2005) further states that correlation would result if no lagged variables are included in the model, therefore the presence of lagged terms ensure unit root tests are highly potent. The ADF test is modeled as follows:

$$\Delta Y_t = \varphi \delta_1 Y_{t-1} + \delta_2 t + \sum_{j=1}^T \Delta Y_{t-j} + \varepsilon_t \quad (3.12)$$

Where  $\Delta Y_t$ ,  $\varepsilon_t$ , and  $\delta_2 t$  represent the time series, the white noise residual, and the linear deterministic trend respectively.

The PP test analyses time series data to validate the null hypothesis that a time series model is non-stationary. The integration of order 1 includes a non-

parametric alteration and builds up on the ADF test that allows the model to account for autocorrelation and heteroscedasticity (Virmani, 2004). Autocorrelation refers to correlations involving a variable and a lag of the same variable; and heteroscedasticity is a problem related to unequal variations amongst variables across a range of values (Wooldridge, 2013).

### 3.6.3. The Unit root test for co-integration

Wooldridge (2013) indicates that if the time series involved is non-stationary, i.e.  $I(1)$ , then regressing one against the other would result in the spurious regression phenomenon. However, if the residuals of the non-stationary time series are stationary, i.e.  $I(0)$ , then the series is said to be co-integrated. The hypotheses tested according to Wooldridge (2013) are as follows:

$H_0$ : error term is non-stationary                      i.e. series are not co-integrated

$H_1$ : error term is stationary                      i.e. series are co-integrated

Co-integration means that the time series are moving together over time through the long run (Wooldridge, 2013).

From a simple model with the error term as the dependent variable:

$$e_t = Y - \beta_0 - \beta_1 U_t \quad (3.13)$$

If  $U_t$  and  $Y_t$  have unit root, one would expect the error term to have a unit root; however, this is not always the case, the unit root in both variables may cancel out leaving the error term stationary. If this is the case, then  $U_t$  and  $Y_t$  are said to be co-integrated and trend together towards the long run equilibrium. The correlogram and plotting residuals can be used to present a graphical view of the existence of co-integration.

### **3.6.4. The Engle-Granger Test for Co-integration**

The Engle-Granger Test is one of the methods used to test for co-integration among variables in a model comprising time series. The test makes use of the Dickey-Fuller test on the residuals with no intercept term. The test is based on estimated values and minimizes the sum of square of residuals. The residual term often appears to be more stationary than the error term present in the model. However, if the residuals do not appear to be white noise, serial correlation will result, and the Augmented form test must be used instead (Kennedy, 2008).

### **3.6.5. Error Correction Model**

The Error Correction Model (ECM) is a single equation model. An analysis of the ECM regression results is conducted to evaluate whether or not the model representing the independent variables affects the dependent variable in the long run or short run. When regressing variables that are integrated of order 1 provides residuals that are stationary, it is concluded that the variables are co-integrated or move together, which means that the variables have long run equilibrium (Kennedy, 2008). Thereafter, the ECM regression is conducted.

Wooldridge (2013) posits that the error correction term should be within the following range:

$$-1 \leq \gamma \leq 0$$

Traditional Economic models are static and not flexible enough to observe disequilibrium. The Granger Representation Theorem enables the model to combine long run equilibrium with short run dynamics by using variables lagged once in an OLS regression of the ECM. The ECM is used to explain the speed of adjustment towards long run equilibrium after any shocks (Wooldridge, 2013).

### 3.6.6. The Engle-Granger Causality Test

The theory behind the Granger Causality Test arises from the following models:

$$Y_t = \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{i=1}^p \beta_i U_{t-i} + e_t \quad (3.14)$$

$$U_t = \sum_{i=1}^p \delta_i Y_{t-i} + \sum_{i=1}^p \gamma_i U_{t-i} + v_t \quad (3.15)$$

When  $\sum_{i=1}^p \beta_i \neq 0$ ,  $U_t$  Granger causes  $Y_t$  and when  $\sum_{i=1}^p \delta_i \neq 0$ ,  $Y_t$  Granger causes  $U_t$ . The test is conducted by regressing  $Y_t$  on all lagged  $Y_t$  but not on lagged  $U_t$ ; this will form the restricted model. The next step is to regress  $Y_t$  on all lagged  $Y_t$  and on all lagged  $U_t$ , this will form the unrestricted model. The null hypothesis is given by:  $H_0: \sum_{i=1}^p \beta_i = 0$ .

In the application of the F-test, when the F-statistic is significantly higher than the value of F critical values, the null hypothesis must be rejected (Kennedy, 2008).

### 3.7. APRIORI EXPECTATIONS OF THE VARIABLES

This study envisages a statistically significant negative impact of unemployment on GDP growth in South Africa. Literature indicates that a higher GDP growth is associated with higher output levels. More labour is required in order to achieve these higher output levels, therefore creating more employment opportunities and thus reducing unemployment in the country (Dornbusch, Fischer, & Startz, 2011).

Furthermore, a statistically significant negative relationship is expected between unemployment and fixed investment, as well as between unemployment and government consumption expenditure.

### **3.8. CONCLUSION**

This chapter describes the various research methodology techniques to determine the relationship amongst the variables impacting on unemployment and economic growth. It also describes the procedure adopted to gather secondary data. The chapter concludes with a description of the various econometric techniques for scientific analyses. The results will be presented in the following chapter.

## CHAPTER 4: PRESENTATION AND DISCUSSION OF EMPIRICAL RESULTS

### 4.1. INTRODUCTION

This chapter focuses on the presentation and the discussion of empirical analyses of the results of the study after the application of econometric techniques in each time range during the period's 1994q1-2003q4 and 2004q1-2014q4. The sample has been split into two time periods because the study seeks to compare the results of the first two decades after apartheid in South Africa. The results for both decades are consistent, and Okun's law is thus found to be valid in South Africa for both time periods. The effect does however get stronger over the second decade following apartheid.

The presentation and analysis of results begin with the descriptive statistics related to the variables chosen for the study. These include frequency tables and display charts which provide information on the key variables in the study, followed by the determination of the lag length utilised for the study. The study also evaluates the unit root tests using the Augmented Dickey-Fuller test (ADF), the Phillips-Perron test (PP), and the Kwiatkowski-Phillips-Schmidt-Shin test.

The chapter examines the basic *differenced version* as well as the *dynamic version* of Okun's law in South Africa. A VAR model is used to determine whether or not there is an association between unemployment and economic growth for the specified time periods in South Africa. Finally, the chapter presents an analysis of the test of co-integration and the interpretation of the error correction model. To add value to the study, some important trends emanating from the data are also presented.

## 4.2. DESCRIPTIVE STATISTICS

Descriptive statistics refer to the classification and summarizing of numerical data (Trochim, 2002). The descriptive statistics represents four macroeconomic variables accessed for the study. Unemployment, ( $U_t$ ), is the dependent variable and GDP growth rate, ( $Y_t$ ), fixed investment, ( $FI_t$ ), and government consumption expenditure, ( $GCE_t$ ), are the independent or explanatory variables. The data obtained on unemployment and GDP growth rate are in percentage form, whereas the data set obtained on fixed investment and government consumption expenditure are in non-percentage form. Therefore these two variables are logged in order to allow direct comparison between the variables. The variable data are presented in Appendix 1.

In Table 4.1, the mean value of each variable is the central tendency that measures the average existence of each time series variable in the study, and the standard deviation indicates the precise distribution of each variable around the mean value. Table 4.1 further indicates the maximum and minimum values of each variable in percentage form.

Table 4.1. Descriptive statistics on the selected variables in South Africa from 1994q1-2014q4

	$U_t$	$Y_t$	$\log FI_t$	$\log GCE_t$
Mean	23.81882	2.973818	12.87318	12.99702
Standard Deviation	2.621727	2.427001	0.358777	0.219848
Minimum	16.9	-6.07828	12.25044	12.69326
Maximum	29.3	7.6	13.36999	13.33531
Observations	86	86	86	86

Source: Stat SA (2015) and SARB (2015)

The descriptive statistics presented in Table 4.1 indicates that over the period 1994 to 2014, the average unemployment rate in South Africa is recorded to



be approximately 23.82 percent and the average economic growth rate in the country is approximately 2.97 percent. This evidence indicates that unemployment is relatively high during the selected period in South Africa whilst economic growth is relatively low.

### 4.3. THE DETERMINATION OF LAG LENGTH USED IN THE MODEL

In order to test for unit root and stationarity amongst selected variables, it is crucial to consider the maximum number of lags for inclusion in the test. The number of lags are determined for all variables in logged format. The lags used in the study is premised on three lag length tests, namely the Akaike Information Criterion (AIC), the Hannan-Quinn Information Criterion (HQIC), and the Schwarz Bayesian Information Criterion (SBIC), which are presented on Table 4.2.

Table 4.2. Lag length criterion

Lags	Number of observations: 86					
	AIC		HQIC		SBIC	
	1994q1- 2003q4	2004q1- 2014q4	1994q1- 2003q4	2004q1- 2014q4	1994q1- 2003q4	2004q1- 2014q4
0	-0.04989	-0.04989	0.009176	0.009176	0.138704	0.138704
1	-7.6093	-7.6093	-7.31398	-7.31398	-6.66634	-6.66634
2	-7.41471	-7.41471	-6.88312	-6.88312	-5.71737	-5.71737
3	-7.64473	-7.64473	-6.87689	-6.87689	-5.19303	-5.19303
4	-9.24726	-9.24726	-8.24316	-8.24316	-6.04119	-6.04119
5	-10.2271	-10.2271	-8.98673	-8.98673	-6.26665	-6.26665
6	-17.1544	-17.1544	-15.6778	-15.6778	-12.4396	-12.4396
7	-217.889	-217.889	-216.176	-216.176	-212.419	-212.419
8	-230.924	-230.924	-229.211	-229.211	-225.454	-225.454
9	-229.623	-229.623	-227.91	-227.91	-224.153	-224.153
10	-231.681*	-231.681*	-229.968*	-229.968*	-226.212*	-226.212*

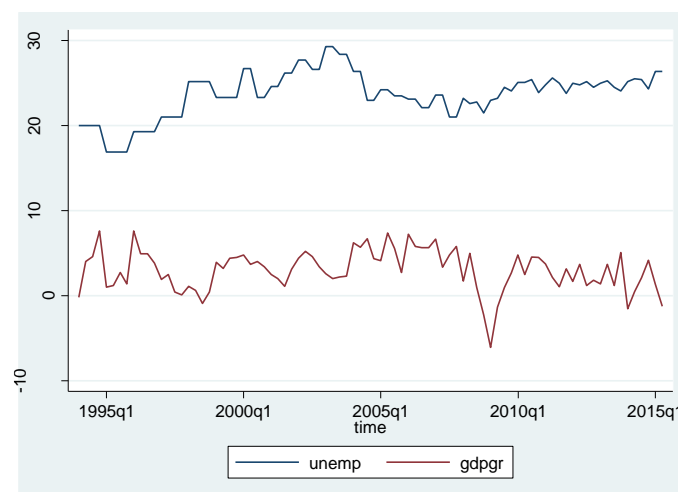
Source: Stats SA (2015) and SARB (2015)

In Table 4.2, all three information criterion indicates that the optimal lag length for both period 1994q1-2003q4 and 2004q1-2014q4 are 10 lags, which is represented by \*.

#### 4.4. UNIT ROOT TESTING: AUGMENTED-DICKEY FULLER TEST (ADF), THE PHILIPS-PERRON TEST (PP), AND THE KWIATKOWSKI-PHILLIPS-SCHMIDT-SHIN TEST (KPSS)

Figure 4.1 indicates that unemployment and GDP growth are non-stationary at level over the specified period in South Africa. The variables appear to have a stochastic trend process present over the period. As a means of transforming the time series data into a stationary process, the differencing method is preferred.

**Figure 4.1. Trends in unemployment and GDP growth rate across 1994q1 to 2015q2 in South Africa**



Source: Stata13 output

The unit root test results for period 1994-q1-2003q4 are presented in Table 4.3. The study makes use of the ADF test, the PP, and the KPSS test to ensure robust results. Furthermore, the study tests the existence of unit root in each variable at level and trend stationarity.

Table 4.3. Unit root test statistics results: 1994q1 to 2003q4 with 10 lags

Number of observation for each model: 28

Variables		ADF		PP		KPSS	
		Constant	Constant + Trend	Constant	Constant + Trend	Constant	Constant + Trend
Level	Unemployment ( $\log U_t$ )	-1.243	-1.966	-0.127	-2.618	0.0496	0.047
	GDP growth rate ( $\log Y_t$ )	-1.808	-2.174	-3.893***	-3.862**	0.0692	0.0695
	Government Consumption Expenditure ( $\log GCE_t$ )	-1.001	-0.283	1.776	-0.946	0.078	0.021
	Fixed Investment ( $\log FI_t$ )	0.351	-1.710	-1.349	-2.095	0.090	0.0158
First Difference	Unemployment ( $\log U_t$ )	-2.137	-2.260	-6.758***	-6.656***	0.080	0.0655
	GDP growth rate ( $\log Y_t$ )	-2.055	-2.049	-12.392***	-11.989***	0.0747	0.0519
	Government Consumption Expenditure ( $\log GCE_t$ )	-0.408	-3.770***	-1.682	-2.141	0.432*	0.0461
	Fixed investment ( $\log FI_t$ )	-1.230	-0.504	-3.450**	-3.368*	0.185	0.165**
Second Difference	Unemployment ( $\log U_t$ )	-2.259*	-2.104	-17.085***	-17.032***	0.973***	0.165*
	GDP growth rate ( $\log Y_t$ )	-3.115**	-2.993	-26.583***	-26.420***	0.166*	0.165*
	Government consumption expenditure ( $\log GCE_t$ )	-5.094***	-5.164***	-6.887***	-6.705***	0.794***	0.217***
	Fixed investment ( $\log FI_t$ )	-1.022	-1.811	-9.676***	-11.055***	0.905***	0.156**

**Note: The ADF and PP statistics test the null hypothesis that variables are not stationary. The KPSS statistic tests the null hypothesis that the variables are stationary. \*\*\*, \*\*, and \* indicates the significance at 1, 5, and 10 percent respectively.**

Source: Stats SA (2015) and SARB (2015)

According to the results presented in Table 4.3, the PP test, ADF test, and KPSS test results are inconsistent for level and First-difference. The results presented in Table 4.3 indicate that Government consumption expenditure (indicated by the ADF, PP, and KPSS test output of -5.094\*\*\*, -6.887\*\*\*, and 0.794\*\*\* respectively) becomes difference stationary at a 1 percent significance level after the second-difference and is trend stationary at a 1 percent significance level as well (indicated by the ADF, PP, and KPSS test output of -5.164\*\*\*, -6.705\*\*\*, and 0.217\*\*\* respectively). This outcome is consistent in all three unit root tests. Furthermore, unemployment rate (with

PP and KPSS output of -17.085\*\*\* and 0.973\*\*\* respectively), GDP growth rate (with PP and KPSS output of -26.583\*\*\* and 0.166\* respectively) and fixed investment (with PP and KPSS output of -9.676\*\*\* and 0.905\*\*\* respectively) become difference stationary and trend stationary after the second-difference, and this is confirmed through the output of the PP test and the KPSS test output. The results presented in Table 4.3 indicate that for the period 1994q1 to 2003q4, government consumption expenditure, unemployment rate, GDP growth rate, and fixed investment are all integrated of order 2, i.e. I(2).

The unit root test results for period 2004-q1-2014q4 are presented in Table 4.4. Here again the study tests for the existence of unit root in each variable at constant level and trend stationarity.

Table 4.4. Unit root test statistics results: 2004q1 to 2014q4 with 10 lags

		Number of observation for each model 28					
Variables		ADF		PP		KPSS	
		Constant	Constant + Trend	Constant	Constant + Trend	Constant	Constant + Trend
Level	Unemployment ( $\log U_t$ )	-0.029	-2.817	-3.529**	-4.084**	0.306**	0.203**
	GDP growth rate ( $\log Y_t$ )	-1.719	-2.151	-3.407**	-3.899**	0.0515	0.0517
	Government Consumption Expenditure ( $\log GCE_t$ )	-2.855*	-0.101	-4.181***	0.454	0.671**	0.0545
	Fixed Investment ( $\log FI_t$ )	-1.936	-2.720	-2.764*	-1.850	0.358**	0.0945
First Difference	Unemployment ( $\log U_t$ )	-1.885	-1.956	-7.305***	-7.984***	0.498***	0.143**
	GDP growth rate ( $\log Y_t$ )	-2.490	-2.483	-12.917***	-12.627***	0.553**	0.198*
	Government Consumption Expenditure ( $\log GCE_t$ )	-0.352	-3.307*	-4.166***	-4.886***	1.22***	0.297***
	Fixed investment ( $\log FI_t$ )	-1.771	-1.847	-3.303**	-3.495*	1.00***	0.213***

**Note: The ADF and PP statistics test the null hypothesis that variables are not stationary. The KPSS statistic tests the null hypothesis that the variables are stationary. \*\*\*, \*\*, and \* indicates the significance at 1, 5, and 10 percent respectively.**

Source: Stats SA (2015) and SARB (2015)

According to the results presented in Table 4.4, the PP test, ADF test, and KPSS test results are inconsistent for level. The results of the PP test and the

KPSS test are fairly consistent at first difference form. Government consumption expenditure, with values resulting from the PP and KPSS test of -4.166\*\*\* and 1.22\*\*\* respectively, unemployment rate, -7.305\*\*\* and 0.498\*\*\*, GDP growth rate, 12.917\*\*\* and 0.553\*\* respectively, and fixed capital investment, -3.303\*\* and 1.00\*\*\* respectively, becomes difference stationary and trend stationary at a 1 percent and 5 percent significance level indicated by the number of asterisk on each value. The results presented in Table 4.4 therefore indicate that for the period 2004q1 to 2014q4, all variables included in the study are integrated of order 1, i.e.  $I(1)$ .

#### **4.5. STATIC DIFFERENCED VERSION MODEL REGRESSION ESTIMATION**

The study first analyses the relationship between the rates of unemployment and economic growth by applying the simple static version of Okun's law as described in Chapter 3. This version uses a non-linear (logarithmic) ordinary least square (OLS) model when analysing the stated relationship. The static version allows the model to consider the effects of the two focal variables, namely, unemployment rate as the dependent and GDP growth rate as the explanatory variable. The Okun's coefficient is predicted to be negative because increasing growth rate is associated with decreasing rates of unemployment. The results of the regression for period 1994q1-2003q4 are illustrated in Table 4.5.

Table 4.5. Simple static differenced version of Okun's law using the OLS method for period 1994q1 to 2003q4

Dependent Variable ( $\log \Delta U_t$ )	First difference			Second difference		
	Coefficient value	t-stat	P-value	Coefficient value	t-stat	P-value
GDP growth rate ( $\log \Delta Y_t$ )	0.164448 (0.1097636)	1.51	0.150	0.1971349 (0.1011656)	1.95	0.059
Constant	0.2331286	0.92	0.366	0.0212698 (0.3222664)	0.07	0.948
<b>R-squared</b>	0.0598			0.0994		
<b>Adjusted R-squared</b>	0.0373			0.0703		
<b>Sum squared residual</b>	72.2024681			141.911544		
<b>Standard Error of regression</b>	1.3969			1.9854		
<b>Number of observations</b>	38					

Source: Stats SA (2015) and SARB (2015)

The output for the first difference regression as presented in Table 4.5 indicates an insignificant unemployment and GDP growth relationship for South Africa in the stated period, indicated by a p-value of 0.150. This result is expected since the first difference unit root analysis indicates non-stationarity at first difference, therefore the consequences indicates spurious results. The variables yield stationary results after the second difference.

The regression output of the second difference confirms that there is a significant positive relationship between unemployment and economic growth rate at almost a 5 percent significance level, indicated by a p-value of 0.059 (Table 4.5). Therefore, the null hypothesis that states there is an insignificant negative relationship between unemployment and economic growth in South Africa cannot be rejected. The result is inconsistent with theory and *apriori* expectations of Okun's law for the period 1994q1 to 2003q4 with regards to the sign on Okun's coefficient. The results indicate that for each 1 percent growth in GDP for the country, the unemployment rate will simultaneously increase by approximately 0.20 percent, *ceteris paribus*.

The R-squared value improved considerably from the first difference to the second difference, from 0.0598 to 0.0994; however it still remains fairly small in value, indicating that the model explains approximately 10 percent of the variations of the GDP growth rate around the mean value. Therefore, Okun's law is invalid for the period 1994q1 to 2003q4 in South Africa. The findings are consistent with similar studies conducted in other developing countries. For example, a study conducted in Macedonia indicates that the difference version of Okun's law resulted in a 1 percent adjustment in the GDP growth. This resulted in a 0.022 percent increase in unemployment, indicating that Okun's law does not apply in the Macedonia economy for the selected period (Sadiku, Ibraimi, and Sadiku, 2014).

The results of the regression for period 2004q1-2014q4 are illustrated in Table 4.6. The first difference regression results indicate a significant negative correlation between unemployment and economic growth over the specified time period in South Africa, indicated by the coefficient value of -0.1177421 and p-value of 0.063. This implies that the null hypothesis, which states that there is no significant negative correlation between unemployment and economic growth in South Africa, can be rejected. The result for the second period of the analysis is therefore consistent with theory and *apriori* expectations of Okun's law for the period 2004q1 to 2014q4.

The result of Okun's coefficient indicates that for every 1 percent increase in GDP growth of the country, unemployment rate will simultaneously decrease by approximately 0.12 percent, *ceteris paribus*. This indicates that Okun's law is valid for the period 2004q1 to 2014q4 in South Africa. However, the proportion of decrease in unemployment is not consistent with the findings of Okun in 1962, which states that a 1 percent increase in GDP growth is likely to result in a 0.33 percent reduction in unemployment.

Furthermore, the R squared value is 0.0796 showing low explanatory power of the model. This low explanatory power could be as a result of the exclusion of some relevant variables from the model. Therefore, the dynamic version expands the model to include two additional explanatory variables that may

influence the unemployment rate of the country. The results, however, are realistic to some extent, since there have been other studies conducted in developing countries that revealed the correlation between unemployment and economic growth to be negative but with different magnitudes as illustrated by Okun (1962). For example, the results of a study conducted in Jordan indicated that the relationship between unemployment and economic growth in the Jordanian economy showed that an increase by 1 percent in unemployment corresponds to a 0.007 percent decrease in GDP growth. This is significantly lower than the expected ratio of Okun's law, which is an inverse 1:3 percentage respectively (Alamro and Al-dalaïen, 2014).

Table 4.6: Simple differenced version of Okun's law applying the OLS method for period 2004q1 to 2014q4

First Difference			
Dependent Variable ( $\Delta U_t$ )	Coefficient value	t-stat	P-value
GDP growth rate ( $\Delta Y_t$ )	-0.1177421 (0.0614239)	-1.94	0.063
Constant	-0.0195688 (0.1568232)	-0.12	0.921
<b>R-squared</b>			0.0796
<b>Adjusted R-squared</b>			0.0577
<b>Sum squared residual</b>			48.390689
<b>Standard Error of regression</b>			1.0598
<b>Number of observations</b>			45

Source: Stats SA (2015) and SARB (2015)

The results of the static model for period 1994q1 to 2003q4, and for period 2004q1 to 2014q4 in South Africa differs significantly in terms of magnitudes and signs on Okun's coefficient. This difference could be due to the theory behind the simple static *differenced version* of Okun's law. These have been critiqued by economists over the years and due to the exclusion of various important explanatory variables from the model, this may lead to biased estimate results (Ayoyinka, 2008).



## 4.6. DYNAMIC VERSION MODEL REGRESSION ESTIMATION

In order to analyse the true effects of GDP growth rate on unemployment, the study further evaluates the *dynamic version* of Okun's law by including two additional explanatory variables that may impact on unemployment in South Africa, namely, government consumption expenditure and fixed capital formation investment.

This *dynamic version* uses a non-linear (logarithmic) ordinary least square (OLS) model when analysing the stated relationship. The *dynamic version* allows the model to consider the effects of the three explanatory variables on unemployment in South Africa. The output for the dynamic version of Okun's law for period 1994q1 to 2003q4 is illustrated in Table 4.7.

Table 4.7. The dynamic non-linear version of Okun's law using OLS method for period 1994q1 to 2003q4

Dynamic version: 1994q1-2003q4				
Dependent Variable ( $U_t$ )	Coefficient value	Standard Error	t-stat	P-value
Unemployment ( $U_{t-1}$ )	-0.3769273	0.1737548	-2.17	0.011
GDP growth rate ( $Y_t$ )	-0.0412258	0.0131234	3.14	0.014
GDP growth rate ( $Y_{t-1}$ )	0.0106945	0.0151846	0.70	0.488
Government Consumption Expenditure ( $\log GCE_t$ )	-1.725038	1.975297	-0.87	0.391
Fixed investment ( $\log FI_t$ )	0.882451	1.279914	0.69	0.497
Constant	0.0043509	0.0203666	0.15	0.882
<b>R-squared</b>	0.5663		<b>Sum squared residual</b>	0.350274295
<b>Adjusted R-squared</b>	0.4374		<b>Standard Error of regression</b>	0.12081
<b>Number of observations</b>	38			

Source: Stats SA (2015) and SARB (2015)

The *dynamic version* of Okun's law for the period 1994q1 to 2003q4 includes the regression results of the second difference of each variable to ensure

more accurate results due to unit root problems causing biased and invalid results. The results seem to be better and more accurate than the simple static version of Okun's law for the specified period. There is a significant negative correlation between unemployment and GDP growth rate at almost 1 percent level over the stated period in South Africa, indicated by the coefficient value of -0.0412258 and a p-value of 0.014 (Table 4.7). Therefore, the null hypothesis that states there is no significant negative relationship between unemployment and economic growth in South Africa can be rejected. This outcome is in line with the *a priori* expectations of the analysis.

However, the value of Okun's coefficient is fairly low (-0.0412258), indicating that a 1 percent increase in GDP growth rate results in approximately 0.041 percent decrease in unemployment over 1994q1 to 2003q4 in South Africa (Table 4.7). Here again, the ratio between unemployment and GDP growth is different and much lower than the magnitude specified by Okun (1962), where a 1 percent increase in GDP growth will result in a 0.41 percent decrease in unemployment.

Furthermore, the logged coefficients of government consumption expenditure (-1.725038), fixed investment (0.882451), and the lagged coefficient on GDP growth (0.0106945) have no significant impact on unemployment indicated by the corresponding high p-values for each of these coefficients illustrated in Table 4.7. The R squared value of 0.5663 is relatively higher than the simple static version, therefore indicating better explanatory power of the *dynamic model* for the stated period.

The output for the *dynamic version* of Okun's law for period 2004q1 to 2014q4 is illustrated in Table 4.8.

Table 4.8. The dynamic logarithmic version of Okun's law using OLS method for period 2004q1 to 2014q4

<b>Dynamic version: 2004q1-2014q4</b>				
<b>Dependent Variable (<math>U_t</math>)</b>	<b>Coefficient value</b>	<b>Standard Error</b>	<b>t-stat</b>	<b>P-value</b>
Unemployment ( $U_{t-1}$ )	-0.7855246	0.1124416	-6.99	0.000
GDP growth rate ( $Y_t$ )	-0.1271667	0.0548831	-2.32	0.037
GDP growth rate ( $Y_{t-1}$ )	-0.0682663	0.0595547	-1.15	0.261
Government Consumption Expenditure ( $\log GCE_t$ )	11.22427	20.76415	0.54	0.581
Fixed investment ( $\log FI_t$ )	-4.246961	7.915333	-0.54	0.069
Constant	0.0472598	0.7827523	0.06	0.952
<b>R-squared</b>	0.7324		<b>Sum squared residual</b>	831.388353
<b>Adjusted R-squared</b>	0.6752		<b>Standard Error of regression</b>	4.944
<b>Number of observations</b>	44			

Source: Stats SA (2015) and SARB (2015)

The *dynamic version* of Okun's law for the period 2004q1 to 2014q4 includes the regression results of the first difference of each variable due to the same reason described above. Here again, the results seem to be better and more accurate than the simple static version of Okun's law for the specified period. During the time period 2004q1 to 2014q4, GDP growth (with coefficient value of -0.1271667 and p-value of 0.037) was found to have a significant negative impact on unemployment at a 5 percent conventional level (Table 4.8). Therefore, the null hypothesis that states there is no significant negative relationship between unemployment and economic growth in South Africa can be rejected. The output indicates that for a 1 percent increase in GDP growth rate in South Africa, unemployment is likely to decline by approximately 0.13 percent during this period, *ceteris paribus*.

Furthermore, fixed investment seems to have a significant negative impact on unemployment at almost 10 percent conventional level, indicated by a coefficient value of -4.246961 and a p-value of 0.069, which is in line with the *a priori* expectations of the study, indicating that for a 1 percent increase in South Africa's fixed investment, unemployment will decrease by approximately 4 percent, *ceteris paribus*. The R squared value of 0.7324 has

improved further to 0.73 from the simple static model, thus indicating improved explanatory power of the dynamic model.

The results of the *dynamic version* of Okun's law for both time periods analysed in the study reveal a negative relationship between unemployment and GDP growth. This result is seemingly consistent with the theory put forward by Okun in 1962. Furthermore, other studies conducted in developing countries, such as Nigeria, revealed a significant positive relationship between employment and GDP growth, in which public expenditure and foreign private capital were included as additional explanatory variables. The outcome of the study conducted in Nigeria, as discussed in Chapter 2, indicated that a 1 percent increase in GDP growth led to a 0.35 percent increase in employment (Sidope and Ogunrinola, 2011).

#### **4.7. ANALYSIS OF THE INTER-RELATIONSHIP BETWEEN UNEMPLOYMENT AND ECONOMIC GROWTH IN SOUTH AFRICA**

The Vector Auto-regression (VAR) model is used to determine whether or not an inter-relationship exists between unemployment and economic growth in South Africa for the periods 1994q1 to 2003q4 and 2004q1 to 2014q4.

In order to ensure unbiased results, the VAR model used the third difference results for the period 1994q1-2004q4 and the fifth difference for the period 2004q1-2014q4 in conducting the analysis. The Akaike Information Criteria (AIC), the Hannan-Quinn Information Criterion (HQIC), and the Schwarz Bayesian Information Criterion (SBIC) have chosen 10 lags as the optimal number of lags for conducting the VAR regression analysis for both periods, i.e. 1994q1-2004q4 and 2004q1-2014q4.

The VAR model regression results for the period 1994q1 to 2003q4 are illustrated in Table 4.9.

Table 4.9. VAR Model in analysing the inter-relationship between  
unemployment and economic growth: 1994q1-2003q4

Lag length chosen by AIC SBIC and HQIC: 10

Number of observations: 28

Variables	Coefficient values	Standard error	t-stat	p-value
<b>Dependent variable <math>\ln\Delta U_t</math></b>				
$\ln\Delta U_{t-1}$	-1.389218	0.2139561	-6.49	0.001
$\ln\Delta U_{t-2}$	-2.067036	0.3522068	-5.87	0.002
$\ln\Delta U_{t-3}$	-2.069961	0.5132771	-4.03	0.010
$\ln\Delta U_{t-4}$	-1.873497	0.6029577	-3.11	0.027
$\ln\Delta U_{t-5}$	-1.846322	0.6406073	-2.88	0.035
$\ln\Delta U_{t-6}$	-1.568522	0.6332506	-2.48	0.056
$\ln\Delta U_{t-7}$	-1.453371	0.5542843	-2.62	0.047
$\ln\Delta U_{t-8}$	-0.3916521	0.5214866	-0.75	0.486
$\ln\Delta U_{t-9}$	-0.0261571	0.3351338	-0.08	0.941
$\ln\Delta U_{t-10}$	0.2544225	0.2582851	0.99	0.370
$\ln\Delta Y_{t-1}$	-0.9374023	0.3155177	-2.97	0.031
$\ln\Delta Y_{t-2}$	-1.049567	0.3809117	-2.76	0.040
$\ln\Delta Y_{t-3}$	-0.6918705	0.3973519	-1.74	0.142
$\ln\Delta Y_{t-4}$	-0.6209132	0.4315828	-1.44	0.210
$\ln\Delta Y_{t-5}$	-0.6495021	0.4488522	-1.45	0.208
$\ln\Delta Y_{t-6}$	-0.8663342	0.4156623	-2.08	0.092
$\ln\Delta Y_{t-7}$	-0.9294247	0.2996736	-3.10	0.027
$\ln\Delta Y_{t-8}$	-0.7785784	0.2813551	-2.77	0.039
$\ln\Delta Y_{t-9}$	-0.6009906	0.25491	-2.36	0.065
$\ln\Delta Y_{t-10}$	-0.32726	0.1596252	-2.05	0.096
<b>Constant</b>	-0.0877531	0.1830789	-0.48	0.652
<b>Dependent variable <math>\ln\Delta Y_t</math></b>				
$\ln\Delta U_{t-1}$	-0.7222587	0.4655589	-1.55	0.182
$\ln\Delta U_{t-2}$	-1.331652	0.6107794	-2.18	0.081
$\ln\Delta U_{t-3}$	-1.226292	0.7296705	-1.68	0.154
$\ln\Delta U_{t-4}$	-.9722244	0.7767549	-1.25	0.266
$\ln\Delta U_{t-5}$	-1.044412	0.7707239	-1.36	0.233
$\ln\Delta U_{t-6}$	-0.8788928	0.7138802	-1.23	0.273
$\ln\Delta U_{t-7}$	-0.8975119	0.617674	-1.45	0.206
$\ln\Delta U_{t-8}$	0.0084408	0.4743748	0.02	0.986
$\ln\Delta U_{t-9}$	0.0674536	0.2875998	0.23	0.824
$\ln\Delta U_{t-10}$	0.3452506	0.1881407	1.84	0.126
$\ln\Delta Y_{t-1}$	-0.8714813	0.2298384	-3.79	0.013
$\ln\Delta Y_{t-2}$	-0.9774714	0.2839812	-3.44	0.018
$\ln\Delta Y_{t-3}$	-0.6249697	0.3323989	-1.88	0.119
$\ln\Delta Y_{t-4}$	-0.6489	0.3341242	-1.94	0.110
$\ln\Delta Y_{t-5}$	-0.7604341	0.3113033	-2.44	0.058
$\ln\Delta Y_{t-6}$	-0.874369	0.2953039	-2.96	0.031
$\ln\Delta Y_{t-7}$	-0.7205218	0.3023705	-2.38	0.063
$\ln\Delta Y_{t-8}$	-0.6633556	0.2470139	-2.69	0.044
$\ln\Delta Y_{t-9}$	-0.5965261	0.1757033	-3.40	0.019
$\ln\Delta Y_{t-10}$	-0.3521249	0.1003914	-3.51	0.017
<b>Constant</b>	-0.0276423	0.1609899	-0.17	0.870

Source: Stats SA (2015) and SARB (2015)

In the conditions of the model, when unemployment rate is considered the dependent variable, the results indicate that the first 7 lagged coefficient values on unemployment, ranging from -0.7222587 to -0.8975119, have a significant negative impact on the current levels of unemployment at a 5 percent significance level as illustrated in Table 4.9. Thereafter, from 8 to 10 lags, there is no significant impact on current levels of unemployment. Furthermore, the lagged coefficients of GDP growth rate that have a significant negative impact on current levels of unemployment are the first, second, sixth, seventh, eighth, ninth and tenth lagged values on GDP growth rate, with significance levels ranging from 3 percent to 10 percent levels. The third, fourth, and fifth lags have no significant impact on the current levels of unemployment for the selected period in South Africa (Table 4.9).

When current level of GDP growth is considered as the dependent variable, the results seem to be unexpected. Surprisingly, the lagged coefficients on unemployment reaching 10 lags have no significant impact on the current levels of GDP growth. However, lagged GDP growth rates have an astonishing significantly negative impact on the current GDP growth rate at a 5 percent significance level, except for the third lag (with p-value of 0.119) and fourth lag (with p-value of 0.110), which indicates insignificant effects (Table 4.9).

Therefore, for the period 1994q1 to 2003q4, the VAR model produces inconsistent results for explaining the existence of an inter-relationship between unemployment and economic growth rates in South Africa. There is indeed a significant negative relationship between unemployment and lagged GDP growth; however, there exists an insignificant relationship between GDP growth and lagged unemployment rates for the specified period.

The VAR model regression results for the period 2004q1 to 2014q4 are illustrated in Table 4.10.

Table 4.10. VAR Model in analysing the inter-relationship between  
unemployment and economic growth: 2004q1-2014q4

Lag length chosen by AIC SBIC and HQIC: 10

Number of observation: 28

Variables	Coefficient values	Standard error	t-stat	p-value
<b>Dependent variable <math>\ln\Delta U_t</math></b>				
$\ln\Delta U_{t-1}$	-3.265086	0.2389291	-13.67	0.000
$\ln\Delta U_{t-2}$	-6.525797	0.7361973	-8.86	0.000
$\ln\Delta U_{t-3}$	-9.887583	1.340685	-7.38	0.000
$\ln\Delta U_{t-4}$	-12.03457	1.893983	-6.35	0.000
$\ln\Delta U_{t-5}$	-12.37256	2.210454	-5.60	0.000
$\ln\Delta U_{t-6}$	-10.73352	2.151795	-4.99	0.001
$\ln\Delta U_{t-7}$	-8.030889	1.757029	-4.57	0.001
$\ln\Delta U_{t-8}$	-4.950119	1.193889	-4.15	0.002
$\ln\Delta U_{t-9}$	-2.315845	0.6645325	-3.48	0.007
$\ln\Delta U_{t-10}$	-0.7184417	0.2383972	-3.01	0.015
$\ln\Delta Y_{t-1}$	0.1169602	0.1893717	0.62	0.552
$\ln\Delta Y_{t-2}$	0.2989729	0.3304834	0.90	0.389
$\ln\Delta Y_{t-3}$	0.4706564	0.4622396	1.02	0.335
$\ln\Delta Y_{t-4}$	0.494918	0.5729168	0.86	0.410
$\ln\Delta Y_{t-5}$	0.4403408	0.6244417	0.71	0.499
$\ln\Delta Y_{t-6}$	0.3112926	0.5985498	0.52	0.616
$\ln\Delta Y_{t-7}$	0.0535381	0.4905339	0.11	0.915
$\ln\Delta Y_{t-8}$	-0.1457648	0.3385704	-0.43	0.677
$\ln\Delta Y_{t-9}$	-0.1986309	0.2028149	-0.98	0.353
$\ln\Delta Y_{t-10}$	-0.1206194	0.0825718	-1.46	0.017
<b>Constant</b>	0.0008397	0.1896192	0.00	0.997
<b>Dependent variable <math>\ln\Delta Y_t</math></b>				
$\ln\Delta U_{t-1}$	0.6438119	5.821871	0.11	0.914
$\ln\Delta U_{t-2}$	0.7039385	12.00441	0.06	0.955
$\ln\Delta U_{t-3}$	0.1121019	18.60294	0.01	0.995
$\ln\Delta U_{t-4}$	-0.1422446	23.19366	-0.01	0.995
$\ln\Delta U_{t-5}$	-0.1057534	24.46446	-0.00	0.997
$\ln\Delta U_{t-6}$	0.2885071	21.82841	0.01	0.990
$\ln\Delta U_{t-7}$	0.4019883	16.74098	0.02	0.981
$\ln\Delta U_{t-8}$	0.1732907	10.6482	0.02	0.987
$\ln\Delta U_{t-9}$	-0.6718328	5.320772	-0.13	0.902
$\ln\Delta U_{t-10}$	-0.9850384	1.735934	-0.57	0.584
$\ln\Delta Y_{t-1}$	-2.845119	0.3499031	-8.13	0.000
$\ln\Delta Y_{t-2}$	-4.445852	1.029985	-4.32	0.002
$\ln\Delta Y_{t-3}$	-5.383378	1.814764	-2.97	0.016
$\Delta \ln Y_{t-4}$	-5.973472	2.398265	-2.49	0.034
$\ln\Delta Y_{t-5}$	-6.077341	2.672825	-2.27	0.049
$\ln\Delta Y_{t-6}$	-5.391291	2.618782	-2.06	0.070
$\ln\Delta Y_{t-7}$	-3.861482	2.220243	-1.74	0.116
$\ln\Delta Y_{t-8}$	-2.398686	1.599593	-1.50	0.168
$\ln\Delta Y_{t-9}$	-1.517953	0.9940964	-1.53	0.161
$\ln\Delta Y_{t-10}$	-0.6643421	0.4260593	-1.56	0.153
<b>Constant</b>	0.0104133	0.9913874	0.01	0.992

Source: Stats SA (2015) and SARB (2015)

In the conditions of the model, when unemployment rate is considered the dependent variable, the results indicate that all 10 lagged coefficient values on unemployment have a significant negative impact on the current levels of unemployment at a 1 percent significance level. The first 9 lagged values on GDP growth rate have an insignificant impact on the current levels of unemployment. However, the tenth lagged coefficient (-0.1206194) is reported to have a significant negative impact on unemployment (indicated by a p-value of 0.017) as theory predicts (Table 4.10).

When current level of GDP growth is considered as the dependent variable, the 10 lagged values on the unemployment variable have no significant impact on the current GDP growth rate. Furthermore, the first 6 lagged values on GDP growth rate have a significant negative impact on the current GDP growth rate for the specified period, of which five are at a 5 percent significance level and one is at a 7 percent significance level (Table 4.10).

The results thus indicate that for the period 2004q1 to 2014q4, the VAR model produces inconsistent results for explaining the existence of an inter-relationship between unemployment and economic growth rate in South Africa. There is indeed a significant negative relationship between unemployment and the GDP growth variable lagged 10 times. However, there exists an insignificant relationship between GDP growth and lagged unemployment rates for the specified period.

#### **4.8. THE UNIT ROOT TEST FOR CO-INTEGRATION**

As discussed in Chapter 4, the Engle-Granger test for co-integration is used to analyse the stationarity of the residual term included in the model. The analysis of the results for the period 1994q1 to 2003q4 are illustrated in Table 4.11.



Table 4.11. Engle-Granger test for co-integration: 1994q1-2003q4  
Number of observations: 40

		<b>ADF</b>		<b>PP</b>	
		t-stat	p-value	t-stat	p-value
		-5.871	0.0000	-5.893	0.0000
<b>Test critical values</b>	1% level	-3.661		-3.665	
	5% level	-2.955		-2.951	
	10% level	-2.612		-2.609	

Source: Stats SA (2015) and SARB (2015)

The ADF test and the PP test conducted on the residuals to test for co-integration and unit root of the residual terms for the period 1994q1 to 2003q4. The test-statistic (-5.871 and -5.893) for this period was found to be less than the critical values at all conventional level for both the tests, and hence the null hypothesis of a unit root must be rejected at greater than 1 percent significance level (Table 4.11). Therefore, the variables are trending together and residuals are said to be stationary. Thus the time series are said to be co-integrated, and hence the initial regression results are proved not to be spurious.

The co-integration analysis results for the period 2004q1 to 2014q4 are illustrated in Table 4.12.

Table 4.12. Engle-Granger test for co-integration: 2004q1-2014q4  
Number of observations: 42

		<b>ADF</b>		<b>PP</b>	
		t-stat	p-value	t-stat	p-value
		-6.730	0.0000	-6.775	0.0000
<b>Test critical values</b>	1% level	-3.631		-3.631	
	5% level	-2.932		-2.946	
	10% level	-2.610		-2.609	

Source: Stats SA (2015) and SARB (2015)

Here again the ADF test and the PP test is conducted on the residual terms to test for co-integration and unit root on the residual terms for the period 2004q1 to 2014q4. The test-statistic for this period (-6.730 and -6.775) was also found to be less than the critical values at all conventional level for both the tests (Table 4.12). Hence, the null hypothesis of a unit root must be rejected at greater than 1 percent significance level. Therefore, the variables are trending together and residuals are said to be stationary. Thus the time series are said to be co-integrated, and as a consequence the initial regression results for the specified period are proved not to be spurious.

#### 4.9. AN ANALYSIS OF THE ERROR CORRECTION MODEL REGRESSION RESULTS

The results of the error correction model for the period 1994q1 to 2003q4 are illustrated in Table 4.13. As discussed in the previous Chapter, the error correction term should be within the following range:  $-1 \leq \gamma \leq 0$ , and for the selected period, the error correction term falls within the range and is given by -0.1315169

Table 4.13. Error Correction Model: 1994q1-2003q4

**Dependent variable:**  $\Delta U_t$   
Number of observations: 40

Variable	Coefficient	Standard error
$\Delta Y_{t-1}$	-0.0185551**	0.0091662
$\Delta U_{t-1}$	-0.7009453***	0.1441135
$\Delta \log GCE_t$	-0.315312	1.757109
$\Delta \log FI_t$	0.1489823	1.046377
Speed of Adjustment ( $e_{t-1}$ )	-0.1315169****	0.0408730
Constant	0.0293451	0.0526915
<b>R-squared</b>	0.7440	
<b>Adjusted R-squared</b>	0.6855	

\*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% levels respectively

Source: Stats SA (2015) and SARB (2015)

According to Table 4.13, the error correction mechanism of approximately 13.15 percent is significant at 1 percent. The error correction term is fairly small and close to zero, thereby indicating that the adjustment towards equilibrium after a shock is quite slow. The results show that for the system of unemployment rates in South Africa to be reinstated back to equilibrium, a short run adjustment rate of approximately 13.15 percent per quarter may be applied. This translates to seven quarters, or almost 2 years, for the full disequilibrium effect to be sorted out. Thus, there is evidence of inertia in the system.

Furthermore, the coefficients on the lagged difference of unemployment,  $\Delta U_{t-1}$  (-0.7009453\*\*\*), the lagged difference of,  $\Delta Y_{t-1}$  (-0.0185551\*\*), the differenced government consumption expenditure (-0.315312), and the fixed investment (0.1489823) variables represent the short-run coefficient effects on the dependent variable for the specified period. From the results, it is evident that  $\Delta U_{t-1}$  is individually significant at 1 percent;  $\Delta Y_{t-1}$ , is individually significant at 5 percent, whereas government consumption expenditure and fixed investment are not significant at any conventional levels (Table 4.13). Thus, the lag of unemployment and the lag of GDP growth rate have a short-run impact on the levels of current unemployment in South Africa for the period 1994q1 to 2003q4.

The results of the error correction model for the period 2004q1 to 2014q4 is illustrated in Table 4.14.

Table 4.14. Error Correction Model: 2004q1-2014q4

**Dependent variable:  $\Delta U_t$**   
Number of observations: 42

Variable	Coefficient	Standard error
$\Delta Y_{t-1}$	-0.0641796**	0.0273611
$\Delta U_{t-1}$	-0.695313***	0.0924815
$\Delta \log GCE_t$	10.8851	18.76960
$\Delta \log FI_t$	-3.629391	7.15530
Speed of Adjustment ( $e_{t-1}$ )	-0.1208174**	.0552965
Constant	0.050881	0.7076015
<b>R-squared</b>	0.7679	
<b>Adjusted R-squared</b>	0.7336	

\*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% levels respectively

Source: Stats SA (2015) and SARB (2015)

The error correction term for the period 2004q1 to 2014q4 is given by -0.1208174 (Table 4.14). This value is statistically significant at a 5 percent significance level. The error correction term again is fairly small and close to zero, thereby indicating that the adjustment towards equilibrium after a shock is quite slow. The results show that for the system of unemployment rates in South Africa to be reinstated back to equilibrium, a short run adjustment rate of approximately 12.08 percent per quarter may be applied. This translates to eight quarters, or nearly 2 years to eliminate disequilibrium, reflecting labour market rigidities in the South African economy.

The results indicate that the lagged value of unemployment,  $\Delta U_{t-1}$ , (-0.695313\*\*\*), and the lagged value of GDP growth rate,  $\Delta Y_{t-1}$  (-0.0641796\*\*), are both statistically significant at 1 percent, whereas government consumption expenditure (10.8851) and fixed investment (-3.629391) are not significant at any conventional levels. Thus, the lag of unemployment and the lag of GDP growth rate have a short-run impact on the levels of current unemployment in South Africa for the period 2004q1 to 2014q4.

Table 4.15. Engle-Granger Causality Test Results

Year	Variable Y	Variable X	P-value	Obsv.
1994-2003	Unemployment rate ( $U_t$ )	GDP growth rate ( $Y_t$ )	0.5451	40
	GDP growth rate ( $Y_t$ )	Unemployment rate ( $U_t$ )	0.3104	
2004-2014	Unemployment rate ( $U_t$ )	GDP growth rate ( $Y_t$ )	0.1460	42
	GDP growth rate ( $Y_t$ )	Unemployment rate ( $U_t$ )	0.6453	

Source: Stats SA (2015) and SARB (2015)

According to the results obtained from the Granger causality test, the p-values are statistically insignificant at all conventional levels (Table 4.15), indicating that the null hypothesis of no causality cannot be rejected for both selected periods and both variables in South Africa. This indicates that unemployment does not Granger-cause GDP growth rate and vice versa. This further implies that there is no two-way relationship between economic growth and unemployment in the country, which is in line with the co-integration findings previously analysed.

#### 4.10. CONCLUSION

The dynamic version of Okun's law gives the best overall fit of the OLS model for both time periods, 1994q1-2003q4 and 2004q1-2014q4, as indicated by the relatively high R squared values of approximately 0.57 and 0.73 respectively. Furthermore, the dynamic model indicates that Okun's law is valid for the South African economy for both selected time periods. It is essential to note that the model is in logarithmic form, thus the coefficients are interpreted as elasticities. Here we see that the unemployment elasticity for the time period 1994q1-2003q4 is given by the coefficient on GDP growth rate i.e. -0.04. This indicates that a 1 percent increase in GDP growth decreases unemployment by 0.04 percent for the selected period in South Africa, *ceteris paribus*. Subsequently, the unemployment growth elasticity for the period 2004q1-2014q4 is given by approximately -0.13. This confirms that for a 1

percent increase in GDP growth, unemployment will decrease by approximately 0.13 percent, *ceteris paribus*.

The unemployment growth elasticities for both periods provide some indication of how unemployment varies with the economic growth of the country. The value of unemployment elasticities for both time periods are significantly less than one indicating that a given level of GDP growth brings about a less than proportionate decline in unemployment rate in the South African economy. This shows a lack of a strong elastic relationship between unemployment and GDP growth in South Africa.

In determining whether or not there exists a relationship between unemployment and economic growth in South Africa, the VAR model regression output for the time period 1994q1 to 2003q4 reveals the GDP growth rates tend to have a significant impact on the unemployment rate, and for the time period 2004q1 to 2014q4, the output reveals that the GDP growth tends to have a significant impact on the unemployment at 10 lags. Furthermore, there is no evidence of any contemporaneous impact of unemployment rate on GDP growth rate for both the selected time periods in South Africa.

The co-integration test results reveal that the residual terms included in the model are stationary, and therefore co-integrated for both the selected time periods. This further indicates that the results obtained from the OLS model and the VAR model are not spurious, and therefore are valid.

The ECM results indicate that for the period's 1994q1-2003q4 and 2004q1-2014q4, the speed of adjustment is approximately 13.15 percent and 12.08 percent respectively, which are both fairly low, thus concluding that any adjustment after a shock for the specified period is quite slow, suggesting rigidities and inertia in growth, unemployment, and the macro-environment in South Africa. The results posit that for the specified time periods, lagged GDP growth rate and lagged unemployment rate have a significant negative impact on unemployment in the short run. However, for both the selected time

periods, fixed investment is found to impact on reducing unemployment, but the relationship is not significant at the conventional level in the short run.

## **CHAPTER FIVE: SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS**

### **5.1. INTRODUCTION**

The South African economy has experienced persistent low economic growth and high unemployment rates over the post-apartheid era. The South African Government, through the NDP and National Economic and Labour Council (NEDLAC) have initiated policies to combat the problems associated with unemployment and economic growth. However, such interventions have not been highly successful. This study analysed the impact of unemployment on economic growth in post-apartheid South Africa, covering the period 1994-2014. It also examined whether or not Okun's law is valid for the South African economy, and analysed the corresponding unemployment elasticities.

The chapter summarizes the findings of the study in response to the objectives of the study and research questions. Conclusions and recommendations as well as implications for future research are presented.

### **5.2. SYNTHESIS OF FINDINGS**

The study analysed the impact of unemployment on economic growth in post-apartheid South Africa. The study used quarterly data from the South African Reserve Bank for the period 1994-2014. The time series data is further examined in a two-time period analyses, 1994q1-2003q4 and 2004q1-2014q4.

The major findings of the study are synthesized below.

- There is sufficient support for Okun's law in post-apartheid South Africa for the period 1994q1-2003q4 and 2004q1-2014q4, indicating that a



reduction in GDP does impact negatively on creating further unemployment in the country.

- The unemployment growth elasticity has evidently improved over the two decades from -0.04 in period 1994q1-2003q4 to -0.13 in period 2004q1-2014q4, *ceteris paribus*.
- The unemployment growth elasticity is less than one, indicating that a given level of GDP growth brings about a less than proportionate decline in unemployment rate in the South African economy.
- There is evidence of a 'weak' elastic relationship between unemployment and economic growth in post-apartheid South Africa for the two decade period.
- The sensitivity of labour absorption to economic growth is rather low. This indicates that economic growth does not sufficiently generate growth in demand for labour, perhaps indicating labour market rigidities in South Africa.
- The *Dynamic version* of Okun's law gives a better overall fit of the OLS model as compared to the *Differenced version* of Okun's law for both specified time periods.
- The results of the VAR model showed no evidence of any contemporaneous impact of unemployment rate on GDP growth rate for both the selected time periods in South Africa.
- The co-integration test results revealed that the residual terms for both time periods were stationary and thus co-integrated.
- The ECM results indicate that for the period's 1994q1-2003q4 and 2004q1-2014q4, the speed of adjustment is approximately 13.15 percent and 12.08 percent respectively, which are both fairly low, thus

concluding that any adjustment after a shock for the specified period is quite slow, perhaps reflecting rigidities in the labour market.

Overall, the results for period 1994q1-2003q4 indicate that there is support for the main hypotheses of the study. Specifically, the study found a significantly negative relationship between unemployment and GDP growth rate in post-apartheid South Africa. Furthermore, the results for period 2004q1-2014q4 indicate that there is support for two out of the three alternate hypotheses. In detail, the study revealed a significantly negative relationship between unemployment and economic growth; and a significantly negative relationship between unemployment and fixed capital formation investment in post-apartheid South Africa.

This study did not consider the effects of productivity and trade on unemployment in South Africa. Hence, as directions for future research, further studies could investigate the relationship on the effects of productivity on employment.

### **5.3. POLICY RECOMMENDATIONS**

The end of Apartheid in 1994 brought hope to South Africans in terms of transformation to political empowerment and economic progress. Following the democratic election in 1994, South Africa has experienced improvements in access to education, health care, and decline in poverty levels. The relatively high unemployment in South Africa is due to various current economic and structural factors. The Greece and China economic crises, as well as low domestics and foreign direct investment, electricity shortages, high levels of corruption, poor levels of education, poor labour relations and capacity to deliver, are some of the factors that have contributed to the low employment and economic growth rates in South Africa (Johnson, 2015; Lings, 2014).

Using the dynamic version of Okun's Law, the study recorded coefficient values of 0.04 and 0.13 for the periods 1994-2003 and 2004-2014 respectively. The outcomes therefore suggest that there is an inverse relationship between unemployment rate and GDP growth rate for the South African economy during the specified period. These results are consistent with that of Okun's law, indicating that the lack of economic growth does explain the relatively high unemployment rate problem that the South African economy is currently facing.

South African government needs to place more emphasis on addressing the low rates of economic growth to address the high rates of unemployment in the country (Moroke, Leballo, and Mello, 2014). Since the low economic growth rate is found to have a significant impact on this study further recommends that policy makers should focus on policies that are labour absorbing to enhance the employment situation in the country, more specially creating employment opportunities for the youth (Moroke et al, 2014). Rigidities in the labour market are to be minimized to create incentives for firms to employ more labour.

Policy-makers have implemented a number of policies during the post-apartheid era to help alleviate unemployment in the country. Policies such as ASGISA, GEAR, and the NDP have shown various limitations. Bhorat et al (2013) indicate that these policies have, at best, short-term impacts are unable to sustain the long run benefits.

The government finds it extremely difficult to deal with the rising unemployment rates, considering unpredictable external factors impacting on the South African economy. According to the Global Entrepreneurship Monitor reports, excessive regulations impact adversely on entrepreneurship and employment creation. Furthermore, load shedding since 2008 and costly communication methods together with high levels of crime and public sector inefficiencies have led to foreign investors finding it risky to invest in South Africa, which compound the unemployment (Bhorat et al, 2013; Parson, 2013).

The government constantly faces a critical short run challenge of implementing policies that would aid in boosting economic growth and creating employment opportunities, especially youth employment. In doing so, the government has recently (since 2014) implemented the youth wage subsidy programme to help boost youth employment. The government should aim to implement prudent macroeconomic fiscal policies to address its current challenges.

Government should ensure good, reliable, and cheap infrastructure services, to support investments and innovations. The established reason for unemployment in South Africa is the mismatch in skills requirements of industry and skills available in the labour market. The South African government should focus attention in developing policies and legislation that are relevant to structural transformation in the labour market. In addressing high levels of unemployment, government should consider implementing pro-growth macroeconomic policies and targeting skills deficiencies, as well as introducing labour market flexibilities, thus enhancing employment potentials.

Government further faces challenges associated with quality of tertiary education and teacher performance management (Bhorat et al, 2013). According to the World Competitiveness Report (2014), South Africa is one of the least labour productive nations in the world. This is partly due to the education system, especially in the science, technology, and crafts trade. The government should execute policies to encourage labour productivity by creating skilled training and enhancing the work ethic of labour (Johnson, 2015).

In investigating the statistical results of the Granger causality test following shocks in the economy, the study found that the variables, namely, unemployment and GDP growth, have no causal effect on one another. This indicates that during any sharp or anticipated shock to the economy, policy interventions may not be as effective in restoring the long-run equilibrium

between the unemployment rate and economic growth rate in the economy (Phiri, 2014).

Furthermore, the results stipulate that economic growth does not granger cause unemployment, therefore policies that are intended to improve economic growth rate in the country, such as foreign exchange policies, will have limited impact on reducing unemployment in the long-run (Phiri, 2014).

Government should rather focus policies on structural labour transformation policies, and further create employment opportunities by encouraging foreign direct investment and entrepreneurship, which would create employment opportunities and thus reduce unemployment. Entrepreneurial opportunities are one of the main factors that generate employment in most countries. More jobs can be created if the level of entrepreneurship in South Africa improves. According to the 2014 Global Entrepreneurship Monitor (GEM) report, the early stage total entrepreneurial activity (TEA) rate decreased from 10.6% in 2013 to 7% in 2014. Hopefully, with a new ministry for small businesses created since 2014, the rate of entrepreneurship can be enhanced, thus leading to higher levels of job creation and output expansion. Businesses and foreign investors believe that labour legislations in South Africa are too rigid and do not sufficiently encourage entrepreneurship development and foreign business investment. For example, the South African labour legislation encourages strikes and protest actions, and does not support flexible employment (casual appointments and temporary employment). Furthermore, the Employment Equity Act compromises excellence or merit by giving preference to designated employees.

To encourage employment, the government should address the factors mentioned above. Generally, as this study's results indicate a negative relationship between unemployment and economic growth in South Africa, government policies that are aimed on persistently improving and sustaining high levels of economic growth and job creation in the spirit of the NDP could be a solution to declining unemployment over the long run. The NDP suggests

that the economy needs to grow at an average rate of 6 percent to bring about enhanced job opportunities and prosperity for all.

## **5.4. CONCLUSION**

South Africa has the potential to register higher levels of economic growth and employment creation. Implementing the right policies with effective human capital and exemplary leadership can make a difference. By attracting foreign businesses and encouraging local high value-adding entrepreneurship activities in South Africa, the demand for labour will increase. Job opportunities can be created for those that are unemployed. This will consequently lead to improved income levels and thus raising consumption, savings, investments, and will further contribute to sustainable GDP growth in the country (Faulkner, Loewald, and Makrelvo, 2013; Herbst and Mills, 2015).

The unemployment rate in South Africa is a cause for major concern. The South African government is yet to find a significant long run solution to combat the rising unemployment rates. The high unemployment rate contributes to social problems, such as crime, poverty, and poor quality of life, which in turn adversely affect the economy as a whole. (Lee, 2004; Parsons, 2013). Symptoms of social problems are already apparent with frequent service delivery protests in South Africa, and more recently with mass demonstrations and student unrests on a national scale.

The NDP suggests that the economy needs to grow at an average rate of 6 percent to bring about enhanced job opportunities and prosperity for all. Hopefully, with an enhanced environment supportive of private enterprise development and infrastructure investment and good leadership, South Africa can be placed on the high economic growth and employment path.

## REFERENCE

1. Abdulla, A. K. (2012). 'The Relationship between Economic Growth and Unemployment in Iraq', Iraqi Journal for Economic Sciences, 32(10), 193-203.
2. Acemoglu, D. (1997). 'Technology, Unemployment and Efficiency', European Economic Review, 41, 525-533.
3. Alamro, H. and Al-dalaïen, Q. (2014). 'Modelling the relationship between GDP and unemployment for Okun's law specific to Jordan', MPRA Paper 55302, University Library of Munich, Germany.
4. Al-Habees, M. A. and Rumman, M. A. (2012). 'The Relationship Between Unemployment and Economic Growth in Jordan and Some Arab Countries', World Applied Sciences Journal, 18(5), 673-680.
5. Andrei, D.B. Vasile, D. and Adrian, E. (2009). 'The correlation between unemployment and Real GDP growth: A study case on Romania', The Academy of Economic Studies Faculty of Finance, Insurance and Banking.
6. Annual Labour Market Bulletin (2014). 'ANNUAL LABOUR MARKET BULLETIN APRIL 2013 - MARCH 2014', Department of Labour, Republic of South Africa.
7. Arewa, A. and Nwakanma, P.C. (2012). 'Potential-Real GDP relationship and growth process of Nigeria Economy: An empirical re-evaluation of Okun's Law', European Scientific Journal, No. 8(9).
8. Arico. F.R. (2001). 'Growth and Unemployment: towards a theoretical integration', Department of Economics and Quantitative Methods, University of Pavia, Italy.

9. Arora. V. (2005). 'Economic growth in Post-apartheid South Africa: A Growth Accounting Analysis', In: M. Nowak and L.A. Ricci (eds.). Post-Apartheid South Africa: The First Ten Years. Washington, International Monetary Fund.
  
10. Bangane, W. T. (1999). 'The unemployment problem in South Africa with reference to the Lekoa Vaal Triangle Metropolitan Area (LVTMA)', Faculty of Arts, The Rand Afrikaans University, unpublished.
  
11. Bankole, A.S. and Fatai, B.O. (2013). 'Empirical Test of Okun's Law in Nigeria', International Journal of Economic Practices and Theories, 3(3): 227-231.
  
12. Bhorat, H. Hirsch, A. Kanbur, R. and Ncube, M. (2013). 'Economic Policy in South Africa Past, Present, and Future', Oxford Companion to the Economics of South Africa, Oxford University Press.
  
13. Blumenfeld, J. (2014) 'Youth unemployment in South Africa and the wage subsidy debate', page 62-70.
  
14. Brunner, K. and Meltzer, A. H. (1978). 'Theory of Employment and Unemployment', Paper presented at Konstanz Seminar 1978.
  
15. Buba, S. and Ishak, S. (2014). 'An Analysis of the Effect of Real Gross Domestic Product on Unemployment in Nigeria (An ARDL-Approach)', University Putra Malaysia, Journal of Economics and Sustainable Development, 5(14): 7-13.
  
16. Budget Review (2014). 'Chapter 2: Economic Outlook', National Development plan, page 13-30.
  
17. Castells-Quintana, D. and Royuela, V. (2012). 'Unemployment and long-run economic growth: The role of income inequality and



- urbanisation', *Investigaciones Regionales*, No. 24: 153-173.
18. Central Bank of Malta (2013). 'Estimating Okun's Law for Malta', *Quarterly Review*, 2013:3.
19. Christensen, L. B. (1994). 'Experimental Methodology', 6<sup>th</sup> edition. Massachusetts: Allyn and Bacon.
20. Cooley, T.F. and Quadrini, V. (1999). 'A neoclassical model of the Phillips curve relation', *Journal of Monetary Economics* No. 44 (1999), 165-193.
21. Dixon, Lin and Van Ours (2015). 'Revisiting Okun's relationship', Department of Economics, University of Melbourne, Australia.
22. Domar, E. D. (1946). 'Capital Expansion, Rate of Growth and Employment', *Econometrica*, 14:137-47.
23. Dornbusch, R. Fischer, S. and Startz, R. (2011). 'Macroeconomics', 11<sup>th</sup> edition, International edition, McGraw-Hill Companies, New York, America.
24. Du Plessis, S. and Smit, B. (2007). 'South Africa's Growth Revival After 1994', *Journal of African Economies*, 16(5), 668-704.
25. Faulkner, D. Loewald, C. and Makrelvo, K. (2013). 'Achieving higher growth and employment: Policy options for South Africa', South African Reserve Bank Working Paper, Research Department, July 2013.

26. Fields, G. (2000). 'The Employment Problem in South Africa', Keynote address prepared for presentation at the Trade and Industrial Policy Secretariat Forum, 18 September, Johannesburg.
  
27. Fin24 (2015). 'SA among top 10 with highest unemployment' [online], available: <http://www.fin24.com/Economy/SA-among-top-10-with-highest-unemployment-20150120> [21 March 2015].
  
28. Finnemore, M. (2009). 'Introduction to Labour Relations in South Africa', 10th edition. Durban: LexisNexis Butterworths.
  
29. Gordhan, P. (2014). 'Budget Speech', Republic of South Africa, Pretoria: Government Printers.
  
30. Gujarati, D.N. and Porter, D.C. (2009). 'Basic Econometrics', McGraw-Hill, New York.
  
31. Gupta, R. and Du Toit, C.B. (2009). 'Active versus passive policies of unemployment: growth and public finance perspectives', South African Journal of Economic & Management Sciences, 12(1): 1-10.
  
32. Herbst, J. and Mills, G. (2015). 'How South Africa works', Macmillan, Johannesburg.
  
33. Holden, S. and Sparrman, V. (2011). 'Do Government Purchases Affect Unemployment?', University of Oslo, Department of Economics, Research Council of Norway. December 4, 2014.
  
34. Iacovoiu, V. B. (2012). 'Impact of Capital Investments on Unemployment in the Context of Economic Crisis. The Case of Romania', Petroleum-Gas University of Ploiești, Bd. București 39,

Ploiești, Romania. Economic Insights – Trends and Challenges: 1, 4 (36 – 47).

- 35.IDC (2013). 'International Development Corporation', South African economy: An overview of key trends since 1994, December 2013 Department of Research and Information.
- 36.International Labour Organization (2015). 'World Employment and Social Outlook', Trends 2015, International Labour Office, Geneva.
- 37.Jingya, L. and Jie, K. (2011). 'Why There Is Rapid Economic Growth Accompanied By High Unemployment in China', Master of Science in Management, Economics and Industrial Engineering, unpublished.
- 38.Johnson, H.W. (2015). 'How long will South Africa Survive? The looming crisis', Jonathan Ball Publishers, Cape Town.
- 39.Kennedy, P. (2008). 'A Guide to Econometrics', 6<sup>th</sup> edition, Oxford: Blackwell Publishing.
- 40.Khan, M. A. Saboor, A. Mian, S. A. and Anwar, A. (2013). 'Modeling the relationship between GDP and unemployment for Okun's law specific to Pakistan during 1976-2010' Theoretical and Applied Economics, 10(587): 71-78.
- 41.Kingdon, G. and Knight, J. (2001). 'Unemployment in South Africa: The nature of the beast', Working Paper No. 2001-15.
- 42.Kingdon, G. G. & Knight, J. B. (2004). 'Unemployment in South Africa: The nature of the beast', Centre for the Study of African Economies, University of Oxford, 32(3): 391-408.

43. Kingdon, G. & Knight, J. (2005). 'Unemployment in South Africa, 1995-2003: Causes, problems and policies', Global Poverty Research Group, GPRG-WPS-010.
44. Knotek, E.S. (2007). 'How useful is Okun's law?', Economic Review, Federal Reserve Bank of Kansas City, Fourth Quarter, pp. 73-103.
45. Kohler, M. Lakay, L. Rhodes, B. Saayman, A. Schoer, V. Scholtz, F. and Thompson, K. (2010). 'Economic: Global and Southern Perspectives', Pearson Education South Africa (Pty) Ltd.
46. Kreishan, F.M. (2011). 'Economic Growth and Unemployment: An Empirical Analysis', Journal of Social Sciences 7 (2): 228-231.
47. Kumo, W. L. (2012). 'Infrastructure Investment and Economic Growth in South Africa: A Granger Causality Analysis', African development Bank Group Working Paper Series No. 160.
48. Kurtovic, S. Siljkovic, B. and Milanovic, M. ( 2015). 'Long-term impact of foreign direct investment on reduction of unemployment: panel data analysis of the Western Balkans countries', Journal of Applied Economics and Business Research, 5 (2): 112-129 (2015).
49. Lancaster, D.P. and Tulip, P. (2015). 'Okun's Law and Potential Output', Reserve Bank of Australia Research Discussion, Paper No. 2015-14.
50. Lee, N.L. (2004) 'Knowledge Management: It's application in IT projects', Zytex Publishing, South Africa.
51. Levinsohn, J. Rankin, N. Roberts, G. and Schoer, V. (2014). 'Wage subsidies and youth employment in South Africa: Evidence from a

randomized control trial', Stellenbosch Economic Working papers: 02/04, A working paper of the Department of Economics and the Bureau for Economic Research at the University of Stellenbosch.

52. Lings, K. (2014). 'The missing piece', Macmillan, Johannesburg.
53. Mahadea, D. (2003). 'Employment and Growth in SA: Hope or despair?', South African Journal of Economics, 71(1): 21-48.
54. Mahadea, D. (2012). 'Prospects of Entrepreneurship to the Challenge of Job Creation in South Africa', University of Kwazulu-Natal, South Africa.
55. Mahadea, D. and Simson, R. (2010): The Challenge of Low Employment Economic Growth' in South Africa, South African Journal of Economics and Management Sciences, 13(4): 391- 406.
56. Mahadeva, L. & Robinson, P. (2004), 'Unit Root Testing to Help Model Building', A. Blake and G. Hammond (eds.), Handbooks in Central Banking, Centre for Central Banking Studies, Bank of England, No. 22.
57. Mankiw, N.G. (2014). 'Macroeconomics', 9<sup>th</sup> Edition, Palgrave Macmillan, Worth Publishers, New York.
58. Maqbool M. S. Mahmood A. Sattar T. and Bhalli M. N. (2013). 'Determinants of Unemployment Empirical Evidences From Pakistan', Pakistan Economic And Social Review, Volume 51, No. 2 (Winter 2013), Pp. 191-207.
59. May, J. Budlender, D. Mokate, R. Rogerson, C. Stavrou, A. (1998). 'Poverty and inequality in South Africa', Report prepared for the Office of the Deputy President, Republic of South Africa. Pretoria.
60. Memedovic, O. and Lapadre, L. (2009). 'Structural Change in the

World Economy: Main Features and Trends', Working paper 24/2009, United Nations Industrial Development Organization, Vienna.

61. Metes, D. V. (2005) 'Visual, Unit Root and Stationarity Tests and Their Power and Accuracy', Summer NSERC student report [online], available:  
<http://www.stat.ualberta.ca/~wiens/home%20page/pubs/BSc%20reports/metes.pdf> (accessed: 22 April 2014).
62. Moazzami, B. and Dadgostar, B. (2009). 'Okun's Law Revisited: Evidence from OECD Countries', International Business and Economic Research Journal, Vol. 8(8).
63. Mroke, N. Leballo, G.P. and Mello, D.M. (2014). 'An empirical robustness of Okun's law in South Africa: An error correction modeling approach', Mediterranean Journal of Social Sciences, MCSER Publishing, Rome-Italy.
64. Mouhammed A. H. (2011). 'Important Theories of Unemployment and Public Policies', Journal of Applied Business and Economics, 12(5).
65. Moutinho, L. and Hutcheson, G. (2011). 'Multinomial Logistic Regression', The SAGE Dictionary of Quantitative Management Research. SAGE Publications Ltd. (2011): 208-212.
66. National Development Plan (2014). 'NATIONAL DEVELOPMENT PLAN 2030: Our future, make it work, Executive Summary, [online], available:  
<http://www.gov.za/sites/www.gov.za/files/Executive%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf> (accessed: 12 July 2015).

67. Neto, A. and Silva, S.T. (2013) 'Growth and Unemployment: A bibliometric analysis on mechanisms and methods' Working Paper, School of Economics and Management, University of Porto.
68. Nikolli, E. (2014). 'Economic growth and unemployment rate. Case of Albania', European Journal of Social Sciences Education and Research, May-August 2014, 1(1).
69. Okun, A. (1962). 'Potential GNP: Its measurement and significance', In American Statistical Association, Proceedings of the Business and Economic Statistics Section, 98-104.
70. Osinubi, T.S. (2005). 'Macroeconometric Analysis of Growth, Unemployment and Poverty in Nigeria', Pakistan Economic and Social Review, 43(2): 249-269.
71. Parkin, M. Kohler, M. Lakay, L. Rhodes, B. Saayman, A. Schoer, V. Scholtz, D. and Thompson, K. (2010). 'Economics - Global And Southern African Perspectives', Pearson Education South Africa, 2010.
72. Parsons, R. (2013). 'Zumanomics Revisited: the road from Mangaung 20 2030', Auckland Park: Jacana, 2013.
73. Phiri, A. (2014). 'Re-evaluating Okun's law in South Africa: A nonlinear cointegration approach', Munich Personal RePEc Archive, North West University, South Africa.
74. Pollin, R. Heintz, G. and Epstein, J. (2008). 'Pro-Growth Alternatives for Monetary and Financial Policies in Sub-Saharan Africa', International Policy Centre, Jan/2008, No. 6.

75. Roşoiu, I. & Roşoiu, A. (2014). 'The Relation between Unemployment Rate and Economic Growth in USA', *International Journal of Economic Practices and Theories*, 4(2): 162-167.
76. Sadiku, M. Ibraimi, A. and Sadiku, L. (2014). 'Econometric Estimation of the Relationship between Unemployment Rate and Economic Growth of FYR of Macedonia', *Procedia Economics and Finance*, 19 (2015), 69-81, Elsevier, ScienceDirect.
77. SARB (2015) 'Unemployment rate', Official unemployment rate, South African Reserve Bank, [online], available: <http://www.resbank.co.za/webindicators/SDDSDetail.aspx?DataItem=LABT079A>, (accessed: 13 June 2015).
78. SARB (2015Q2) 'Quarterly Bulletin South African Reserve Bank', No. 227 (September), Second Quarter.
79. Schwab, K. (2014). 'The Global Competitiveness Report 2014-2015', World Economic Forum.
80. Smet, K. (2013). 'Trade-induced Unemployment: The case of Post-Apartheid South Africa', *South African Journal of Economics*, 81(2): 240-259.
81. Sodipe, A. O. (2008). 'Employment and Economic Growth in Nigeria', Department of Economics and Development studies, College of Business and Social Sciences, Covenant University, OTA, Ogun State.
82. Sodipe, O.A. & Ogunrinola, O.I. (2011). 'Employment and Economic Growth Nexus in Nigeria', *International Journal of Business and Social Science*, 2(11): 232-239.
83. South African Employment Plan (2014). [online], available:



[https://g20.org/wp-content/uploads/2014/12/g20\\_employment\\_plan\\_south\\_africa.pdf](https://g20.org/wp-content/uploads/2014/12/g20_employment_plan_south_africa.pdf).  
(accessed: 3 May 2015).

84. Stats SA (2014a). 'Statistics South Africa: National and provincial labour market: Youth', Quarter 1, Released June 2014.
85. Stats SA (2014d), 'Statistics South Africa: Quarterly Labour Force Survey', Quarter 4, Released February 2015.
86. Stats SA (2015a). 'Statistics South Africa: Quarterly Labour Force Survey', Quarter 4, Released May 2015.
87. Stats SA (2015d). 'Unemployment increases in the third quarter of 2015', Quarterly labour force survey, October 2015, Media Release.
88. Syczewska, E. M. (2010). 'Empirical power of the Kwiatkowski-Phillips-Schmidt-Shin test', Working Papers, Department of Applied Econometrics, Warsaw School of Economics 45.
89. Tombolo, G.A. and Hasegawa, M.M. (2014). 'Okun's law: evidence for the Brazilian economy', Federal University of Parana, Munich Personal RePEc Archive.
90. Thirlwall, A. P. (2013): Growth and Development, Palgrave Macmillan, New York.
91. Trading Economics (2015). 'South Africa GDP Annual Growth Rate 1994-2015', [online], available: <http://www.tradingeconomics.com/south-africa/gdp-growth-annual> (accessed: 20 April 2015).

92. Trochim, W.M.K. (2002). 'Descriptive statistics [Online]. Available from: <http://www.socialresearchmethods.net/kb/statinf.htm> (accessed 17 September 2015).
93. Tshabalala, N. G. (2014). 'Crime and Unemployment in South Africa; Revisiting an Established Causality: Evidence from the Kwa-Zulu Natal Province', *Mediterranean Journal of Social Sciences*.
94. Twenty Year Review (2014). 'TWENTY YEAR REVIEW SOUTH AFRICA 1994 – 2014', [online], available: <http://www.thepresidency-dpme.gov.za/news/Documents/20%20Year%20Review.pdf> (accessed: 13 June 2015).
95. Verbeek, M. (2012). 'A Guide to Modern Econometrics', 4<sup>th</sup> Edition, John Wiley.
96. Villaverde, J. and Maza, A. (2009). 'The robustness of Okun's law in Spain, 1980-2004, Regional evidence', *Journal of policy modelling*, 31(2009): 289-297.
97. Virmani, V. (2004). 'Unit Root Tests: Results from some recent tests applied to select Indian macroeconomic variables', Indian Institute of Management, Ahmedabad.
98. Wooldridge, J.M. (2013). 'Introductory Econometrics: A Modern Approach', 5th edition, Thomson, NY.

**APPENDIX 1: DATA USED FOR STUDY OBTAINED  
FROM THE SOUTH AFRICAN RESERVE BANK  
DATABASE AND STATS SA**

## APPENDIX 1: DATA USED FOR STUDY OBTAINED FROM THE SOUTH AFRICAN RESERVE BANK DATABASE

Year/Time period	Gross Domestic Product growth rate (gdpgr)	Real GDP (rgdp)	Unemployment rate (unemp)	Government consumption Expenditure (govecons)	Fixed Capital Investment (fixinvest)
1994/01	-0.2	1622832	20	353740	209074
1994/02	4	1640437	19.2	353743	213646
1994/03	4.6	1658888	18.5	352158	219527
1994/04	7.6	1686577	17.7	348202	227810
1995/01	1	1692669	16.9	339456	233056
1995/02	1.2	1700185	17.5	332015	242214
1995/03	2.7	1707524	18.1	326230	243393
1995/04	1.4	1714263	18.7	325548	244412
1996/01	7.6	1738318	19.3	333695	253381
1996/02	4.9	1770877	19.7	340484	261413
1996/03	4.9	1790973	20.2	346341	266185
1996/04	3.8	1807959	20.6	353077	268852
1997/01	1.9	1813153	21	351206	274639
1997/02	2.5	1824244	22.1	351348	277140
1997/03	0.4	1828055	23.1	350524	278334
1997/04	0.1	1830815	24.2	349862	280000
1998/01	1.1	1833129	25.2	345363	286210
1998/02	0.6	1835721	24.7	344625	286001
1998/03	-0.9	1831698	24.3	342073	293196
1998/04	0.4	1833468	23.8	339730	297607
1999/01	3.9	1850328	23.3	340711	276586
1999/02	3.2	1865054	24.2	342748	265572
1999/03	4.4	1885422	25	345433	264225
1999/04	4.5	1906156	25.9	348865	268297
2000/01	4.8	1927597	26.7	350966	272115
2000/02	3.7	1945333	26.7	353178	276014
2000/03	4	1964599	25	355731	281046
2000/04	3.4	1981313	23.3	358226	287048
2001/01	2.5	1994180	24	360830	287815
2001/02	2	2004149	24.6	363796	287092
2001/03	1.1	2009472	25.4	367209	287061

2001/04	3.1	2024922	26.2	370543	286057
2002/01	4.4	2051198	27	374840	290229
2002/02	5.2	2076037	27.7	379535	292527
2002/03	4.6	2093066	27.2	384779	298925
2002/04	3.4	2107049	26.6	390074	306437
2003/01	2.6	2126547	28	395738	311520
2003/02	2	2136932	29.3	401090	322397
2003/03	2.2	2148528	28.9	406465	332473
2003/04	2.3	2160922	28.4	412398	343360
2004/01	6.194468	2193636	27.4	417296	353674
2004/02	5.707884	2224290	26.4	422470	360668
2004/03	6.702689	2260660	24.7	427649	375645
2004/04	4.340406	2284801	23	432893	388418
2005/01	4.128959	2308029	23.6	436999	392814
2005/02	7.373795	2349448	24.2	442981	403360
2005/03	5.567146	2381486	23.9	449146	415474
2005/04	2.705348	2397432	23.5	458698	429140
2006/01	7.21472	2439551	23.3	466944	438994
2006/02	5.803395	2474200	23.1	467183	451850
2006/03	5.640042	2508372	22.6	470169	467348
2006/04	5.646862	2543057	22.1	470772	481864
2007/01	6.655097	2584351	22.9	476246	510060
2007/02	3.318554	2605530	23.6	483302	520181
2007/03	4.770773	2636065	22.3	492145	526153
2007/04	5.788976	2673414	21	498951	536830
2008/01	1.691471	2684648	23.2	509314	559722
2008/02	4.973632	2717424	22.6	512708	577411
2008/03	0.959337	2723918	22.8	518405	604986
2008/04	-2.25793	2708410	21.5	523281	619509
2009/01	-6.07828	2666281	23	530082	576222
2009/02	-1.36565	2657131	23.2	537090	554497
2009/03	0.930849	2663293	24.5	545204	538820
2009/04	2.693868	2681051	24.1	547232	534409
2010/01	4.800123	2712661	25.1	549563	531277
2010/02	2.473045	2729279	25.1	557527	529522
2010/03	4.559931	2759874	25.4	558212	527893
2010/04	4.470945	2790218	23.9	558346	529032
2011/01	3.732716	2815899	24.8	558478	546966
2011/02	2.134999	2830810	25.6	563901	554191
2011/03	1.051453	2838222	25	566499	561096
2011/04	3.135471	2860213	23.8	572926	576699
2012/01	1.66429	2872040	25	573569	571867
2012/02	3.699353	2898241	24.8	580382	573675
2012/03	1.200715	2906902	25.2	588690	583000
2012/04	1.787913	2919809	24.5	596423	591122

2013/01	1.361644	2929698	25	600975	604300
2013/02	3.694583	2956391	25.3	602472	618634
2013/03	1.201565	2965232	24.5	603484	633083
2013/04	5.085797	3002235	24.1	608749	640491
2014/01	-1.55554	2990491	25.2	611378	625295
2014/02	0.478235	2994060	25.5	615037	616715
2014/03	2.079033	3009502	25.4	617193	620442
2014/04	4.149986	3040251	24.3	618660	624408
2015/01	1.334677	3050345	26.4	615646	627181
2015/02	-1.27282	3040592	26.4	616232	628682

## **APPENDIX 2: TURNITIN REPORT**

## **APPENDIX 3: ETHICAL CLEARANCE**