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THE IMPACT OF TRANSPORT INFRASTRUCTURE INVESTMENT ON UNEMPLOYMENT IN SOUTH AFRICA

By

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ABSTRACT

The transport infrastructure investment has been a subject of many studies for some time, mainly in improving and predicting the economic growth of the country and improving employment in South Africa. Given this, the study examines the impact of transport infrastructure investment on unemployment in South Africa by using time series econometric analysis over the period 1982-2012. Some key variables considered include unemployment, real GDP, real exchange rate, real interest rate, and trade openness total infrastructure investment exclude transport infrastructure investment. To separate the long and short run effect, VECM was employed after ensuring stationarity of the series. The study found that a long run relationship exist between the unemployment, transport infrastructure investment, real GDP, real exchange rate , real interest rate, trade openness and total infrastructure investment exclude transport infrastructure investment. The Results of this thesis have implications for policy and academic work.

Keywords: *Transport Infrastructure investment; unemployment; South Africa*

DECLARATIONS

On originality of work

I, the undersigned, **Mayekiso Sipokazi** student number **200805226**, hereby declare that the dissertation is my own original work, and that it has not been submitted, and will not be presented at any other University for a similar or any other degree award.

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DEDICATION

To my son Lunathi, my parents, grandmother and siblings

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ACRONYMS AND ABBREVIATIONS

ADF- Augmented Dickey-Fuller Test

ARDL- Autoregressive Distributed Lag Mode

DF- Dickey Fuller

ECM- Error correction model

EG- Engle Granger

GDP- Gross Domestic Product

GDP- Gross Domestic Product

OLS- Ordinary Least Squares

OTC – Over the Counter

PP- Phillips-Perron

SARB- South African Reserve Bank

STATS SA- Statistics South Africa

VECM- Vector Error correction model

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

Investment is an important tool in the economy of any country in the world; it serves as the part of the economic growth in a country. Investment is important for improving productivity and increasing the competitiveness of an economy (Pettinger, 2008). Without investment, an economy could enjoy high levels of consumption, but that can create an unbalanced economy since there would be current deficit and little investment in future growth prospects. Most economists see investment as the driver of the economy in any given country (Pettinger, 2008).

Effective investment should increase the productive capacity of the economy. Investment in new technology and capital can increase the productive capacity of the economy. If investment leads to a significant increase in productivity, then it can lead to an increase in the long run trend rate of the economic growth (Pettinger, 2008).

Every country specializes on investing in different sectors which can boost the economic growth. Infrastructure is said to be the physical system of a country which includes transportation, communication, sewage, water and electricity systems. These systems tend to be high-cost investments; however, they are vital to a country's economic development and prosperity. Infrastructure may be funded by public sector or private sector. Infrastructure is also an asset class that tends to be less volatile than equities over the long-term and generally provides a higher yield. Many governments in the world are focussing on improving their infrastructure by investing more on infrastructure for its defensive characteristic.

Infrastructure is important for the services it provides as it provides services that support economic growth by increasing the productivity of labours and capital, thereby reducing the costs of production and raising profitability, production, income and employment (Yemek, 2006). Efficient infrastructure warrants accessibility which attracts centres of production and consumption and thus impacts positively on the regional economy. More efficient infrastructures enable better mobility for people and goods as well as a better connection between regions.

Transport infrastructure is considered as one of the key elements for the economic growth and development. It plays a fundamental role in achieving the objectives of increasing economic growth and job creation. Transport infrastructure has an impact on economic growth, and a country cannot be competitive without an efficient transport network (Aschaer, 1997).

Transport infrastructure is a dynamic group and economic asset that builds space and defines mobility. It influences trade flows as well as industrial and residence locations. Its construction and maintenance absorbs significant resources and its highly visible and public nature raises important policy concerns, especially on its environmental effects (Short, 2005).

The maintenance and expansion of transport infrastructure are important dimensions of supporting economic activity in a growing economy in any country. According Gramlich (1994) it is important for the analysis of transport infrastructure investment on employment to be made to study its impact. Firms locate where the conditions, in terms of infrastructure, agglomeration incentives, and labour supply and investment incentives are favourable. On other hand, labour will be attracted to regions where the manufacturing sector is developing favourably in terms of the transport system (Dowrick, 1994).

According to the SA information reporter (2012), South Africa has a modern and well-developed transport infrastructure. The air and network are the largest on the continent, and the roads are in good condition. The country's ports provide a natural stopover for shipping to and from Europe, Americas, Asia and both coasts of Africa. The transport sector has been highlighted by the government as a key contributor to South Africa's competitiveness in global markets. It is regarded as a crucial engine for economic growth and social development, and the government has unveiled plans to spend billions of rand to improve the country's roads, railways and ports (Hertz, 1995).

1.2 PROBLEM STATEMENT

The high rate of unemployment in South Africa has been a concern as it is probably the most severe problem and is conceivably the cause of many other challenges such as great levels of crime rate and violence. It is the greatest single cause of deep poverty and has replaced race as the major factor in inequality, and all have a negative impact on the economy (Barker, 2003).

Statistics from Stats SA in August, 2013 revealed that unemployment is increasing. South Africa's Unemployment Rate averaged 25.49 percent from 2000 until 2013, reaching an all-time high of 31.20 percent in March of 2003 and a record low of 21.90 percent in December of 2008. In the second quarter of 2013, the South African unemployment rate increased to 25.6 percent, the highest rate in two years. Between the first and the second quarters of 2013, the labour force increased by 222 000 persons, reflecting a rise in the number of both unemployed persons (122 000) and employed persons (100 000) (StatsSA, 2013). With the establishment of democracy in 1994, many South African unemployed people became hopeful that there was going to be employment. This was further strengthened by the implementation of different government policies that sought to increase economic growth and employment opportunities.

Trade Unions such as COSATU are appalled that South Africa's official unemployment rate is still rising, and they have called for the implementation of policies such as the Industrial Policy Action Plan in 2007. The New Growth Path in 2010, in principle, was to be achieved by increasing the economic growth rate and reducing unemployment. The transport sector has also been targeted under the New Growth Theory as a sector that can enhance South Africa's employment opportunities.

According to the budget in 2008, South Africa government have increased the infrastructure in transport, energy and communications amounted to R89 billion. The allocation to the Department of Transport has increased from R42 billion to R53 billion, and that shows that there is an improvement made by government to transport infrastructure and the overall investment in transport infrastructure grew by almost 3% (BudgetSA, 2013).

The rate of unemployment is continuously increasing while government invests more billions of rand on transport infrastructure; the rate of unemployment keeps on increasing and is said to be a problem that is faced by South Africa (Lombard, 1992).

Despite the implementation of the many growth supporting policies by the government to back up employment creation, the latter still continues to weaken in South Africa. With regards to job creation, for instance, the GEAR policy targeted, amongst other things, employment growth averaging 270 000 jobs per annum from 1996 to 2000, and the number was expected to rise over time from 126 000 in 1996 to 409 000 in 2000 (Knight, 2001).

Bhorat (1999) believes that transport infrastructure increases aggregate demand, which, in turn, increases investment and eventually creates employment. Moreover, most studies investigating such relationships are mostly focused on developed countries such as China, Argentina and America, but there are very few studies on developing countries like South Africa. Given such a gap in literature and policies, this study sought to examine the impact of transport infrastructure investment on employment using South African data.

According to Mohr and Fourie (2005), investment is inversely related to unemployment. When there is an increase in investment expenditure made by government or private sectors, the level of unemployment decreases.

1.3 OBJECTIVE OF THE STUDY

The main objective of the study was to investigate the impact of transport infrastructure investment on unemployment in South Africa.

Specific objectives

The specific objectives of the study were to:

- Analyse trends on transport infrastructure investment and unemployment in South Africa from 1982 and 2012.
- Econometrically investigate the impact of transport infrastructure investment on unemployment in South Africa.
- Make policy recommendations based on the findings.

1.4 HYPOTHESIS

H_0: Transport infrastructure investment does not have a positive impact on employment in South Africa.

H_1: Transport infrastructure investment does have a positive impact on employment in South Africa.

1.5 SIGNIFICANCE OF THE STUDY

The government has, over the years, tried to find ways to create jobs. Various policies such as GEAR, RDP and ASGISA had economic growth, job creation, and elimination of poverty as their main priorities. However, as these programmes failed to achieve their objectives, the government announced a fourth programme, the New Growth Path (NGP) in 2010. The aim of the NGP is to increase the economic growth to sustainable rates between 6 and 7 percent per year in order to create 5million jobs by 2020, thereby reducing the unemployment rate to 15 percent (DBSA, 2012). The government introduced Passenger Rail Agency of South Africa (PRASA) in 2013 with the aim of revitalising the rail industry, create jobs and provide efficient, reliable and safe public transport, which will be delivered between 2015 and 2025. Unemployment is still alarmingly high, and as such, there is need for identification of projects or programmes that create employment opportunities.

In the light of the uncertainty in the areas that can create jobs, this study could prove important to the government and policy makers. It could highlight the relationship that runs between investment in transport infrastructure and employment creation. The relevant policy arenas could find usefulness and meaning in this study because when this study presented that a relationship does exists between the two variables. Understanding the effect of investment in transport infrastructure will potentially expand the information set available to policy-makers for decision-making. Such knowledge would be worthwhile if policymakers hope to formulate policies that ensure job creation and poverty reduction. A number of studies in South Africa have examined the impact of transport infrastructure investment on economic growth; however, these studies have not adequately addressed how transport infrastructure investment has an impact on employment. Therefore, this study will contribute to different sectors of the economy from both public and private sector.

CHAPTER TWO

OVERVIEW OF THE STUDY

2.1 Introduction

The purpose of this chapter is to provide an overview of the impact of transport infrastructure investment on unemployment in South Africa. This chapter looks at the trends of infrastructure investments, real gross domestic product, real interest rate, real exchange rate, openness and total infrastructure investment excluding transport infrastructure investment on unemployment.

2.2 Background of infrastructure investment in South Africa

There are several classifications of what creates infrastructure, but generally, infrastructure refers to large-scale public systems, services, and facilities of a country or region that are necessary for economic activity (Fulmer, 2009). The sector tends to be separated into two broad subsets, namely, economic and social infrastructures. Economic infrastructure includes transport, water and sewerage facilities, and energy distribution and telecommunication networks whereas social infrastructure encompasses schools, universities, hospitals, public housing and prisons (Nurre, 2012).

Infrastructures are generally characterized by high development cost and long lives and are managed and financed on a long-term basis. Historically, it was seen as the role of the government to fund and manage these infrastructures for the good of the population (Fisher, 2003). Today, the role of the government, as the provider of the public services, is increasingly being questioned both in terms of the absolute cost to taxpayers and as to whether a government can deliver the assets as efficiently as a private company competing for the privilege (Oliver, 2015).

John Oliver continues stating that from the government's perspective, there is a strong case for privatization, where the debt raised by the private partner remains on their balance sheets, not on that of the Treasury's. These factors have resulted in a gradual migration from the public provision of infrastructure to the private sector. The private provision of these assets may take many forms from joint ventures, concessions and franchises through to straight delivery contracts.

The South African Government adopted a National Infrastructure Plan (NIP) in 2012 with the aim of transforming the economic landscape while simultaneously creating significant numbers of new jobs and strengthening delivery of basic services. The plan also supports the integration of African economies. Pravin Gordhan, Minister of Finance, in the 2013 budget speech, announced that the government will, over the three years from 2013/14, invest R827 billion in building new and upgrading existing infrastructures. These investments were aimed improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrisation. On the other hand, investment in the construction of ports, roads, railway systems, electricity plants, hospitals, schools and dams are targeted at contributing to faster economic growth (Budget speech, 2013).

Pravin Gordhan in 2013 announced that through the years of democracy, there are still major challenges of poverty, unemployment and inequality. In order to address these challenges and goals, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC) to: coordinate, integrate and accelerate implementation, develop a single common NIP that will be monitored and centrally driven, and develop a 20 year planning framework beyond one administration to avoid a stop-start pattern to the infrastructure roll out. Under the guidance of the Cabinet, 18 strategic integration projects (SIPS) have been developed. By January 2013, work had commenced on all 18 SIPs, and by the end of March 2013, government had spent about R860 billion rand on infrastructure development since 2009 (Budget speech, 2013).

Jacob Zuma in 2012 announced that Transnet has increased its Capital Expenditure Programme (Capex) from R110 billion to R300 billion to ensure adequate capacity to meet future demands through investments in rail, ports and pipeline infrastructure. Eskom embarked on a massive build programme to boost electricity-generation. Projects include the construction of Medupi, Lephalale and Ingula power stations, which have also created jobs and stimulated development in the surrounding communities. Broadband Infro invested in an international undersea cable, Western Africa Cable System, which was launched in 2012. It contributes to an increase in capacity, linking South Africa and Europe and providing the State with the ability to provide broadband infrastructure to national projects such as the Square Kilometre Array. Some of the highlights of water and sanitation delivery in 2012 include: construction of the first phase of Mokolo and Crocodile River Water Augmentation project; the project provides part of the water required for the Matimba and the Medupi power stations (SONA, 2012).

The Minister of Economic Development, Ebraihim Patel, in 2013 listed the achievements made thus: in Mpumalanga, government was ready for site-clearing and construction of the first new large rail lines by the state since 1986, with construction of the 63km Majuba Rail coal line. This formed part of the 140 km of new rail in Mpumalanga as part of government's promise to move coal from road transport to rail transport. The road maintenance programme saw basic maintenance of some 21000 km of roads in the past year, which is almost equal to the size of the African continent's coastline. It also created thousands of job opportunities in the nine provinces. An Infrastructure Development Bill was released for public comment in March, and government planned to table the Bill in Parliament in 2013 following receipt of public comments. The Bill builds on a new approach the state has already begun using to speed up regulatory decisions. Government is now tracking job creation within the R24 billions of spending, and the porting alone provides jobs to about 145000 people across the country (Patel, 2013).

Ebrahim Patel continued saying that in the last five years, there was the biggest investment in infrastructure since the 1960s, and some of these projects are eye catching, but others are less visible, for example, upgrades to roads and introduction of water and electricity in rural parts of South Africa. Ebrahim Patel also said that they have some long-term infrastructure projects in the pipeline and that they are now converting them into bankable projects, adding that the project pipeline would cost R4.7trn (Patel, 2013).

2.3 Background of transport infrastructure investment in South Africa

There is no doubt that infrastructure, in general, and specifically, transport infrastructure plays a major role in the economic development (Weisbrod, 1997). Infrastructure activities form a significant part of a country's GDP. In South Africa, the infrastructure industry contributes only 20.8% to GDP, and it is currently growing. Ferreira and Khatami in 1996 argue that investment in transport infrastructure in South Africa will play an important role in increasing the productivity of labour and business. The importance of social development had been particularly highlighted in striving towards achieving the Millennium Development Goals (MDG, 2007).

The South Africa government recognized the importance of transport and transport infrastructure in policies such as the Reconstruction and Development Programme (RDP, 1994), the Growth

Employment and Redistribution (GEAR in 1996) and the Accelerated Shared Growth Initiative for South Africa (Asgisa) (Mlambo-Ngcuka, 2006). GEAR specifically states a requirement for an increase in infrastructural development and service delivery, thereby making intensive use of labour-based techniques.

The Asgisa strategy refines the objectives of GEAR by placing specific emphasis on economic growth with improvements to the well-being of the poor. In terms of political economy, this requires development strategies enabling the poor to participate in economic growth, as well as benefit from it, for example, giving the poor better access to economic opportunities (employment, assets and markets) as well as to basic public services (education, health, housing, water, sanitation) which would contribute significantly to growth (Yemek, 2006).

This recognition has recently also been manifested in the South African Government's decision to make a special budget allocation of R320b towards infrastructure development (EN, 2005). This figure was later increased to more than R400b. The strive for improved infrastructure in South Africa was, of course, also currently fuelled by the expectations around a world-class soccer world cup event in 2010. Transport features significantly in this investment as well as in mega-events such as the World Cup. However, South Africa's growth is currently hampered by two key constraints: lack of skilled manpower and lack of appropriate infrastructure (Bruggemans, 2005).

The provision of adequate transport infrastructure is one of the key elements of South Africa's strategy for growth. While South African transport is in a stellar condition compared to other African countries, the quality of the various components of the system is uneven and higher growth of output and trade require new investments. Organization and financing for roads is superior to that of the other transport systems (SAEO, 2006; 470).
The railways and ports, in particular, function poorly and constitute obstacles to increased growth. Moreover, demand is increasing, and the growth of freight traffic has improved on most of the 20-year growth forecasts made by the Moving South Africa (MSA) strategy in 1999. Rapid urban development and migration to the cities, as well as the soccer World Cup in 2010 provided additional pressure to strengthen urban transport infrastructure (SAEO, 2006; 470).

2.4 South African transport network

According to Minister of Transport, Dipuo Peters in 2014 she stated that Transport infrastructure investments have changed the urban landscape and helped improve economic efficiency, thus improving the timeous movement of goods and services. Moreover, government has positioned the country as an attractive destination for investment. They build investor confidence and contribute towards economic development. As a gateway to other African markets, South Africa's transport infrastructure such as ports, rail links, pipelines, and roads are helping to support the economic development of the region and the continent. The many transport upgrades and road works seen every day in and around the cities mean that that the face of South Africa is changing. Through these changes, government is ensuring a better quality of life through better transport (Peters, 2014).

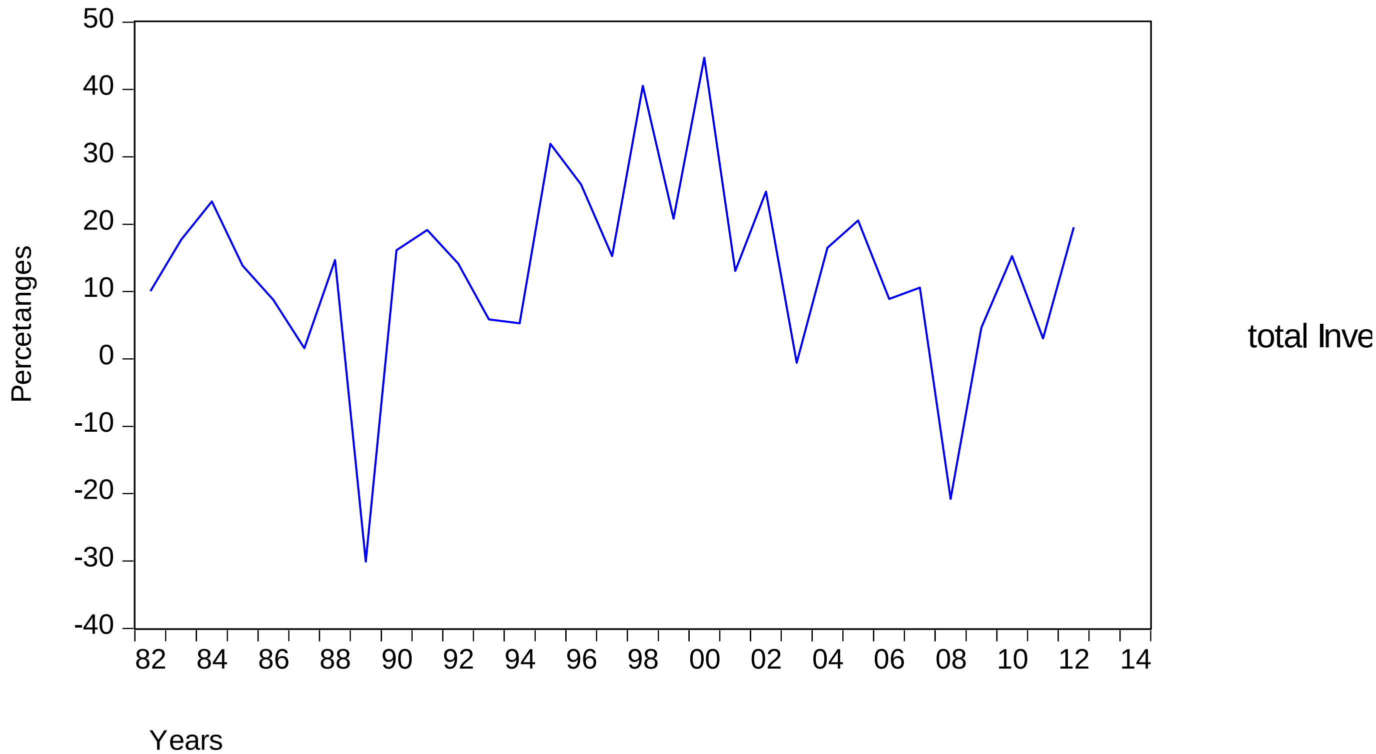
The South African government was attempting to respond to the triple infrastructure challenge through substantial increases in infrastructure spending. National treasury allocated R416 billion to infrastructure development and maintenance for the period 2004/2007 (Fedderke & Garlic, 2008). This figure was increased to R568 billion for the period 2008/2011 (DBSA, 2008). The State of City Finances report for 2007 indicates that municipal expenditure on road infrastructure has increased substantially. Infrastructure expenditure constitutes more than half of capital expenditure which has increased from 13% in 2004 to 17% in 2006 (SCN, 2007). Road infrastructure accounts for the greatest share of infrastructure expenditure, followed by electricity and water. Increased road infrastructure investment is driven, to a large extent, by the ASGISA imperatives, that is, to halve unemployment and poverty by 2014. Considerable financial resources have been committed to the improvement of South Africa's public transport infrastructure. Improvement of South Africa's public transport system was a priority partly because of the 2010 FIFA World Cup, but also because two thirds of South Africans rely on the public transport system.

South Africa has a modern and well-developed transport infrastructure. The air and rail networks are the largest on the continent, and the roads are in good condition. The country's ports provide a natural stopover for shipping to and from Europe, the Americas, Asia, Australasia and both coasts of Africa.

The transport sector has been highlighted by the government as a key contributor to South Africa's competitiveness in global markets. It is regarded as a crucial engine for economic growth and social development, and the government has unveiled plans to spend billions of rands to improve the country's roads, railways and ports.

2.5 Total investment

Figure 2.1: Trends of Total Investment



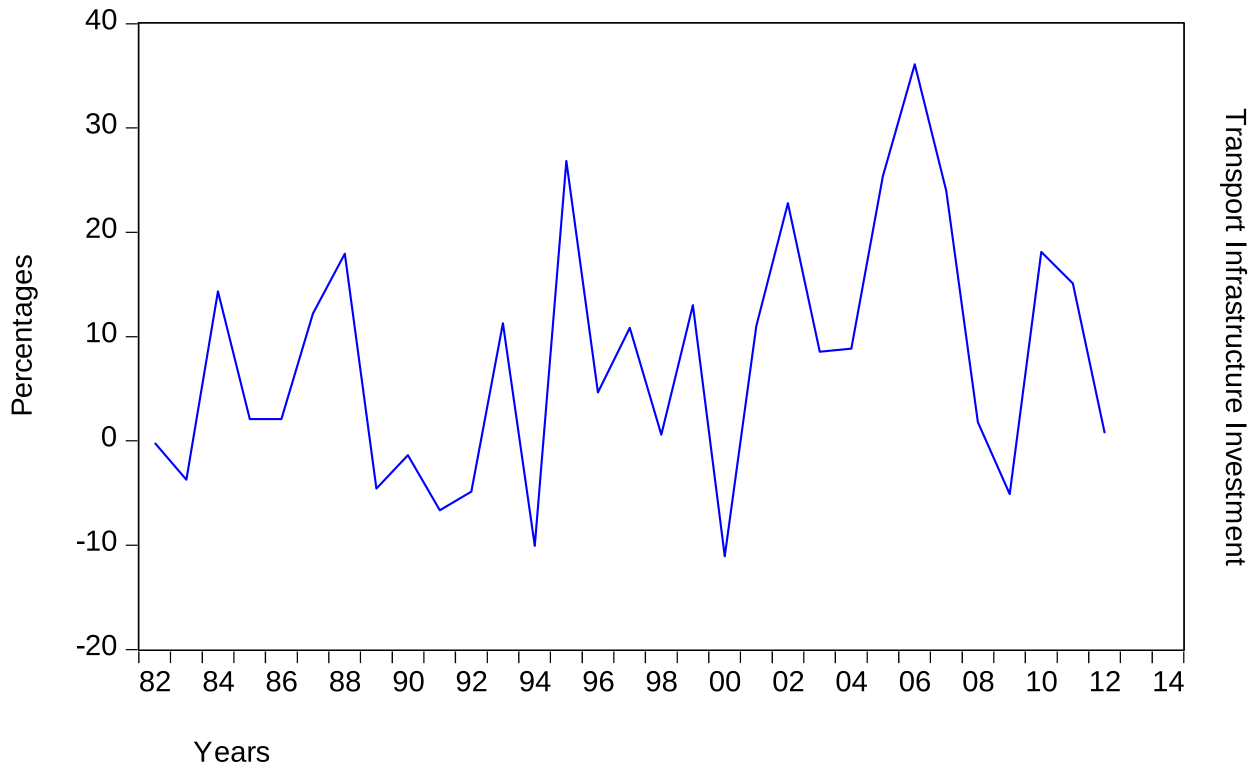
Data source: SARB;2015

According to figure 2.3, the trend of total investment, initially total investment, increased from 1982 to 1984; it then declined to its lowest rate of -30% during 1989, thereafter, there was an increase. Total investment has been changing over the years of democracy after 1994, In 2000 total investment was on its highest rate by 43%; thereafter, there was a decrease in 2001 because there was a Rand crisis which led to a decrease in investment as a whole. In 2008, again, the trends are showing a rapid decline on total investment caused by the global financial crisis which took place in 2007-2008. After the global financial crisis was resolved, there was an increase on the total investment.

Total investment consists of all the investment made by South Africa be it on general infrastructure, health, education, communication networks and energy infrastructure.

2.6 Transport Infrastructure Investment

Figure 2.2: Trends of Transport Infrastructure Investment



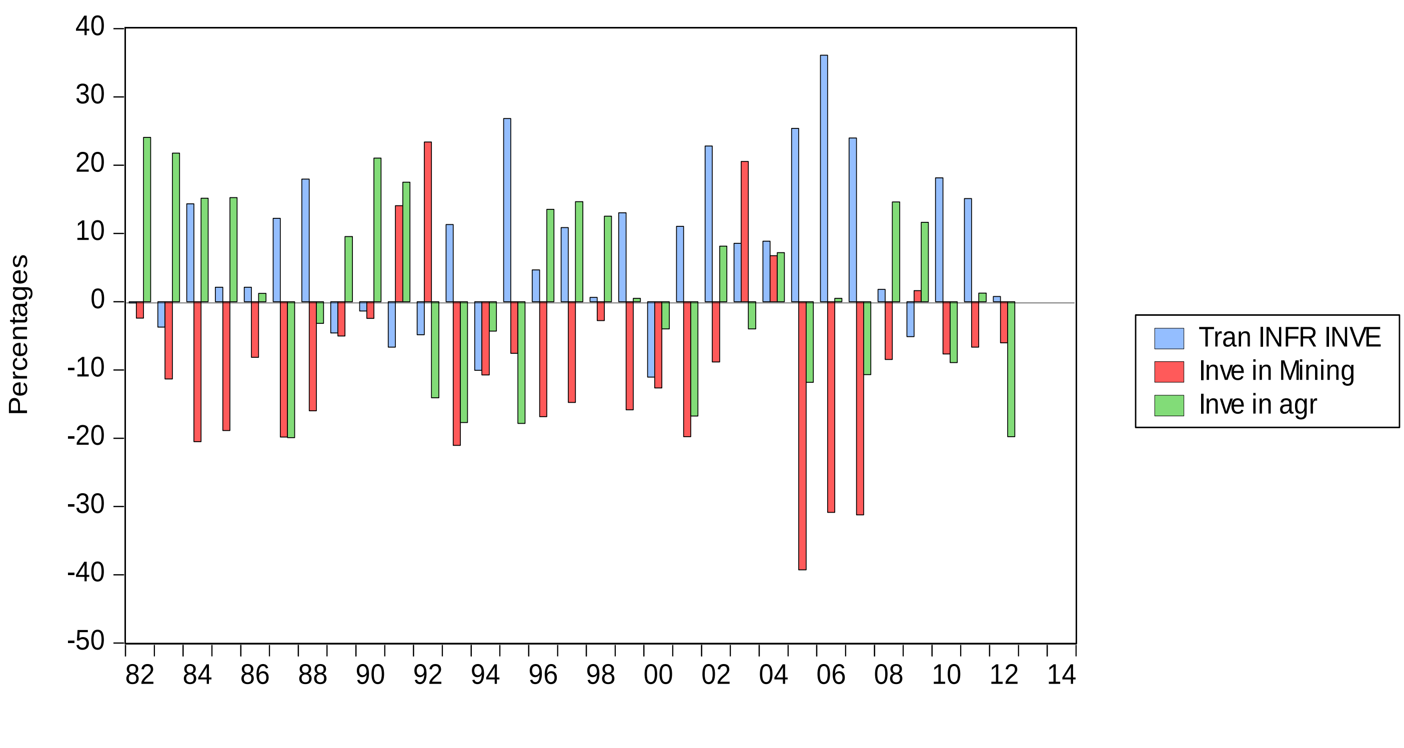
Data source: Easy data;2012

As shown in figure 2.1 above, the shape of the South African transport infrastructure investment has been subject to fairly significant changes since 1988. During 1989-1992, there has been a steady decrease in investment on transport infrastructure due to the political stances, and again in 1994, there was sharp decrease in investment caused by the changes in political positions since there was a democratic transaction which took place. Therefore, the government was not investing much on transport infrastructure. In 2000, there have been significant changes in transport infrastructure investment which shifted from being positive to being negative. In 1995, there was a sharp increase of 29% because South Africa had become a democratic country and government was investing more on infrastructure - transport infrastructure, in particular, and the economy of the country was recovering.

In 2005, the transport infrastructure investment started recovering and as a results transport infrastructure investment was increasing to the point where it reached its highest peak in 2007. In 2008, there was rapid fall in transport infrastructure investment due to the extreme global financial crisis which took place in 2008 and affected transport infrastructure investment and resulted into negative values. In 2009, there was a steady recovery of the infrastructure, particularly on transport, which was caused by the 2010 World Cup which took place in South Africa. Government invested more on the logistics and infrastructure on transport of the country. Thereafter, transport infrastructure investment decreased in 2012.

2.7 Infrastructure Investment and other investment in different sectors

Figure2.3: Infrastructure Investment and Investment in different sectors

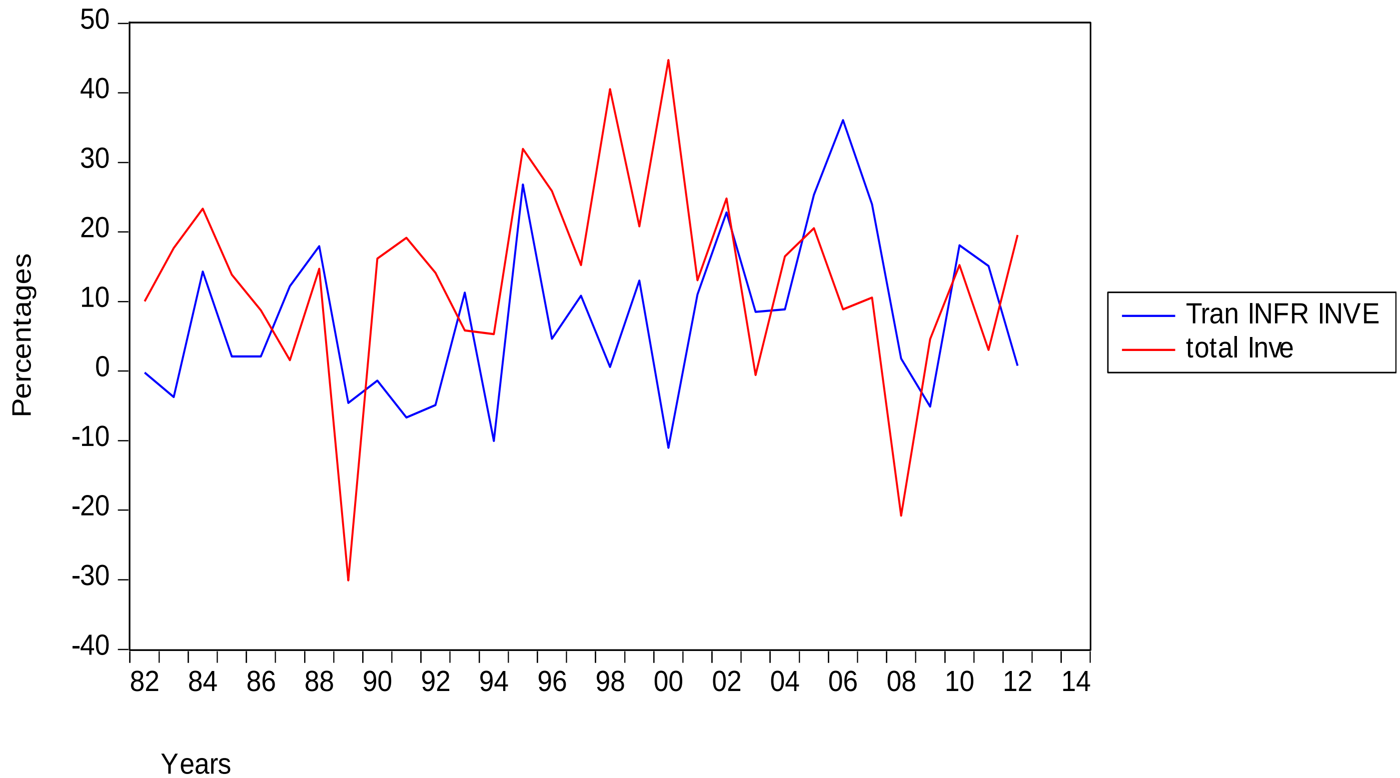


Data source: SARB;2012

In figure 2.2 above looked at the difference in investment on infrastructure, investment in mining and investment in agriculture. The purpose of doing that is to check how much government invested on transport infrastructure compared to the investment in agriculture and mining. As it shows on the trends that from 1982-1986 government invested more on agriculture than on transport infrastructure and mining, in 1988-2001 there was contradiction of trends where there is a decrease in investment in agriculture and mining up to a negative level while the investment in transport infrastructure was on its highest level, which shows a negative relationship between the three. In 2005, there was a rapid decrease in investment in mining. During 2006, transport infrastructure investment was on its highest peak, but investment in agriculture and investment in mining was negative. During the global financial crisis in 2008, investment in transport infrastructure fell to negatives compared to the investment in agriculture which was increasing including investment in mining, which was also increasing; thereafter, they all declined on 2012.

2.8 Transport Infrastructure Investment and Total Infrastructure Investment

Figure 2.4: Trends of Transport Infrastructure Investment and Total Infrastructure Investment



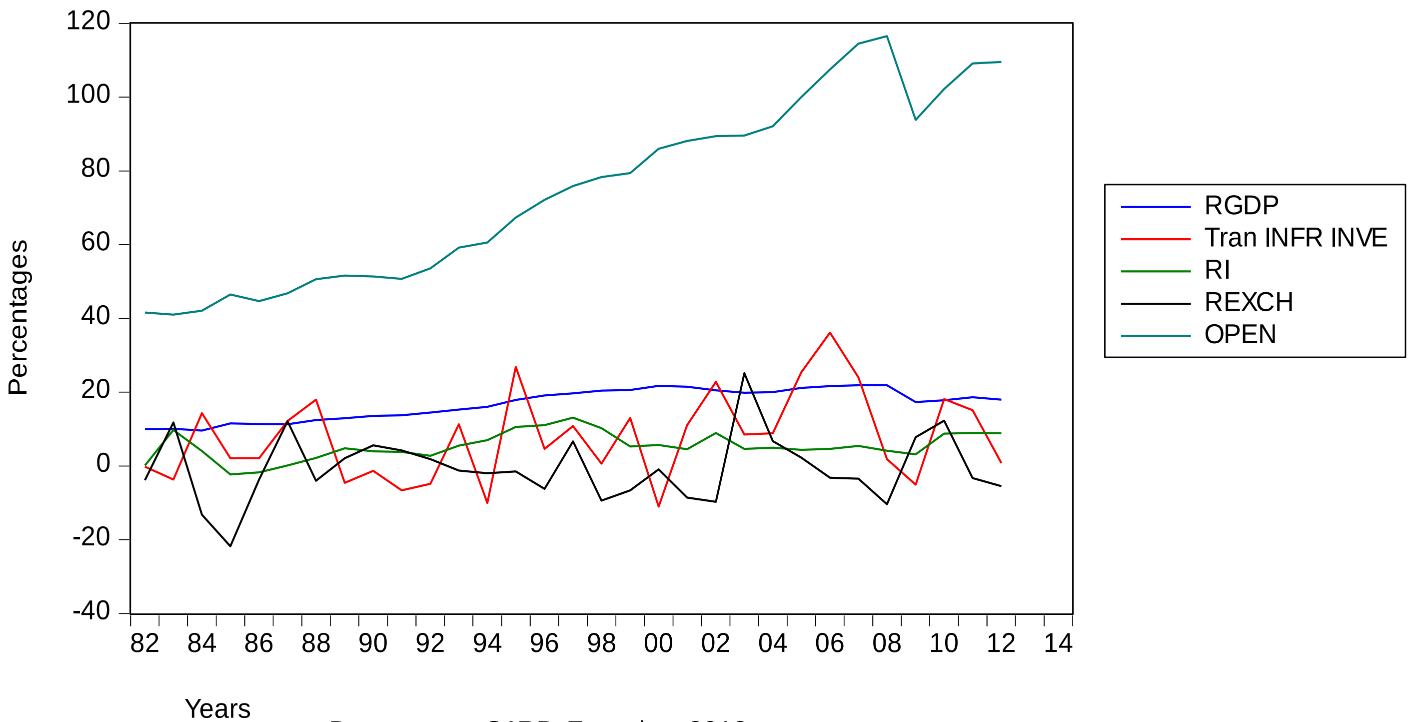
Data source: SARB, Easy data;2012

Figure 2.4 above shows that over the years' review, the total infrastructure investment has been changing and increasing above the transport infrastructure investment. From 1982-1989, the transport infrastructure investment increased and the total investment was also increased. In 1990, there was a rapid decrease in total investment by more than 15% but then increased again in1991.

From 1994 to 2012, when the total investment increased, the transport infrastructure investment also increased, and the trend of total investment was above the transport infrastructure investment. This shows a positive relationship between the two variables.

2.9 Transport Infrastructure Investment and other dependent variables

Figure 2.5: Trends of Transpot Infrastrcture Investment and other dependent variables



Data source: SARB, Easy data;2012

According to the figure 2.5, the trends of Transport infrastructure investment on other dependent variables such as Real interest rate, Real GDP, Real exchange rate, and openness, initially transport infrastructure investment was decreasing but afterwards picked up to 20% as the Real exchange rate initially was increasing but afterwards declined to be negative; in 1985, it was increased to positive. Real interest rates and Real exchange rates keep changing over the years together with transport infrastructure investment trending above them. Real GDP seems more constant but at an increasing rate.

From 1982 to 2007, trade openness has been increasing constantly, and in 2008, trade openness began to decrease due to the global financial crisis. There was an improvement in 2010 due to the 2010 World Cup as it started to increase again until 2012.

Transport Infrastructure investment is negative related to unemployment as suggested by Smith (2003). Real Gross Domestic Product is negatively related to unemployment as suggested by Barker (2007). Real Exchange rate is either negative or positive on the unemployment rate. If the rand depreciates, exports are expected to increase, thereby increasing economic growth which will lead to job creation. If the rand appreciates, exports are expected to decrease, thereby decreasing economic growth, which will lead to less jobs; imports are expected to increase, thus causing a deterioration of the current account in the balance of payment; this causes causing a decline in economic growth (Appleyard & Field, 2005). Real interest rate is a positive relationship between interest rates and unemployment.

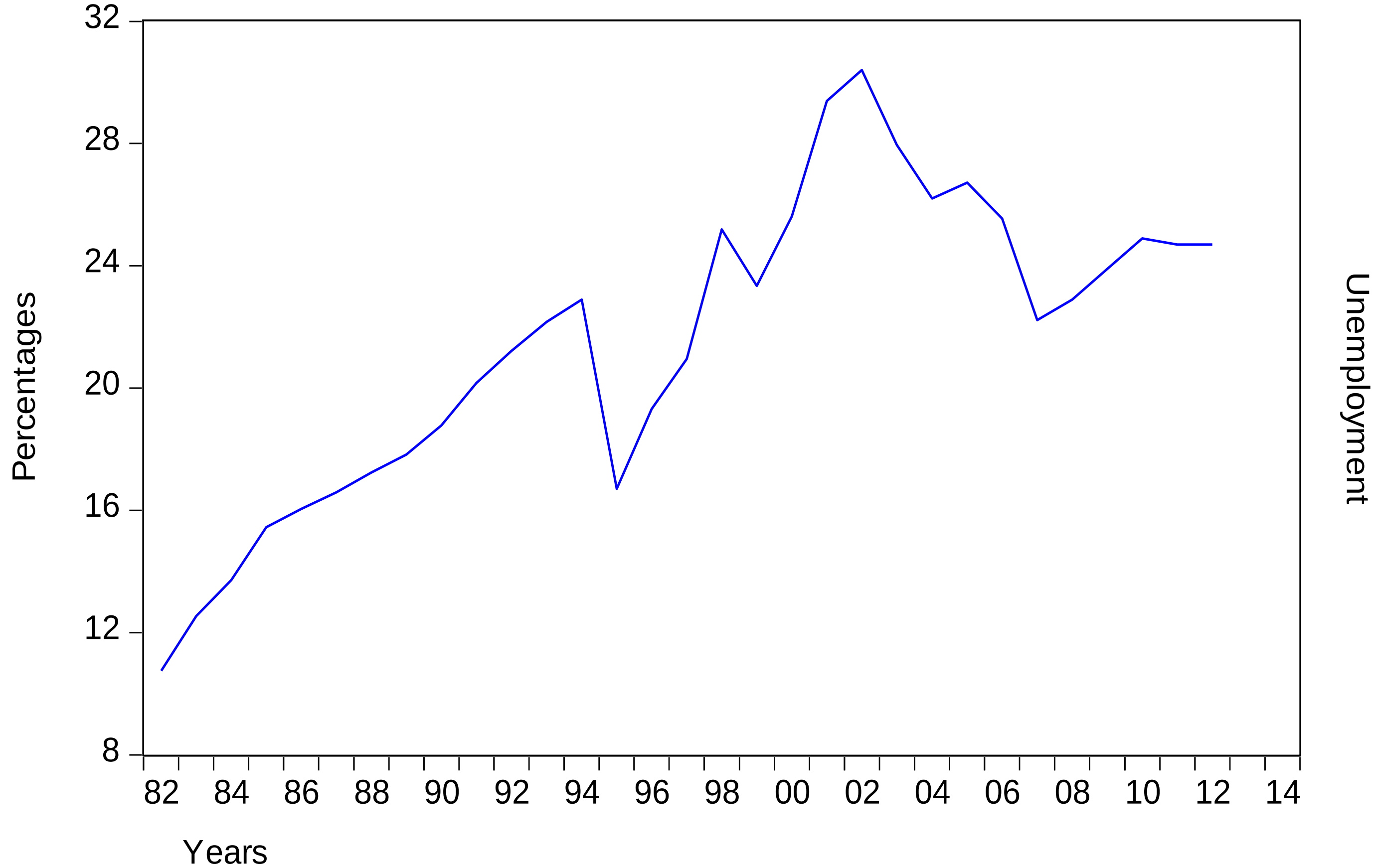
2.10 Background of unemployment in South Africa

Unemployment in South Africa has reached a crisis level if one pays attention into the persistent high levels of unemployment and the pace at which unemployment has been increasing since the beginning of the 80s (Schoeman & Blaauw, 2005).

According to Duncan in 2013, apartheid laws are to blame for South Africa's alarming unemployment rate, and there is no doubt that apartheid is the root of a lot of South Africa's problems. Under apartheid, most South Africans did not get an education that was worth anything much, and most South Africans were not allowed to move freely around the country, were not able to borrow money on fair terms, were not able to start their businesses freely, and in many cases, were not even able to live with their families because of the patterns of migration and employment that were common (Duncan, 2013).

Duncan continues saying that, historically, black schools still have average or fewer resources, higher learner-to-teacher ratios, and less favorable outcomes. The close relationship between government and trade unions has led to a series of labour regulations that are very pleasant for those who have a job, but that makes hiring new staff unappealing for employers. Requirements for industries to adopt the determinations of wage negotiations between big employers and unions, as well as very tough restrictions on hiring and firing have tended to discourage job creation and encourage capital-intensive production. At the same time, government has done relatively little to encourage the development of the small business sector, which is a key driver of new employment in most economies (Duncan, 2013).

Figure 2.6 Trends of Unemployment



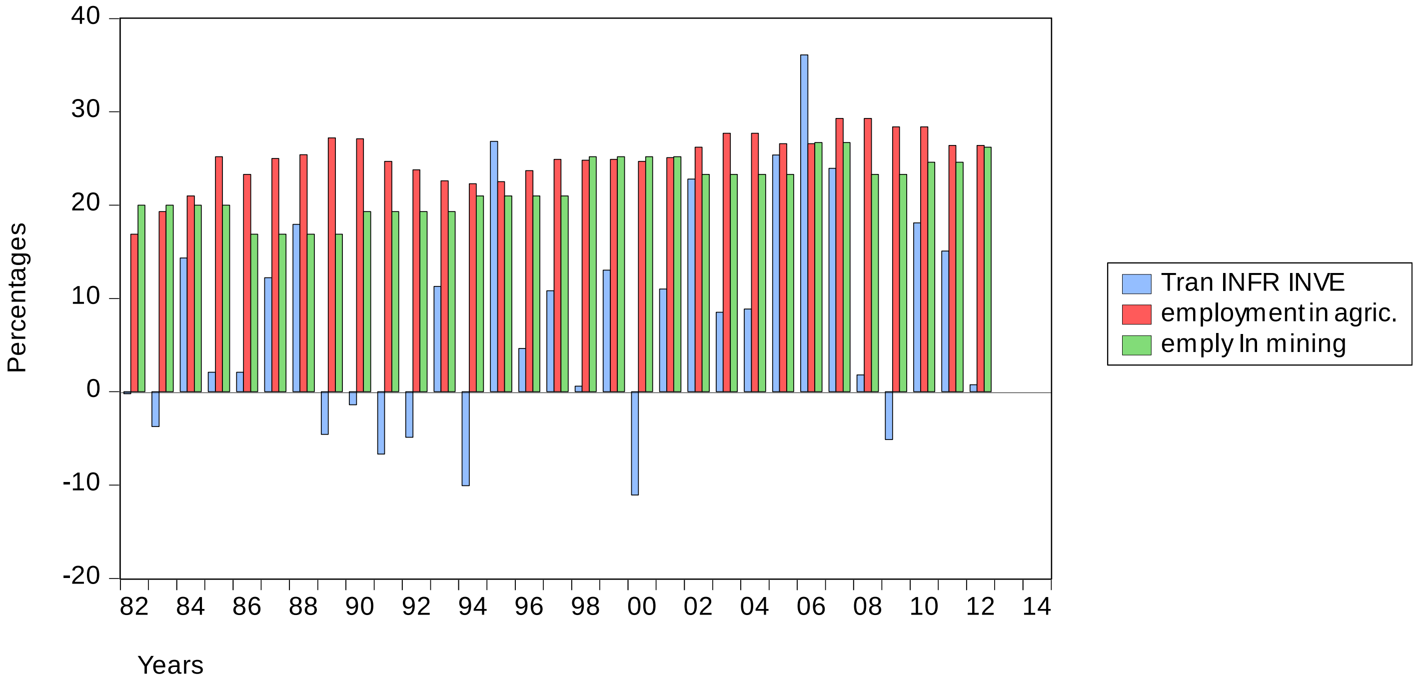
Data source: World Bank;2012

From 1982-1994, unemployment was increasing rapidly with more than 1 percent annually. The rapid increase in unemployment was caused by the challenges of the apartheid regime that was taking place at that time, and most of the people were unemployment and uneducated, especially black people. They were oppressed by the apartheid laws, there were less opportunities for one to start a business or to get a proper education, the most desirable jobs were for white people only, who were the minority, and most of the majority of the people in South Africa were unemployed and under-priviledged.

After 1994 to 1995, there was a decrease in unemployment rates from 22.89 to 16.71 percent, which was a 6.18 percentage change. South Africa was noting an end of the apartheid regime, and the democratic government was taking over the country, bringing the change in policy systems that were oppressive to the people.

2.11 Transport Infrastructure and Employment in different sectors

Figure 2.7: Trends of Employment in Trasport Infrastructure and Employment in different sectors



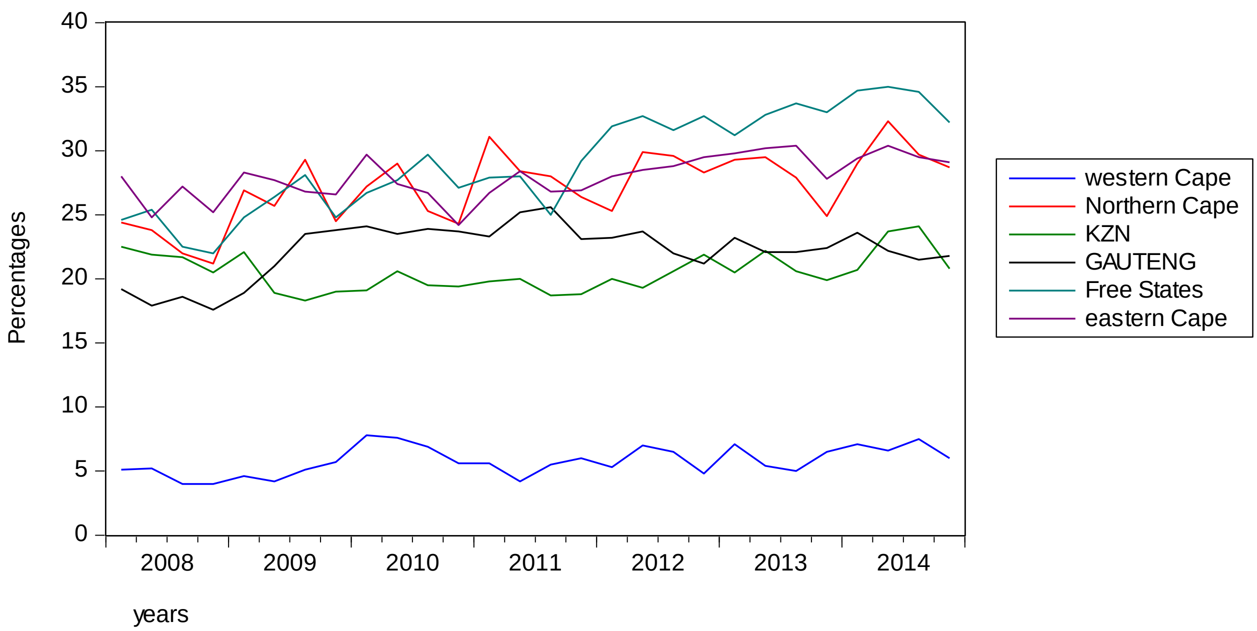
Data source: Easy data;2012

Figure 2.7 above looks at the trends of employment in the transport infrastructure sector and other two different sectors questioning: how much is the employment rate on these sectors and which one has the most employment rate than the other? From the graph, it is clear that the sector with more employment is the agricultural sector since this sector is which is considered to be a primary sector. Furthermore, the agricultural sector tended to employ more people because of the size of the sector. The trends of employment in the agricultural sector are above the employment in mining and transport infrastructure. From 1982 to 1985, the trends showed that employment in the mining sector was constant at 20% up until 1986 to 1990 where there was a decline. The mining sector during that period was retrenching a number of people while the agricultural sector was employing more people. In 1998 to 2001, most employment came from the mining sector more than in the agricultural sector while in 2000, the transport infrastructure sector had a negative rate. In 2006 and 2008, the agricultural sector employed 29% of the labour market while the mining sector only employed 26% of the labour market. In 2010 and 2011, the mining sector retrenched many miners, which resulted to labour unrest.

The Mining Intelligence Database points out that currently, the mining and related industries not only employ over one million people – spending R78 billion in wages and salaries – but are the largest contributor by value to Black Economic Empowerment (BEE). Importantly, mining provides job mining opportunities for unskilled and semi-skilled people.

2.12 Unemployment by Province

Figure 2.8: Trends of Employment in different sectors



Data source Easy data;2014

The graph above shows the trends of unemployment from different sectors, from 2008 to 2014, using the quarterly data in the Western Cape Province. Initially the province with very low level of unemployment, it was between 4% and 8%, and currently, the Western Cape Province has more job opportunities than any province in the country because it has a lesser population compared to other provinces and within that population, most are employed. The second province is the KZN.

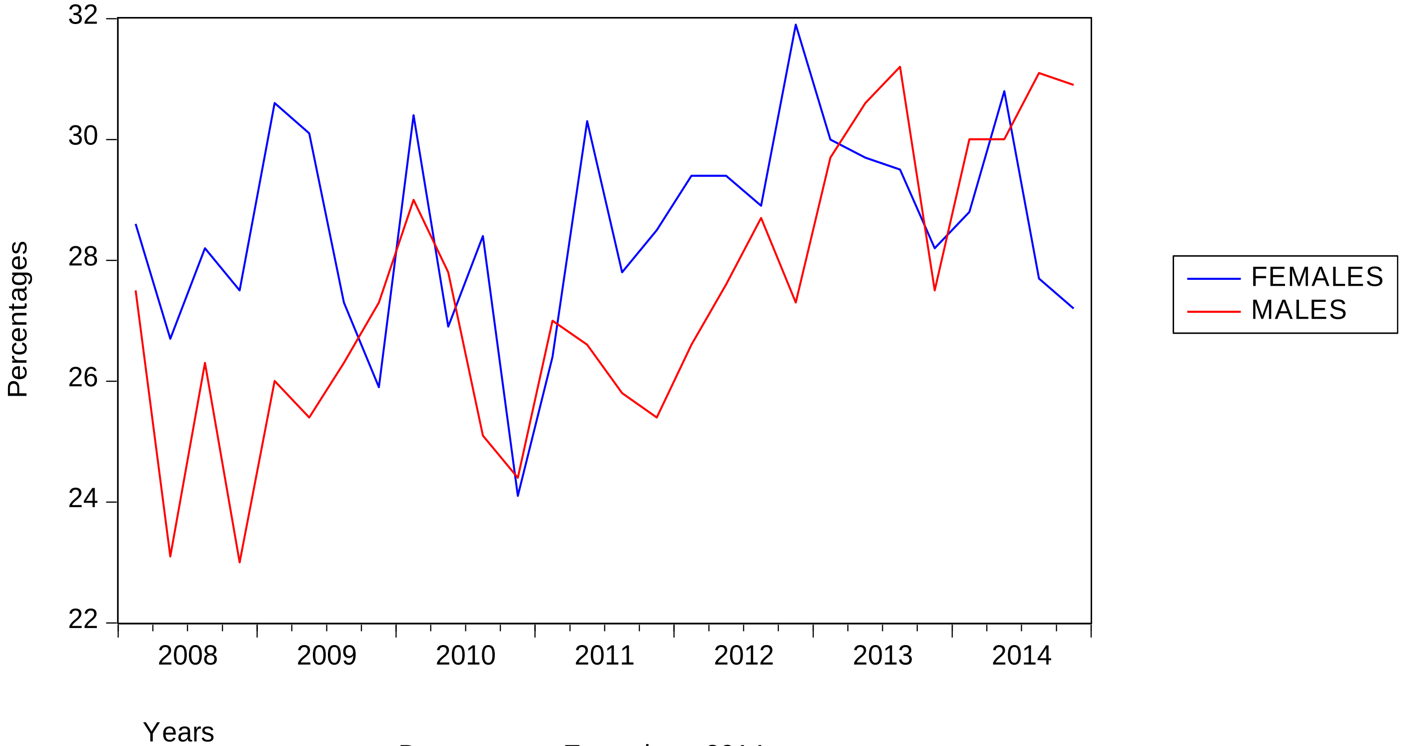
From 2008 (Q1), KZN was above Gauteng Province at 22.5%, but in 2009 (Q2), unemployment declined to 18% below Gauteng Province. KZN continued to be the 2nd Province to have low unemployment in the country until 2012 (Q4) where KZN and Gauteng were equal at 22%. Gauteng Province is the 3rd province with low unemployment rates in South Africa. During 2011(Q4), Gauteng Province experienced a high level of unemployment, and one of the causes of that was the labour unrest and the Marikana massacre which took place in 2011-2012.

Northern Cape, Eastern Cape and Free State appeared to be more or less at the same level between 20% and 30% and have been fluctuating over the years. Free State Province seemed to be the province with the highest unemployment rate from 2011(Q4), and the unemployment rate in Free State Province has been increasing constantly. In 2014(Q2), Free State Province had the highest level of unemployment rate but afterwards, trends showed a slight decline in unemployment to 23.2% in 2014(Q4).

However, it is important to note that the unemployment analysis should be understood within the context of labour market segmentation and limited mobility of new entrants in the market.

2.13 Unemployment by Gender

Figure 2.9: Trends of Unemployment by Gender



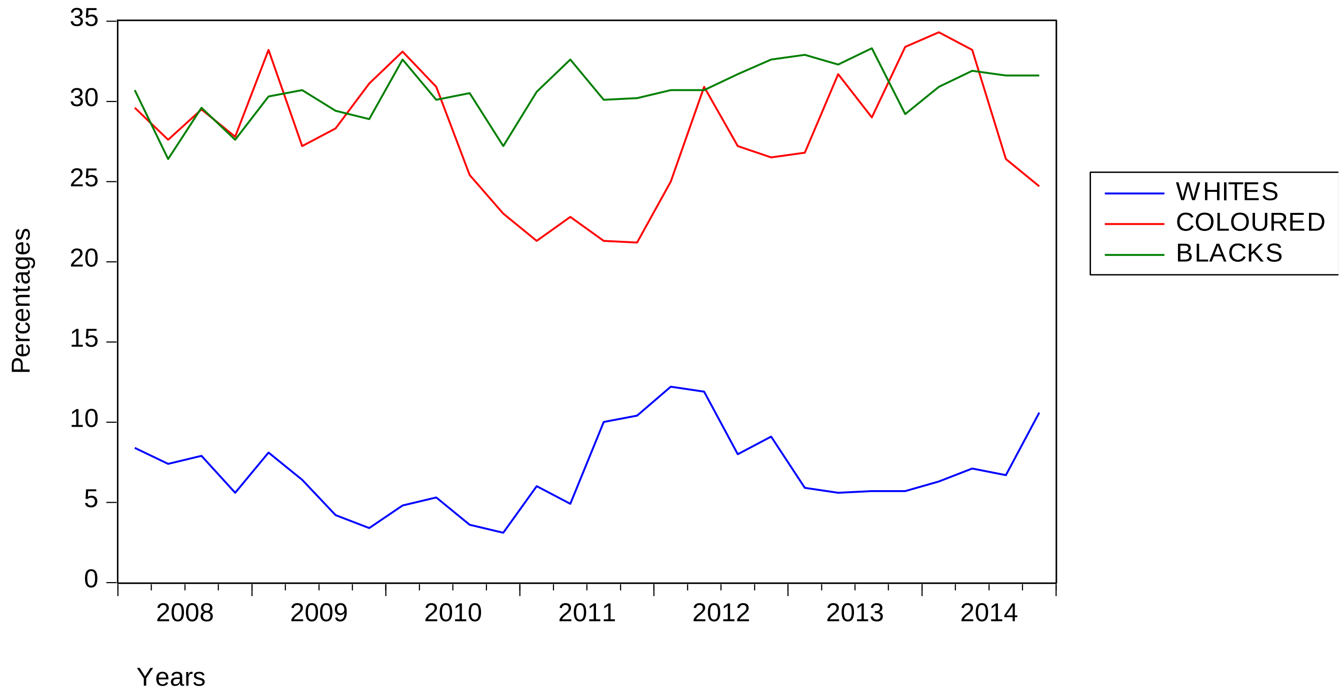
Data source: Easy data; 2014

According to figure 2.9, the trends of unemployment between males and females in 2008-2014 using a quarterly data. At the initial level from 2008(Q1), males are shown to have the lowest unemployment rate and fluctuates below the females' rate of unemployment. That situation might be caused by the gender inequality which was the issue with the apartheid government where most job opportunities such as within the transport infrastructure and other infrastructures, mining, and executive management positions favoured males only. Another reason could be that in some cultures in South Africa, females were not allowed to participate in the labour force market.

During 2009(Q2), the unemployment rate of females declined to 25% compared that of males which increased 29%. Then again, in 2010(Q4), there was rapid decrease in trends of unemployment of males and females due to the 2010 World Cup. Afterwards, both increased at a high rate, particularly the female rate of unemployment. In 2014(Q3), both decreased, but the male rate was above the female rate of unemployment, which clearly showed that in labour force, males are employed more than females, and that is there is still a high level of labour inequality.

2.14 Unemployment by Race

Figure 2.10: Trends of Unemployment by Race



Data source: Easy data;2014

From the trends of unemployment by race in figure 2.10, it is clear that whites have a very low level of unemployment rate which is less than 15% overall. From 2008(Q1) to 2014(Q4) it changed but not more than 15%; during 2012(Q2), the period with the highest rate of unemployment, this was less than 15% compared to coloureds and blacks. According to statistics, whites are the ones who are employed more and were in higher positions. This was caused by the apartheid regime where the government of the minority was ruling and favouring white domination in terms of better lifestyles and better job opportunities (STATSSA, 2009).

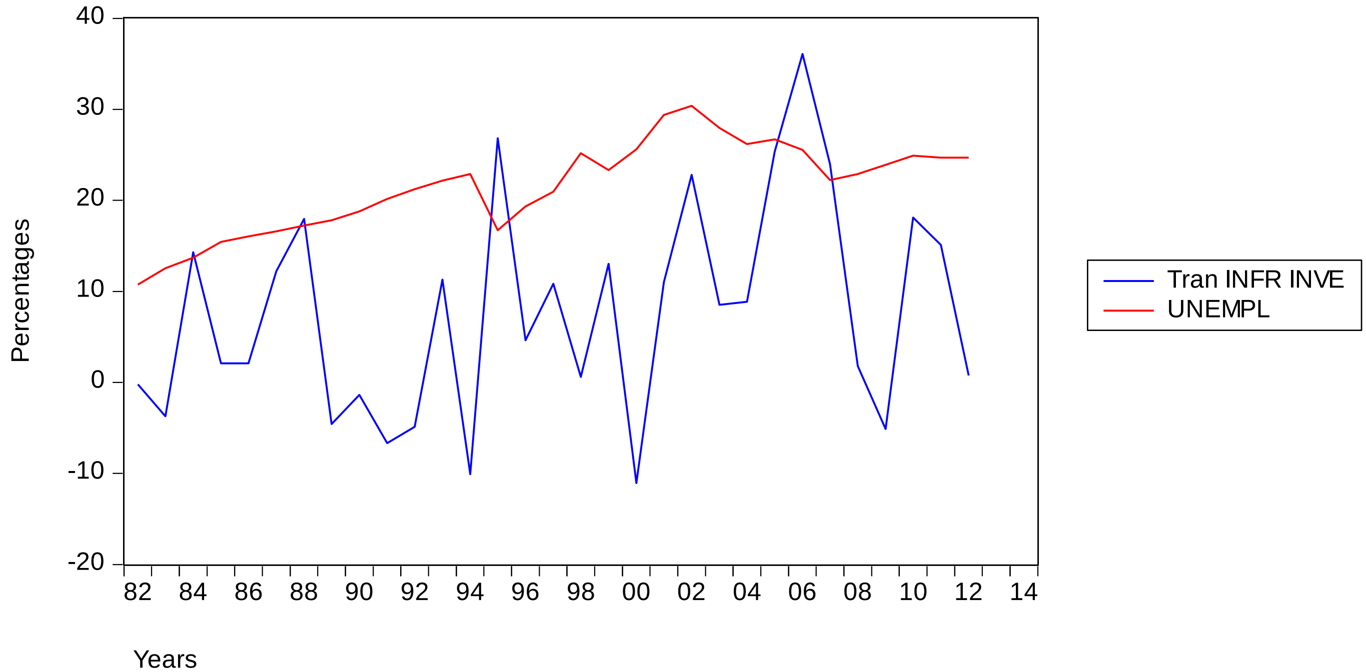
As a result of such trends there was inequality between whites, coloureds and blacks. Coloureds are the second race with a low unemployment rate as compared to blacks (who have high levels of unemployment). During 2008(Q4), coloureds had the highest unemployment rate compared to blacks, but that suddenly changed as trends of unemployment in coloureds rapidly declined to 20%

from 33%, while trends of unemployment in blacks was increasing. During 2012(Q1), trends in unemployment of coloureds increased to be equal to those of blacks, which were constant on 30%.

During 2014(Q1), there was a decrease in the unemployment levels of blacks while the rate of unemployment in coloureds increased above the trends of unemployment of blacks. The trends of unemployment by race suggest that there is still inequality which is taking place in the country even after the democracy era.

2.15 Relationship between Transport Infrastructure Investment and Unemployment

Figure 2.11 Trends of Transport Infrastructure Investment and Unemployment



Data source:World Bank, SARB;2012

According to figure 2.11 above, the transport infrastructure investment has been changing over the years. From 1982, there was a fall up until it went towards negative while unemployment was increasing gradually; this shows a negative relationship between the two variables. Transport infrastructure investment kept rising and falling but was positive between 1984 and 1988. During 1995, there was a rapid increase by 26.8% in transport infrastructure investment due to the end of apartheid wherein the democratic government invested on the transport infrastructure when unemployment was decreasing. In 2000, investment in the transport infrastructure became rapidly low by -11% because of the world Rand crisis which took place during that time; therefore, government invested less funds on infrastructures such as transport.

On the other hand, unemployment was increasing at a higher rate. In 2006, the transport infrastructure investment was at its highest point in the history of the democracy by 36% while unemployment was decreasing. In 2009, the transport infrastructure investment made a rapid fall to -5.11% due to the financial crisis which took place in 2008 which made unemployment to increase to 24.9%. In 2010, due to the World Cup, transport infrastructure investment increased to 18%; afterwards, it declined to 0.74 by 2012. Provision of transport infrastructure investment is one of the effective means made by the government of the country with the aim of improving economic growth.

Transport infrastructure investment is said to be negative related to unemployment, as suggested by the labour market theories (Smith, 2003). If government spends more on the transport infrastructure, this would decrease in unemployment. According to labour markets theory of infrastructure, investment has a negative impact on the unemployment.

During periods of high unemployment and depressed economic growth, governments tend to fund infrastructure projects that are labour-intensive. According to Kangas (1997), the United States of America (USA) embarked on a transport infrastructure drive to pull themselves out of the Great Depression of the 1930s. Great economists such as John Maynard Keynes supported moves that increased spending on transport infrastructure development. His theory was that an increase in capital formation, through public works, during times when employment is low has a greater impact than when the country is near full employment, (Kangas, 1997).

Well-developed transport infrastructure networks are essential for less-developed communities to enable them to access economic activities and services. Transport, including quality roads, railroads, ports and air transport, enable entrepreneurs to get their goods and services to the market places in a secure and timely manner and facilitates the movement of workers to their places of employment, (Kangas, 1997).

2.16 Concluding Remarks

This chapter was aimed at analyzing the South African Transport infrastructure investment and its impact on unemployment looking at trends of the variables. The chapter looked at the trends of transport infrastructure investment and the relationship between unemployment and transport infrastructure investment which have a negative relationship. The trends of the transport infrastructure investment, investment in mining and investment in agriculture to see which sector is being invested more on between the three and agricultural sector is the one with more investments.

The trends of total infrastructure investment against the transport infrastructure investment were discussed in this chapter. The chapter also checked the transport infrastructure investment against other variables used such as the employment in agriculture and mining and employment by provinces to see which provinces have more unemployment than others.

The chapter also looked at the trends of Unemployment by Gender in females and males and lastly, it looked at the trends of unemployment by Race which includes coloureds, whites and blacks, and research showed that whites are the most employed race followed by coloureds, whilst blacks are the least employed race in South Africa.

CHAPTER THREE

LITERATURE REVIEW: Theories and empirical studies

3.1 Introduction

This chapter provides a review of literature on theories and empirical studies on labour markets. The first section looks at: the theoretical literature, demand for labour, supply of labour, standard competitive model and dual market theory. The second section looks at the empirical evidence from developing and developed countries. The last section is the conclusion of the chapter.

3.2 Theoretical literature on labour markets

3.2.1 Demand for labour

Labour demand is defined as a set of decisions that the employers must take in relation to their workers in terms of hiring, wages, ascents and training (Hamermesh, 1993). In neoclassical terms, the objective of the labour demand is to identify the principles that explain the amount of workers demanded by the companies, the type of workers required and the wages that they are prepared to pay to those workers. The labour demand, in this sense, should be understood similarly to derive demand as it is a factor among others into a productive process for goods and services (Hamermesh, 1993).

This theory is primarily a derived demand, and an employer can sell the products of that labour in the market at a price which not compensates the worker for the wage that the employer pays, but also gives an employer a surplus. For the classical and new-classical economists, labour was only one of the many commodities being sold and purchased in the market.
The neo-classical theory, on the basis of the law of Diminishing Returns, hypothesized that every addition to the firm's labour force will bring a diminishing return to the firm and therefore will carry a lower wage rate. As the marginal productivity will be declining, the wages will also have to decline in order to encourage the employers to have the additional hands. The employer will stop expanding the size of his labour force where the value of marginal productivity of labour

equals the prevailing wage. That is the point of the firm's equilibrium at which necessitates the firm having no motive to either to expand or contract. This is a very abstracted view of the behaviour of the firm, and this view simply says that given the falling marginal productivity of labour, the prevailing wage rate will decide how many hands or how much of the labour force will be employed by the firm. Therefore, the demand schedule of the firm consists of the prevailing wage rate and the value of the marginal productivity of labour at different levels of employment (Sinha, 2012).

The firm, again, assuming a competitive model, having no control over prevailing wage rates, is a passive entity seeking to reach the point of equilibrium of the economy by changing the size of its labour force. The firm becomes restless if there is any departure from this equilibrium point, either from the side of the wages or from the side of the level of employment. In addition, the firm keeps shifting its labour force strength by way of reducing or expanding it in order to attain the equilibrium point (Sinha, 2012).

Increasing government spending could be one way to raise demand and reduce unemployment, but given concerns about high debt levels, increase in government spending would have to be compensated by higher fiscal revenues. This could be achieved if governments were to invest in areas with significant growth impact that are, ultimately, self-financing and add little to government debt service (Nickell, 1985).

According to the classical economics, the labour demand is unable to get sufficient employment because of external inflexibilities operating into the economy, for instance government policies and the relative power of the unions. The classical economist thought that just by eliminating the external inflexibilities of the labour market, it would be possible to eliminate the unemployment because the employment price could become completely flexible (Bellais, 2004). Keynesian economics provided a theory arguing that full employment depends on the full aggregate demand, meaning a demand level is considered as both consumption and investment.

According to Keynes, getting full employment will not be possible just by increasing the aggregate consumption, but that the investment rate should also be equal to the difference between the disposable income and aggregate consumption (Stckhammer, 2009). With such a point of view, even though the wages could became absolutely flexible, this is not enough in order to eliminate unemployment, which depends on the investment decisions as well. The classical economics and labour market institutions should be the most important variable affecting unemployment because they can alter the market equilibrium through imposing higher cost of labour (Barker, 2002). However, empirical evidence is not conclusive in order to confirm this theoretical assumption

It was pointed out earlier that a firm can expand its size of labour force, that is, increase employment, if wages were reduced; therefore, the major cause of unemployment could be the reluctance of the workers to accept lower wages, that is, the stickiness of wages. This means that, according to this view, the entire stock of labour could find employment at a wage level equal to marginal productivity of this stock of labour (Hazlitt, 1965).

The Neo-classical theory supports a reduction in wages as a measure to fight cyclical unemployment. Referring to the policy measures of raising wages or calling a stop to falling wages as a measure to fight unemployment, Hazlitt (2006) states that raising the price of a commodity is a strange way of seeking to promote its sale. The mistakes involved in the neo-classical position regarding the behaviour of a firm and its deducing a picture of the behaviour of the economy from the behaviour of the firm have been sufficiently exposed and analyzed to merit any further elaboration here. However, a discussion of the demand for labour at the level of the economy is improper for proper appreciation of any theory of employment or unemployment (Blanchard, 1997).

The other approach which explains employment effects more extensively considers the influences of transport infrastructure on the labour market. In particular, investments in transport infrastructure are viewed to have effects on both the labour demanded by firms and the quantity of labour force supplied to the labour market by households (Eberts & Stone, 1992; Dalenberg & Partridge, 1995, 1997; Dalenberg et al, 1998). Transport infrastructure provision can represent a firm’s amenity, thereby enhancing a firm’s productivity and attracting businesses into an area, which, in turn, leads to changes in the local demand for labour.

3.2.2 Supply of labour

The supply of labour is of crucial importance as a foundation to other more applied aspects of labour economics like unemployment in the context of a welfare benefit system that can influence labour supply decisions. Wasmer (1999) argues that an increase in supply of inexperienced labour can bring about a fall in the wage of unskilled workers and an increase in unemployment and its persistence.

Unemployment occurs when workers are rationed in the labour market, and demand for labour falls short of its supply, (Heintz, 2000). Identifying classification for lack of sufficient labour supply by labelling the Keynesian unemployment theory in which a lack of sufficient aggregate supply in the product market leads to lower of capacity utilization by firms and less demand for labour. Therefore, when sellers are rationed in the goods market, that is, they cannot sell everything that they can produce, rationing of jobs in the labour market occurs. Using this definition, the supply of labour is expressed as total supply of goods and services divided by the average labour productivity in the economy (Heintz, 2000). When supply of labour prevails, the increasing aggregate supply of goods and services reduces the level of involuntary unemployment.

On the supply side of the job market, improvements in transport infrastructure could lead to adjustments in labour supply by attracting households that consider access to good transport services as a residential amenity. Therefore, to the extent that transport infrastructure investment causes these shifts in labour demand and labour supply, this can be translated into changes in employment.

Another reason for transport infrastructure investment is that transport investments can lead to an increase in labour supply by attracting in-migration of households and improve job accessibility.
The basic principle of the theory maintains that the interaction between the demand for labour and the supply of labour determines the equilibrium level of wages and employment in a local labour market. The equilibrium state of the labour market would remain unchanged unless it is disturbed by an economic disturbance or shock to the market. As explicitly pointed out by Eberts and Stone (1992), transport infrastructure investment can be thought of as a shock to the labour market. It

could lead to the enhancement of a region's attractiveness, thereby affecting the decisions of firms and households in several ways. Therefore, if transport infrastructure investment leads to adjustments in labour supply, the current equilibrium of the labour market will move toward a new position that subsequently results in changes in the levels of local wages and/or employment (Cowart, 2000).

The supply side of the labour market can be influenced by transport infrastructure in two major ways. Within a given population, improved access to jobs caused by investments in transportation can lead to adjustments in local labour supply in the short run through changes in the geographical size of the labour market and the amount of labour force participation. A reduction in commuting time and costs associated with transport improvements enables people to increase the geographical scale of their job search and could also encourage potential workers to participate in the labour force. In the long run, improved transport infrastructure could cause the overall population base of a region to increase beyond what it would otherwise be by attracting in-migrations or halting out-migration. As good transportation services can directly serve as a household amenity, improvements in transport infrastructure in the region can also stimulate employment opportunities, which are bound to attract households. Therefore, it is possible that investments in transportation infrastructure could result in an increase in population size, all else being equal, which, in turn, increases the number of persons who will be available to supply the labour to the market (Noland, 2001).

3.2.3 Standard Competitive model

According to labour market theories, the standard competition model assumes that firms and workers are price-takers in the product and labour markets, and that wages and employment are set at the level where aggregate labour demand and aggregate labour supply are equalized. Thus, unemployment is voluntary and is defined as the difference between some exogenous time endowment and actual hours worked, (Brigden & Thomas, 2001).

On the demand side, output is produced according to a Cobb-Douglas production function with labour and capital and as factor inputs. Assuming that firms are always on their labour supply curve, which means they set the employment. Employment is affected by technological changes that are biased towards a particular factor input and changes the level of unemployment benefits. Technological changes shift the labour demand curve, while benefit changes shift the labour supply curve (Layard, 1991).

Transport infrastructure is considered to enter the production process as a factor that augments the productivity of other inputs employed by firms. Therefore, improvements in transport infrastructure can generally be regarded as an increase in the technology of production that could enhance the overall productivity of affected businesses. Better transportation systems, for instance, enable the movement of goods and workers to be more efficient. It can also increase a firm's productivity by lowering the transportation costs of inputs and outputs. Moreover, productivity gains may come from a reduction in other business costs (Quinn, 2001).

For example, good quality roads could lead to savings on vehicle maintenance costs. An increase in the reliability of transport allows firms to reduce stock inventory costs. In some circumstances, transport improvements may also help improve access to customers or remove trade barriers, encouraging firms to exploit economies of scale by serving larger markets. This will result in a reduction in long-run average costs of such firms that can be translated into an increase in productivity. Therefore, one way in which transport infrastructure investment influences firms' productivity is by its effect on production costs, which tends to reduce unemployment.

3.2.4 Dual Labour Market theory

Labour market theory was established in the early 1960s by the Irish political economist, John Elliott Cairnes. Many economists observe the labour market as a market of individuals with different characteristics of education and motivation as well as technology performing a major role in terms of producing output. This opinion later assisted in observing at the demand side of the market. In the theory of labour market, there exist important differences on the demand side which imply differences in compensation and links that are not explained by individual workers' characteristics. Dual labour market was advanced as an alternative to human capital theory by several authors in the early 1970s. Following a brief period of popularity, it faded after influential critiques suggested that existing evidence did not distinguish between labour market and standard human capital theory (Wachter, 1974; Cain, 1976). In the last decade, several important theoretical and empirical developments have generated a recovery of interest in the theory.

David Gordon in 1971 explained the labour market as the historical process whereby political economic forces encourage the division of the labour market into separate submarkets, or segments, distinguished by different labour markets' characteristics and behavioral rules. Dual labour markets are based on employers' needs to motivate workers. In order to stimulate effort from their workers, employers may find it optimal to pay more than the going wage. This changes fundamentally the character of labour markets. The model is applied to a wide range of labour market phenomena. It provides a coherent framework for understanding the claims of industrial policy advocates. It also can provide the basis for a theory of occupational segregation and discrimination that will not be eroded by market forces. The model also provides the basis for a theory of involuntary unemployment (Stiglitz, 1984; Yellen, 1984).

South Africa has been described as having a dual labour market since jobs fall into either the primary or the secondary sector. Jobs in the primary sector are good jobs characterized by high wages, job security, substantial responsibility, and ladders where internal promotion is possible. Jobs in the secondary sector are characterized by low wages and casual attachments between workers, firms and are unskilled (Doeringer & Piore, 1971)

According to dual labour market theory, many economists take the position that competitive markets will tend to make efficient micro-economic decisions about the composition of national output and means by which it is produced, but that macro-economic problems of unemployment will remain. An alternative view is that unemployment and periods of recession are just the most obvious manifestations of market imperfections that pervasively distort the allocation of resources. Market failures that can lead to unemployment are also likely to distort micro-economic aspects of performance badly, (Bulow & Summers, 2009).

The existence of unemployment and the implied failure of the labour market to clear can result only from the failure of wages to adjust to the point at which the supply and demand for labour are equated. Absent minimum wage laws or other institutional impediments, and the failure of firms to reduce wages in the face of unemployment must mean that for some reason, it is unprofitable for them to do so, (Bulow & Summers, 2009).

Reder (1955) and Thurow (1975) have emphasized relative wage rigidities and argued that unemployment is allocated across industries and occupations by the creation and destruction of job opportunities and not by changes in relative wages. Wages are determined largely by social custom and institute factors and queues of workers and fixed wages constitute the supply curve of labour.

Other writers such as Doeringer and Piore (1971) have argued that it is useful to think of employment and the working conditions associated with particular jobs as being determined within dual labour markets. There are two aspects of dual labour theories that are being identified in this theory.

In the short and medium term, the economy generates jobs in both markets at differential rates that are largely independent of relative factor prices and classes of workers. Short and long term can be characterized by the gender, race or social background tend to be confined to one or the other of the labour markets. Some literature also argues that jobs are gender or racially typed and that this rigidity tends to be long standing. The dual labour market theories mention some processes which explain unemployment, unemployment in the primary and secondary market, which is when jobs require and develop stable working habits, and skills are often acquired on the job ladder. Secondary jobs do not require and often discourage stable working habits, wages are low, turnover is high, and job ladders are few. Secondary jobs are mainly filled by minority workers, women and youth, (Doeringer & Piore, 1971).

Unemployment by Race, with minority workers are present in secondary, subordinate primary and independent primary segments, they often face distinct segments within those submarkets. Certain jobs are race-type segregated through prejudice and labour market institutions. Unemployment by gender implies that certain jobs are restricted to men and others to women. Wages in the female segment are usually lower than in comparable male jobs, and female jobs often require and encourage a serving mentality and orientation towards providing services to other people and particularly to men (Gordon, 1997; Harrison, 1991).

3.3 Empirical Evidence

Linkages between public infrastructure investment and unemployment could be established, but the direction of connection may not be unambiguous. Therefore, in order to empirically investigate the influence of transport infrastructure investment and unemployment, it is important to employ estimation techniques that can disentangle the causal nature of infrastructure impact and that can isolate economic changes attributable to improved infrastructure from changes due to other factors

An important research theme relates to differentials in the impact of public infrastructure investment among various industrial sectors. Most previous research has been devoted to examining the role of transport infrastructure investment in an aggregate economy. However, the results found may mask significant information on sectorial differences in the economic development impact of transport infrastructure improvement. Some previous studies have shown that the significance, magnitude, and timing of the impact of infrastructure investment can vary dramatically for different sectors of the economy.

As a measure of the economic development impact from transport infrastructure, the unemployment impact from transport infrastructure investment has been a subject of considerable interest for decades. While the direct economic impact on jobs generated from construction works of transportation projects is of a short-term nature, reduced travel times and costs of travel associated with improved transport facilities could have long-term economic impacts by influencing both firms' and household decisions that can affect employment in several ways.

3.3.1 Empirical Evidence from developed countries

Many studies (Tatom, 1991; Gramlich, 1994; Hulten & Schwab, 1991; Finn, 1993) that have looked at Transport Infrastructure Investment and Economic Growth in the US attribute the change in productivity that occurred between the end of the Second World War and the end of the 1970s, in part, to the construction of the first interstate highways. The results recognized that transport plays an important role in the economy, and developed economies spend substantial sums on investing, maintaining and managing their transport networks. Economic growth in US over the last 20 years has been coupled with increased transport demand.

Walsh (2000) looked at the impact of transport infrastructure investment on regional development in the United Kingdom using the cost benefit analysis (CBA) for the purpose of concentrating on direct user benefits of transport. However, it has been suggested that transport infrastructure investment has a wide impacts on regional development which range beyond direct user benefits; these should also be taken into account in order to ensure efficient allocation of resources. The finding was that there is a high benefit of transport infrastructure investment on regional development.

Many studies have been reviewed concerning the transport infrastructure investment and unemployment. Such studies are those by Lombard (1992) and Dlenberg (1998) whereby they both investigated the impact of transport infrastructure on employment in India using an OLS model from 1982 to 2012; they found that transport infrastructure is positively and significantly related to the employment,

In developed countries, whether rates of investment influence rate of unemployment in the very long-run remains an unsettled question. However, Rowthron (1995) investigated the relationship between transport investment and employment in the United Kingdom using the VECM model from the period 1984-1994, and the results showed a positive relationship between transport investment and employment. Nickell (1990) pointed out that without capital stock from labour demand, valuations can turn to mistakes of misrepresentation. The level to which extra transport investment affects employment is complex regarding the expectations made about technology and the substitutability of capital for labour between other factors.

Sahoo, Dash and Nataraj, (2010) looked at the impact made by the transport infrastructure investment on economic growth in China. The annual data for the period 1975 to 2007 was analysed, using the VAR model. They estimated that the output elasticity of infrastructure investment in China is around 0.2 to 0.41 percent and concluded that China’s transport infrastructure investment strategy was successful since it was embedded in an overall economic policy that focused not only on improving physical infrastructure, but also reducing unemployment rate.

Chen, Salike and Luan (2014) investigated the transportation infrastructure on Economic Growth in China, using panel data for a sample of 28 provinces over the period of 2009 -2010. Empirical findings showed that the eastern region should prioritize the intra-city infrastructure investment to alleviate the negative influence of within city congestion even though the economic impact of highway investment is the largest; while the economic growth of western region of China relies heavily on railway development and the middle area depends more on highway infrastructure investment.

Noland (2006) investigated the extent to which investments in transport contribute to aggregate country-level employment in the private sector of the State of North Carolina, using a panel data model for all 100 North Carolina countries over the period 1985-1997. The results were that employment effect of transport infrastructure depends critically on the model specification considered, and it is essential to account for the dynamics of employment adjustment and potential endogeneity of transport infrastructure to avoid biases in the estimated effect of transport.

Melo, Graham and Brage-Ardao (2013) investigated the productivity of transport infrastructure investment based on a sample of 563 estimates obtained from 33 countries from 1980-2010. The results indicate that the existing estimates of the productivity effect of transport infrastructure can vary across main industry groups, tend to be higher for the US economy than for European countries, and are higher for roads compared to other modes of transport. The variation in the estimates of the output elasticity of transport is also explained by differences in the methods and data used in previous studies. Failing to control for unobserved heterogeneity and spurious associations tends to result in higher values, while failing to control for urbanization and congestion levels leads to omitted variable bias. These findings can be used to inform future research on the choice of model specification and estimation and transport-related policy making.

Echui's (2013) the study examined the temporal relationship between transport infrastructure investment and output in Côte d'Ivoire over the period 1970-2002. Using co-integration and causality tests within a multivariate framework, it was found that the public investment in transport infrastructure, private investment and economic output are co-integrated. The results of the Granger causality tests reveal that public investment in transport does not have a causal impact on economic growth; conversely, economic growth has a causal impact on transport investment.

Tong, Yu and Roberts (2014) examined the dynamic relationships among transport infrastructure, exports and economic growth in the United States using a multivariate time-series analysis. Results suggested that the formation of highways and streets affects economic growth indirectly through enhancing the capital stock of non-transport infrastructure and crowding in private capital. The reverse causality from economic output to highway and street infrastructure was also observed. Aggregate capital stock of non-transport infrastructure, excluding national defense, has sustainable positive effects on economic output and exports over a number of years.

Egert, Kozluk and Sutherland (2009) investigated the investment in network infrastructure that can boost long-term economic growth in OECD countries. They found that infrastructure investment can have a positive effect on growth that goes beyond the effect of the capital stock because of economies of scale, the existence of network externalities and competition- enhancing effects. The paper links between infrastructure and growth with the role of public policies and reports the links with growth from a variety of econometric approaches. Time-series results reveal a positive impact of infrastructure investment on growth. They also show that this effect varies across countries and sectors and over time. In some cases, these results reveal evidence of possible over-investment, which may be related to inefficient use of infrastructure. The Bayesian model averaging of cross-section growth regressions confirms that infrastructure investment in telecommunications and electricity sectors has a robust positive effect on long-term growth (but not in railways and road networks). Furthermore, this effect is highly non-linear as the impact is stronger if the physical stock is lower.

Nazwi and Ramirez (1997) analyzed the impact on economic growth of public and private investment spending in Mexico. Public investment expenditures had a positive and significant effect on output growth. Public investment's impact on economic growth was statistically identical to the impact of private capital spending. The contribution of public investment to output expansion came at the expense of private investment as indicating a significant crowding out effect.

The majority of empirical studies find a strong correlation between physical indicators of infrastructure quality, coverage and accessibility as well as the rate of economic growth. While Aschauer’s (1989) seminal studies of the growth performance of the U.S and other G 7 countries since the Second World War found a significant and positive relationship between public investment and growth, more recent studies, based on a broader range of countries and more sophisticated statistical methods, have found a much smaller and, in some cases, negative, impact of public investment on growth (Barro, 1991; Haltz-Eaken & Scwartz, 1994; Deuarajan, 1996). A recent survey of the literature on public investment and growth by the IMF (2004) found no clear-cut relationship between the two. Straub (2008), who looked specifically at the link between public investment in infrastructure and growth, found the relationship to be positive.

3.3.2 Empirical Evidence from developing countries

Edward (2001) looked at the relationship between transport infrastructure investment and employment in Kenya using the OLS model from 1986 to 2006. The results were that there is a negative relationship between transport infrastructure investment and employment. Edward believed that transport infrastructure investment has a negative effect on local industries as it enhances job exploitation.

Kayode and Adegbemi (2002) investigated the impact of public sector investment in transport on economic growth using Nigeria as a case study. The empirical model for the study was developed from the endogenous growth framework in which transport investment entered into the production function as input using the Ordinary Least Squares (OLS) estimation technique and time series properties tests conducted on variables. Data for the study covered from 1977 to 2009. The findings showed that transportation played an insignificant role in the determination of economic growth in Nigeria. An increase in public funding and complete overhauling of the transportation system in the country were suggested.

Morgenroth's (2014) paper reflected on some of the effects of transport infrastructure on regional development. Transport infrastructure investment over the period from 1995 was not overly concentrated in the Dublin area. It was also shown that peripherally, is difficult to eliminate, thereby suggesting that peripheral parts of the country will need additional advantages over more central locations other than transport infrastructure. The paper reviewed various strands of the literature on the effect of transport infrastructure on economic development. The theoretical literature highlights a number of channels by which transport investment can impact on growth and some conditions which might reduce this impact. The empirical literature also shows some mixed results.

While on average, studies find a positive return of transport infrastructure investment, the return is smaller than sometimes assumed and at the regional level, spillovers are important. Indeed, some results suggest that investment in neighbouring regions can have a bigger positive effect on peripheral regions than investment in the region itself.

Oosterhaven and Knaap (2003) looked at the spatial economic impacts of transport infrastructure investment Kenya. The study used spatial computable general equilibrium models (SCGE models) in 1980-1992. Results of a SCGE model with 14 sectors and 548 municipalities on a proposed transport (magnetic levitation train) project from Schiphol Airport to Groningen City, confirm that the SCGE approach has a high potential. Moreover, its implementation appeared to be far easier than was expected.

Isaksson (2009) looked at two different questions: firstly, to what extent does transport infrastructure explain why some countries have managed to industrialize while others have not? Secondly, can growth of transport infrastructure explain differential rates of industrialization? To answer these questions, a simple empirical model, drawing from the deep determinants literature as well as the one on structural change, was formulated and applied to nearly 80 industrialized and developing countries for a time period of 1970 to 2000. The answer or the results to the first question was in the affirmative, especially at the lowest income levels and for the fast-growing Asian tigers. In terms of explaining differential growth rates, faster rate of investment in railway infrastructure is likely to spur industrial development in the Tiger economies, while for the other country groups, this does not seem to be the case. This appears to be the case for road infrastructure as well, that is, Tigers should increase their spending on roads. The overall conclusion is that transport infrastructure significantly explains long-term levels, but that in the case of the short-term concern, the growth dividend of road infrastructure is quite small.

3.3.3 Empirical Evidence from South Africa.

Perkins, Fedderke and Luiz (2005) examined an analysis of Economic infrastructure investment in South Africa. The study analysed the long-term trends in the development of South Africa's economic infrastructure and how this relates to the country's long-term economic growth. A database covering railways, roads, ports, air travel, phone lines and electricity was established for this purpose and may facilitate further quantitative research. Pesaran, Shin and Smith, 1996, 2001(PSS) F-tests are used to identify directions of association between economic infrastructure and economic growth. These indicate long-run forcing relationships from public sector economic infrastructure investment and fixed capital stock to gross domestic product (GDP), from roads to GDP, and from GDP to a range of other types of infrastructure.

There is also evidence of potential simultaneity between specific types of infrastructure and GDP. The results suggested three main findings. Firstly, the relationship between economic infrastructure and economic growth appears to run in both directions. Inadequate investment in infrastructure could create bottlenecks, and opportunities for promoting economic growth could be missed. Secondly, South Africa's stock of economic infrastructure has developed in phases. Policymakers should focus on choosing or encouraging the right type of infrastructure at the right time. Thirdly, the need for investment in economic infrastructure never goes away. The maintenance and expansion of infrastructure are important dimensions of supporting economic activity in a growing economy, provided that individual projects are chosen on the basis of appropriate cost-benefit analyses.

Rust and Wyk (2012) looked at the role of R&D in transport infrastructure in South Africa. Using the panel data from 2008-2010, the results showed that in spite of current government policy in South Africa, R&D expenditure has increased to a minimum of one per cent of GDP. There is, currently, a lack of focus in the national R&D agenda and in government departments on transport-related research. A list pf potential focus areas for future transport research in South Africa was compiled from local and international information.

Chateni (2013) examined the impact of transport infrastructure investment and transport sector productivity on South African economic growth for the period 1975-2011. Cheteni used a Vector

Error Correction Model and a Bayesian Vector Autoregressive model as empirical tools. The models provide an insight into the dynamic shocks on economic growth through impulse responses. The VECM reveals that economic growth is influenced by inflation, domestic fixed transport investments, and real exchange rate, yet on the BVAR model, it was influenced by inflation, domestic fixed transport investments, multi-factor productivity, real exchange rate and second period Gross Domestic Product.

Newbery (2012) looked at infrastructure and growth in South Africa from 2004-2012 using the cost benefit method (CBM). The results reported a significant positive effect of infrastructure on output, productivity, or long-term growth rates. Infrastructure investment is complementary to other investment in the sense that insufficient infrastructure investment constrains other investment, while excessive infrastructure investment has no added value to the extent that suboptimal infrastructure investment constrains other investment, it constrains growth

Pereira (2000) adopted a strategy to study the effects of different types of infrastructure spending. Pereira considers a multiple-equation econometric system that includes private GDP, private investment, and alternative types of public investment (by federal, state, and local governments), from 1956 to 1997, using annual data. The results showed that Congress cannot react within a year to changes in economic conditions. The study reported, among other statistics, the long-run (cumulative) multipliers for total infrastructure spending and its breakdown.

Sequeira (2013) investigated the impact of investments in transport infrastructure on firm performance. Using an original survey of approximately 900 firms in Southern Africa, the impact of access to a railway on firm sales and the exposure to railway infrastructure was shown to be instrumented by geographic proximity to the historical layout of a railway line destroyed by a civil war in the 1980s and rebuilt in 2008. To further account for historical advantages of regions served by the original railway which adopted differences in the Differences approach that compares the performance of firms in the catchment area of a new railroad to that of firms in other historical transport corridors that planned to rebuild their railroads. The findings were limited firm-level gains from access to the railway. The study provided suggestive evidence on how the absence of impact may be driven by monopolistic practices of railway parastatals managing access to rail services. These findings highlight important policy complementarities between investments in “hard” and “soft” railway infrastructure.

Iacono and Levinson (2013) investigated the impact of transportation investment to identify the impact on the local and state economy. The analysis focuses on the construction, manufacturing, retail, wholesale industries and transportation-intensive industries. Earnings data from 1991 to 2009 were collected for the country in which the project was located, along with neighboring counties, forming a panel data set. These data are used to fit an earnings regression with controls for population, state-level earnings in the industry of interest, and national output. The model was estimated using a panel correction technique that accounts for correlation across panels in the data as well as serial correlation. The effect of the improvement was estimated via a series of interaction variables that identify the county in which the improved highway is located, along with the time period of the observation. Results indicated that none of the industries studied in either case study locations show evidence of statistically significant increase in earnings following completion of the respective improvements, once population and macro-economic trends are controlled for.

Kularatne (2005) looked at the Social and Economic Infrastructure Impacts on Economic Growth in South Africa. The study implied that economic infrastructure investment responds to growth. Social infrastructure investment is found to have a direct, positive impact on GVA. Theoretical evidence does posit the belief that even though public and private capital may be complementary, there may exist threshold effects with respect to public infrastructure expenditure. The findings do mention the possibility of a non-linear relationship existing between per capita output and social infrastructure investment. This threshold is not reached at 1.3% with regard to the social infrastructure net investment rate. The threshold between the private investment rate and net investment rate in economic infrastructure is not reached at 6%. This implies that the government can afford to invest (net) at least 1.3% and 6% in social and economic infrastructure, respectively.

Kumo (2012) investigated the infrastructure investment and economic growth in South Africa whereby the paper conducted pairwise Granger causality tests between economic growth, economic infrastructure investment, and employment in South Africa for the period 1960-2009 using bivariate vector autoregression (VAR) model with and without a structural break. The results indicate that there is a strong causality between economic infrastructure investment and GDP growth that runs in both directions, thus implying that economic infrastructure investment drives the long-term economic growth in South Africa while improved growth feeds back into more public infrastructure investments. The study found a strong two-way causal relationship between economic infrastructure investment and public sector employment reflecting the role of such investments on job creation through construction, maintenance and the actual operational activities while increased employment could, in turn, contribute to further infrastructure investments indirectly through higher aggregate demand and economic growth.

According to Fedderke (2006), public sector infrastructural investment had the effect of promoting private sector investment in physical capital which, in turn, had a positive impact on GDP. Fedderke (2006) argues that the relationship between infrastructure investment and growth, based on an examination of infrastructure investment between 1875 and 2001, suggests that infrastructure investment is closely related to economic growth in South Africa. The author found a "forcing relationship running from infrastructural fixed capital stock to GDP, suggesting that infrastructure leads economic growth" in South Africa (Fedderke 2006, p. 1042). This seems to be a two-way relationship where investment in infrastructure stimulates economic growth, and increasing economic growth both requires and provides funding for greater investment in economic infrastructure. The infrastructures included in the model are railway goods stock, locomotives, unpaved and paved roads, goods and passenger vehicles, and electricity outputs (Fedderke, 2006).

Banister and Berechman (2000) looked at the transport infrastructure as a pre-requisite for economic development. They found that a road infrastructure plays a significant role in economic growth and that a fast growing economy warrants an even faster improvement of infrastructure. The relationship between infrastructure and economic growth has, in recent years, become one of the most important economic topics in both academic and policy circles. At the same time, academic journals have seen a flurry of infrastructure-related publications beginning to correct a historical paucity of South African empirical research into the growth infrastructure relationship. Early international studies by Aschauer (1989a, 1989b, 1989c) and Munnell (1990) found a strong positive relationship between infrastructure and growth, thus sparking considerable academic interest in the study of this relationship.

3.4 Assessment of the literature

Regarding theoretical literature review, the labour market theories reviewed are: demand for labour, supply of labour, standard competitive model and structural unemployment.

According to the labour market theory, labour is compensated by the wages in transport infrastructure and also labour is demanded in which there is a need for employment therefore transport infrastructure can create employment. On the contrary, the demand for labour highlights the law of diminishing returns, that is, every labour that is employed or added will bring a diminishing return on production, which will reduce wages and cause unemployment. However, an increase in transport infrastructure investment could be one way of increasing demand for labour with the level of wages and reduce unemployment.

According to Nickell (2002), the theory of supply of labour and transport infrastructure is considered to be the supply of labour, for it provides labour with employment. The theory highlights the fact that whether a fall in the wages of transport infrastructure jobs compares to the pay available elsewhere in the labour market, this will not only lead to a decline in the quantity of labour being supplied to the infrastructure specifically on transport infrastructure, but also to a fall in the quality of that labour supply. Therefore, increase in transport infrastructure investment can increase the level of employment by increasing the quality and quantity of labour supply.

The Standard competitive model stipulates that the level where aggregate labour demand and aggregate supply are equalized the wages and employment are set. Regarding transport infrastructure investment, where there is availability of demand for labour and supply of labour at the same time, wages and employment are created, that is, unemployment is tackled through transport infrastructure. The theory of transport infrastructure investment is considered as the labour supply, meaning it sets employment.

Dual labour market theory argues for a division of labour markets according to the wages and skills creation on different infrastructural and service sectors. A sector dominated by standard employment as a reference point, it mainly address different dualism of the service economy: traditional sectors (banking and insurance), new high-skill sectors (infrastructure and technological) and growing areas of low-skill services (hotel and restaurants). The dynamic job creation in these segments of the services sector is possible if the government is investing more on infrastructure, specifically transport infrastructure (Wener & Marx, 2009).

Dual labour markets have been a bottleneck for South African and productivity. In the secondary sector, where workers are confined to develop a certain pattern of job instability, moving frequently among jobs and out of unemployment and labour force participation. Transport infrastructure also creates the secondary sector where most workers are unskilled or semi-skilled for the job, whereas good jobs make up the primary sector of the dual economy. On the other hand, bad jobs and workers frozen out of the primary sector compose the secondary sector. This implies that sector jobs are sufficiently plentiful to employ all workers, but they are low paying, unstable and generally unattractive. Workers are barred from the primary sector not so much by their own lack of human capital as by institutional restraints such as gender, race and age differences and by simple lack of good jobs. As such, workers in the secondary sector suffer from under-employment.

Overall, empirical evidence shows that most of the studies that have been done on developed and developing countries, related to transport infrastructure investment on employment, exhibit a positive impact between transport infrastructure investment and employment; others are of the view that transport infrastructure investment has a negative relationship on employment.

3.5 Concluding Remarks

This chapter looked at the theories of labour market which are: demand for labour, supply of labour, standard competitive model and dual labour market theory. It also looked at the empirical evidence from developing countries and developed some empirical evidence of the view that transport infrastructure investment can be the tool to tackle the issue of unemployment in a country as it reduces unemployment and creates decent jobs. At the same time, some theories are of the view that transport infrastructure investment cannot be used as the tool to eliminate unemployment in a country as it is increases unemployment.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the analysis of the impact of transport infrastructure investment on unemployment in South Africa. The previous review of the literature on the relationship between transport infrastructure investment and unemployment has shed some light on the linkage between the two variables. This chapter builds on that background using the case of South Africa to setup the analytical framework used in this study. First, a Vector Autoregression (VAR) model was used, using yearly data for the period 1982 to 2012 formulated to capture the relationship between transport infrastructure investment and unemployment.

4.2 Model Specification and estimation

For the empirical analysis, the study benefitted from the model that was developed by Ianchovichia et al's (2013) model. Ianchovichia et al's (2013) in which he expressed the following variables (Public sector employment, Real Gross domestic product, Public Infrastructure Spending and trade Openness) investigated Job Creation through Infrastructure Investment in the Middle East. However, in the case of this study the model was adopted and modified by including some of the variable such as RExch, Tii, TT-Tii, and R*i* and eliminate some variable.

The general equation is as follows:

U*e*= *f* (T*ii* , RGDP, RExch, R*i*, OPEN, TT-Tii) …………………………………………... (1.1)

In investigation of the impact of transport infrastructure investment on unemployment in SA, the variables were based on the overview of the study in chapter two. The explanatory variables in this study are transport infrastructure investment (Tii), real gross domestic product (RGDP), real exchange rate (RExch), real interest rates (R*i*), Openness (OPEN) and total infrastructure investment minus transport infrastructure (TT-Tii). Unemployment (Ue) is a dependent variable.

The dependent variable is explained by movement in transport investment, real gross domestic product, real exchange rate, real interest rates, openness and total infrastructure investment minus transport infrastructure.

The econometric model is expressed in a log-linear form:

$$\mathbf{U}\boldsymbol{e} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{Tii_t} + \boldsymbol{\beta_2}\mathbf{RGDP_t} + \boldsymbol{\beta_3}\mathbf{RExch_t} + \boldsymbol{\beta_4}\mathbf{R}\boldsymbol{i}_\mathbf{t} + \boldsymbol{\beta_5}\mathbf{OPEN}_{\boldsymbol{t}} + \boldsymbol{\beta_6}\mathbf{TT_t\text{-}Tii_t} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(1.2)}$$

U*e* = unemployment;

Tii = transport infrastructure investment;

RGDP = real gross domestic product;

RExch = real exchange rate;

R*i* = real interest rate;

OPEN = openness;

TT-Tii = total infrastructure investment minus transport infrastructure investment

The remainder of the above equations is β_0 which is an interception, β_1, β_2, β_3, β_4, β_5 and β_6 are the coefficient of the independent variables, and *t* is the time. The influence of the omitted variables in the specification of the model is represented by ε.

The examination of the dynamic impact of transport infrastructure investment on unemployment in South Africa was carried out using the Vector Autoregression (VAR) methodology. Westaway (1999:28) states that Vector Autoregressions (VARs) are dynamic systems of equations in which the current level of each variable in the system, for example, real exchange rates and interest rates, depends on past movements in that variable and on all the other variables in the system. It also uses minimal assumptions about the underlying structure of the economy and, instead, focuses entirely on deriving a good statistical representation of the past interactions between economic variables, letting the data determine the model.

Stock and Watson (2001) clarify that there are three varieties of VARs that are discussed in econometric literature, namely, reduced form, recursive and structural. Reduced form VAR expresses each variable as a linear function of its past values and the past values of all other variables being considered and a serially uncorrelated error term. A recursive VAR constructs the error terms in each regression to be uncorrelated in the preceding equations. In VAR, all variables of interest are endogenous, all equations use the same explanatory variables, and explanatory variables are mainly lagged variables. However, even VARs are not completely devoid of assumptions, since the choice of variables to include in the system and the length of lags allowed represent a type of restriction, which can have important implications.

4.3 Estimation Technique

4.3.1 Unit root analysis

The first step in the analysis is to test for stationarity of our variables. This test is undertaken to examine the time series properties of the individual variables. The precise definition of stationarity is that the distribution of the time series variable does not change over time. Stationarity, thus, requires the future to be like the past, at least in a probabilistic sense. In practice, however, many economic time series are non-stationary and, thus, cause the conventional OLS-based statistical inferences to be misleading. The purpose of these stationarity tests, therefore, is to determine the order of integration of each of the variables under consideration in this study and, thus, the number of times that a particular variable must be differenced to achieve stationarity. Besides, it is also to avoid the possibility of a spurious regression. Gujarati (2003) suggests that a stationary stochastic process implies that the mean and variance are constant over time, and the covariance between two periods depends only on the lag between the two time periods and not the actual time at which the covariance is computed. This implies, therefore, that a non-stationary time series will have a varying mean or varying variance or both.

There are various methods for testing for stationarity and unit roots, consisting of informal and formal tests. The informal tests are carried out by means of visual plots of data in the form of graphs and correlogram (auto-correlation function). The formal unit root tests include the Augumented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. This study employed both informal and formal tests to establish stationarity/unit roots in the variables. Informal tests are simple and check for stationarity by plotting the time series and looking for evidence of a trend in mean, variance, auto-correlation and seasonality. The study made use of subjective visual inspection of plots and correlograms.

However, the study gives hints as to the presence or absence of stationarity. Formal tests help with determining stationarity and are based, for the most part, on formal statistical tests. The difference between the different types of formal tests lies in the stringency of the assumptions they use as well as in the form of the null and alternative hypotheses they adopt. Most economists adapt to formal tests because of their statistical nature. The time series properties of the variables were analyzed carefully through the Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests. The two methods were used so as to obtain robust results

4.3.2 Augmented Dickey Fuller (ADF)

The DF method has been criticized for the near observation equivalence. This arises when the analytical tests have low statistical power because they often cannot distinguish between true Unit-root processes and near unit-root processes. In addition, the DF test is valid only if μ_t is assumed not to be auto-correlated, but would be so if there is auto-correlation in the dependent variable of the regression ΔY_t. The test would, therefore, be outsized, meaning that the true size of the test would be higher than the normal size used. The error term should, thus, satisfy the assumption of normality, constant error variance and independent error terms failure would render the DF test biased (Takaendesa, 2006). These problems can be eliminated by using a stricter version of DF test method known as the ADF test together with the PP test. The ADF test is preferred to the DF test since the latter has critical values that are bigger in absolute terms and may sometimes lead to a rejection of a correct null hypothesis (Brooks, 2004:379).

An ADF is a test for a unit root in a time series sample. It is an augmented version of the Dickey-Fuller test for a larger and more complicated set of time series models. The ADF statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence. The ADF test is one of the most used tests for unit root in time series models. It involves the use of the ordinary least-squares (OLS) method to find the coefficients of the chosen model. The t-statistic is computed and compared with the relevant critical value to estimate the significance of the co-efficient. If the test statistic is less than the critical value, then the null hypothesis is rejected with the conviction that there is no unit root (Brooks, 2002).

The respective time series was first be tested utilizing the improved ADF test as it gives better results than the DF test since it includes extra lagged terms of the dependent variable in order to eliminate auto-correlation.

The ADF test for unit root involves the estimation of the following equation:

$\Delta y_t = \alpha_0 + \lambda\, y_{t-1} + \alpha_2 t + \sum \beta_i\, \Delta\, \mu_t\, \mu\, y^{t-1} + \mu_t$ ……………………………..……………………….. (3)

The equation shows that $\Delta Yt = Yt - Yt\text{-}1$; $\Delta Yt\text{-}1 = Yt\text{-}1 - Yt\text{-}2$, and the number of lags to be included is empirically determined using Schwarz information criteria. The same critical values for the DF are calculated by Monte Carlo simulation in MacKinnon-Haug-Michelis (1999) as the distribution is not standard. The test proceeds by testing the significance of the co-efficient of Yt Where μt is the pure white noise error term The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (3) is serially correlated (Gujarati, 2003:819). The null hypothesis is that there exists a unit root in the time series (nonstationary time series), which is H0: $\alpha=0$ against the alternative hypothesis, H1: $\alpha < 0$, that the time series is stationary (no unit root). -1.

The augmenting is done to remove possible auto-correlation among error terms. In the event that the calculated values are greater than the critical values, we reject the null and state that the variable is stationary.

The assumptions that the error terms are independent and have a constant variance raises problems related to the fact that the true data-generating process may contain both auto-regressive and moving average (MA) components. In this case, we do not know how to conduct the test if the order of the MA terms is unknown, we cannot properly estimate α and its standard error unless all the auto-regressive terms are included in the estimating equation, the DF test considers only a single unit root and it is difficult to ascertain where the intercept and/or time trend belongs (Enders, 1995:225). In addition, the DF test tends to accept the null hypothesis of the unit root more often than needed. That is, according to Brooks (2002: 381) and Gujarati (2003:819), it exhibits low power.

4.4.3 The Philips Peron (PP) test

This is a unit root test similar to the Augmented Dickey-Fuller (ADF) test, but the test incorporates an automatic correction to the Dickey-Fuller (DF) procedure to allow for auto-correlated residuals. It is used in time series analysis to test the null hypothesis that a time series is integrated of order 1. Like the ADF test, the PP test addresses the issue that the process of generating data for y_t might have a higher of auto-correlation than is admitted in the test equation, making y_{t-1} endogenous and thus invalidating the Dickey-Fuller t-test. These tests often give the same conclusions as, and suffer from most of the same important limitations as, the ADF tests.

This test allows for fairly mild assumption concerning the distribution of errors. The test regression for the Phillips-Perron test is the AR (1) process given as:

$\Delta y_{t-1} = \alpha_0 + \lambda\, y_{t-1} + e_t$ ………………………………………………………………………….. (4)

As there is likely to be serial correlation in our explanatory variables (real gross domestic product, real interest rates, real exchange rates….), the PP test corrects for higher order serial correlation by adding lagged differenced γ from the AR (1) regression to account for the serial correlation in e_t . In addition, the PP test has an advantage over the ADF test when the concerned time series has serial correlation, and there is a structural break, as in our case. All the variables were tested for stationarity using the above methods.

A great advantage of Philips-Perron test is that it is non-parametric, i.e. it does not require selecting the level of serial correlation as in ADF. It rather takes the same estimation scheme as in the DF test, but corrects the statistic to conduct for auto-correlations and heteroskedasticity (Heteroskedasticity and auto-correlation consistent [HAC] type corrections). The other disadvantage of the PP test is that it is that it is based on asymptotic theory.

4.5 Testing for Stationarity

The assumptions of the Classical regression model necessitate that both the dependent and independent variables be stationary, and the errors have a zero mean and finite variance. Non-stationary variables results in spurious regression, and Granger and Newbold (1974) argued that they are characterized by a high R2 and low Durbin-Watson (*dw*) statistic, t-and F-statistics that appear to be significant, but the results derive no economic sense (Verbeek, 2000:281). The results "looks good" because the least-squares estimates are not consistent, and the customary test of statistical inference do not hold (Enders, 1995:215).

In addition, a series is said to be integrated and is denoted a *I* (d), where d I is the order of integration. The order of integration refers to the number of unit roots in the series, or the number of differencing operations it takes to make a variable stationary (Takaendesa,2004). In particular, as shown in Phillips (1986), the ordinary least squares estimator does not converge in probability as the sample size increases, the t-and F-statistics do not have well defined asymmetric distributions, and the *dw* statistic converges to zero. The reason is that with variables being I(I), the error term μt will also be a non-stationary I(I) variable (Verbeek, 2000:281). Enders (1995:215) noted four cases of spurious regression: Case I - when both variables are stationary, the classical regression is appropriate. Case II - regression equations using variables which are integrated of different sequences are meaningless. Case III - if the variables in non-stationary sequence are integrated of the same order and the sequences contains a stochastic trend, the regression is spurious. The results from such spurious regressions are meaningless in that all errors are permanent. In this case, it is often recommended that the regression equation be estimated in first differences, Case IV - if variables in non-stationary, sequences are integrated of the same order, the residual sequences is stationary and the variables are co-integrated.

4.6 The Johansen Co-integration Technique and Restricted Vector Auto-regression

The study will utilize the Johansen co-integration technique in establishing if there is a long-term relationship between the variables of interest. The Johansen method is preferred to the Engle-Granger approach because it captures the underlying time series properties of the data. It is a systems equation test which provides estimates of all co-integrating relationships that may exist within a vector of non-stationary variables or a mixture of stationary and non-stationary variables. Once the number of co-integrating relationships has been established, a series of likelihood ratios tests can be performed to test different hypothesis about them. The technique is based on full system estimation and has greater power and helps to eliminate simultaneous equation bias and raise efficiency relative to single equation methods. In the study, the Johansen (1995) methodology is used because the maximum likelihood framework involved offers much better properties and strengths than the traditional EG approach which is residual-based.

4.6.1The Johansen methodology uses the following procedure:

- Testing the order of integration of the variables under consideration. When the variables are integrated of the same order, we proceed with the co-integration test, and the data should also be plotted graphically to identify a linear time trend of the variables;
- Setting the appropriate lag length of the model through estimation of the model and determining the rank of matrix;
- Selecting the appropriate model regarding the deterministic components in multivariate system; and
- Determining the number of co-integrating vectors by applying causality tests on the error correction model to identify a structural model and determine whether the estimated model is reasonable.

4.6.2 Advantages of Johansen Co-intergrating Method

The Johansen co-integrating method is the most used and powerful technique used in determining the co-integrating relationships. The Johansen co-integrating method permits the testing of hypotheses about the equilibrium relationship between the variables. The co-integrating tests are performed if a series needs differencing before it becomes stationary. According to Harris (1995:22), "…. if a series must be differenced *d* times before it becomes stationary, then it contains *d* unit roots and is said to be integrated of order *d*, denoted *I(d)*." This suggests that requires differencing before it becomes stationary is integrated of the order equivalent to the number of times that series is differenced. The Johansen co-integration test, which is a Vector auto-regressive (VAR) framework, provides a unified approach for the multivariate co-integration system based on the error correction mechanism of the VAR (*k*) model.

4.7 Vector Error Correction Model (VECM)

In the event that co-integration is established in the study, the VECM is estimated to analyse the short-term interaction between the variables of interest.

The VECM specifies the short-run dynamics of each variable in the system and in a framework that anchors the dynamics to long-run equilibrium relationship suggested by economic theory. For instance, the economic theory suggests that economic activity across regions should converge. If this convergence hypothesis is true, we might observe long run relationships between employment performances across regions. The existence of such long run conditions does not prevent the existence of stationary, though variable short run deviation from them. Phillips and Perron (1998) showed that forecasts based on a VEC model that explicitly estimates co-integrating relationships and unit roots are consistent and asymptotically optimal.

4.8 Impulse Response

Impulse responses traces out the response of current and future values of each variable to a one unit increase in the current value of one of the errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero (Stock & Watson, 2006). Therefore, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system, over time, are noted. Thus, if there are g variables in a system, a total of impulse responses could be generated. This is achieved, in practice, by expressing the VAR model as a vector moving average (VMA). If the system is stable, the shock will gradually die away (Brooks, 2008:299).

To determine the reaction of stock prices to changes in monetary policy, impulse response functions were constructed from the VAR. Brooks (2008) points out that impulse response functions trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. For each variable from each equation, separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted. Thus, this helped us to analyze the response of stock prices to changes in monetary policy for a unit shock in the other variables.

4.9 Variance Decomposition

In addition to the impulse response function results, we also conducted variance decomposition analysis. Yinusa and Akinlo (2008) showed that while impulse response functions trace the effects of a shock to one endogenous variable on to other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. The variance decomposition analysis, thus, provides information about the relative importance of each random innovation in affecting the variables in the VAR. Thus, in this study, variance decomposition gave us the proportion of the movement in the stock prices versus shocks to other variables. This helped us to identify factors which affect stock prices in the short, medium and long run.

4.10 Diagnostic checks

Diagnostic checks are vital in the examination of the relationship between transport infrastructure investment and unemployment variables because they validate the parameter evaluation outcomes achieved by the estimated model. These checks test the stochastic properties of the model such as residual auto-correlation, heteroscedasticity and normality, among others. The multivariate extensions of the residual tests just mentioned are applied in this study and briefly discussed.

4.10.1 Normality Test

This is a test of normality that has now become very popular and is included in several statistical packages is the Jarque-Bera (JB) test. This test first computes the coefficients of skewness and kurtosis of a random variable. For a normally distributed variable, skewness is zero and kurtosis is three (Gujarati, 2009).

The assumptions of the Classical Linear Regression Model (CLRM) require that the residuals are normally distributed with zero mean, and a constant variance and violation of this restriction will result in t-and F-statistics being not valid. One way of detecting mis-specification problems is through observing the regression residuals. Usually, the normality test checks for skewness (third moment) and excess kurtosis (fourth moment) (for details on the test, see Verbeek, 2000:173). The Jarque-Bera normality test compares the third and fourth moments of the residuals to those from the normal distribution under the null hypothesis that residuals are normally distributed, and a significant Jarque-Bera statistic, therefore, points to non-normality in the residuals may not render co-integration tests invalid.

4.10.2 Heteroscedasticity Test

This test is an extension of White's (1980) test to systems of equations. It tests the null hypothesis that the errors are both homoscedastic (no heterocedasticity problem) and independent of the regressors and that there is no problem of mis-specification. The test regression is ran by regressing each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression. The failure of any one or more of the conditions just mentioned above could lead to a significant test statistic. Thus, under the null of no Heteroscedasticity and no misspecification, the test statistic should not be significant.

Heteroskedasticity arises if different error terms do not have identical variances, so that the diagonal elements of the covariance matrix are not identical. The error terms are mutually uncorrelated while the variance of μi may vary over the observations. The consequences of using the usual testing procedures despite the heteroskedasticity are that the conclusions we draw or the inferences we make may be very misleading (Gujarati, 2003:399). In this study, we employed the White test. The general white test of heteroskedasticity does not rely on the normality assumption and is easy to implement (Gujarati, 2003:413). The basis of this test is to check whether there is any systematic relation between the squared residuals and the explanatory variables (Mukherjee *at al*.1998:261). It tests the null hypothesis that there is no heteroskedasticity in which the test statistic should not be significant in the absence of heteroskedacity and mis-specification.

4.10.3 Auto-relation Test

The term auto-correlation can be defined as correlation between members of observations ordered in time series data. Auto-correlation is usually associated with time series data although as the preceding definition suggests autocorrelation can occur in cross-sectional data. There is serial correlation (i.e. auto-correlation) when either the dependent variable or the residual show correlation with its values in pasts periods. This is a problem because standard errors are not consistent, thereby affecting statistical inferences (i.e. Hypothesis testing). It arises in cases where the data have a time dimension and where two or more consecutive error terms are related. In this case, the error term is subject to auto-correlation or serial correlation. It arises as a result of either excluded variables or the use of incorrect functional form. The consequences of auto-correlation are that the OLS remains unbiased, but becomes inefficient and its standardized errors are estimated in the wrong way (Gujarati, 2003: 454; Verbeek, 2000:90).

The study applied the Lagrange Multiplier (LM) test, a multivariate test statistic for residual serial correlation up to the specified lag order. Harris (1995: 82) argues that the lag order for this test should be the same as that of the corresponding VAR. The Lagrange Multiplier (LM) tests the null hypothesis, H0: $\rho1=\rho2= \ldots\ldots =\rho p=0$ (no auto-correlation) against the alternative hypothesis, H1: at least one of the ρs is not zero, thus serial correlation.

4.11 CONCLUDING REMARKS

The chapter presented the procedures involved in the Johansen (1988), Johansen and Juselius (1990) approach. The co-integration technique has been chosen as the preferred parameter estimation technique for monetary policy model. This is because of its several advantages over alternative techniques. Based on the co-integration approach, the error correction model, which contains information on both the long run and short run relationship between variables is estimated. The estimated model has to pass all the diagnostic checks which involve the auto-correlation LM test, white heteroskedasticity test and residual normality test. Having familiarized ourselves with the estimation techniques, we now apply these techniques to South African data in order to achieve the objectives of this study as set out in Chapter one.

CHAPTER FIVE

ESTIMATION AND INTERPRETATION OF RESULTS

5.1 Introduction

The main aim of this chapter is to present, interpret and analyze all the tests results. This chapter also applies the techniques discussed previously using South African data in order to achieve the objectives set out in Chapter 1. It amplifies the trends analysis of Chapter 2 by applying the analytical techniques proposed on annual data covering 1982 to 2012. The results presented include those of unit root and co-integration. Assuming the presence of at least one co-integration relationship among the variables, the error correction model (VECM) is estimated; otherwise VAR analysis is done. After the VECM and VAR analysis, the study moves on to carry out diagnostic checks to ensure the adequacy of the model. The econometric package used in this study is the E-views version.

5.2 Informal Unit Root Tests

5.2.1 Graphical displays

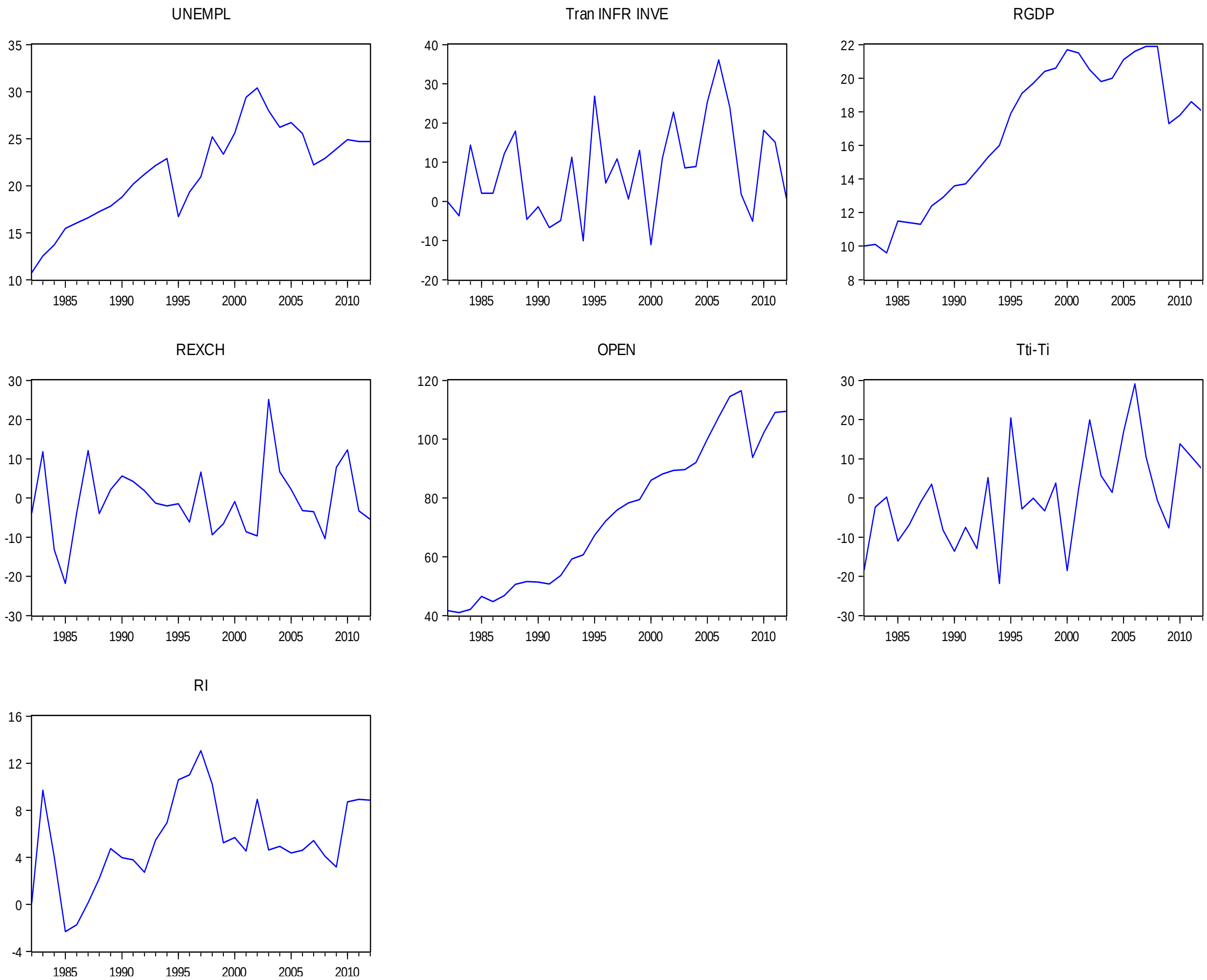
A popular informal test for Stationarity is the graphical analysis of the series. This is a visual plot of the series which is an important step in the analysis of time series before pursuing any formal tests. This introductory examination of the data is important as it allows the recognition of any data capturing errors and structural breaks and gives an idea of the trends and Stationarity of the data set. Figure 5.1 below displays plots of all variables considered for the unemployment model.

Figure 5.1 below shows five of the series (Unemployment, RGDP, RExch, OPEN,Ri) are trending upwards with some fluctuations while the rest of the series (transport infrastructure investment and total infrastructure – transport infrastructure investment) do not show any trend, notwithstanding huge fluctuations.

All other variables in figure 5.1 follow a stationary process-white noise process as it moves closely around the mean and could be stationary or closer to the stationary boundary; it also seems to be hovering around its mean, but the variance is clearly not constant over time. Except for the variables Unemployment, GDP and OPEN, they have a time variant mean and variance suggesting that they are not stationary in their levels.

Figure 5. 1: Graphical unit root tests 1982-2012

5.2.1i Stationarity test: levels



Based on this analysis above, we cannot be certain of the stationarity of the variables, especially those that do not follow a clear trend such as transport infrastructure investment in this study. Therefore, more analysis is required.

Figure 5.2: Graphical unit root tests 1982-2012

5.2.1.ii Stationarity test: differenced

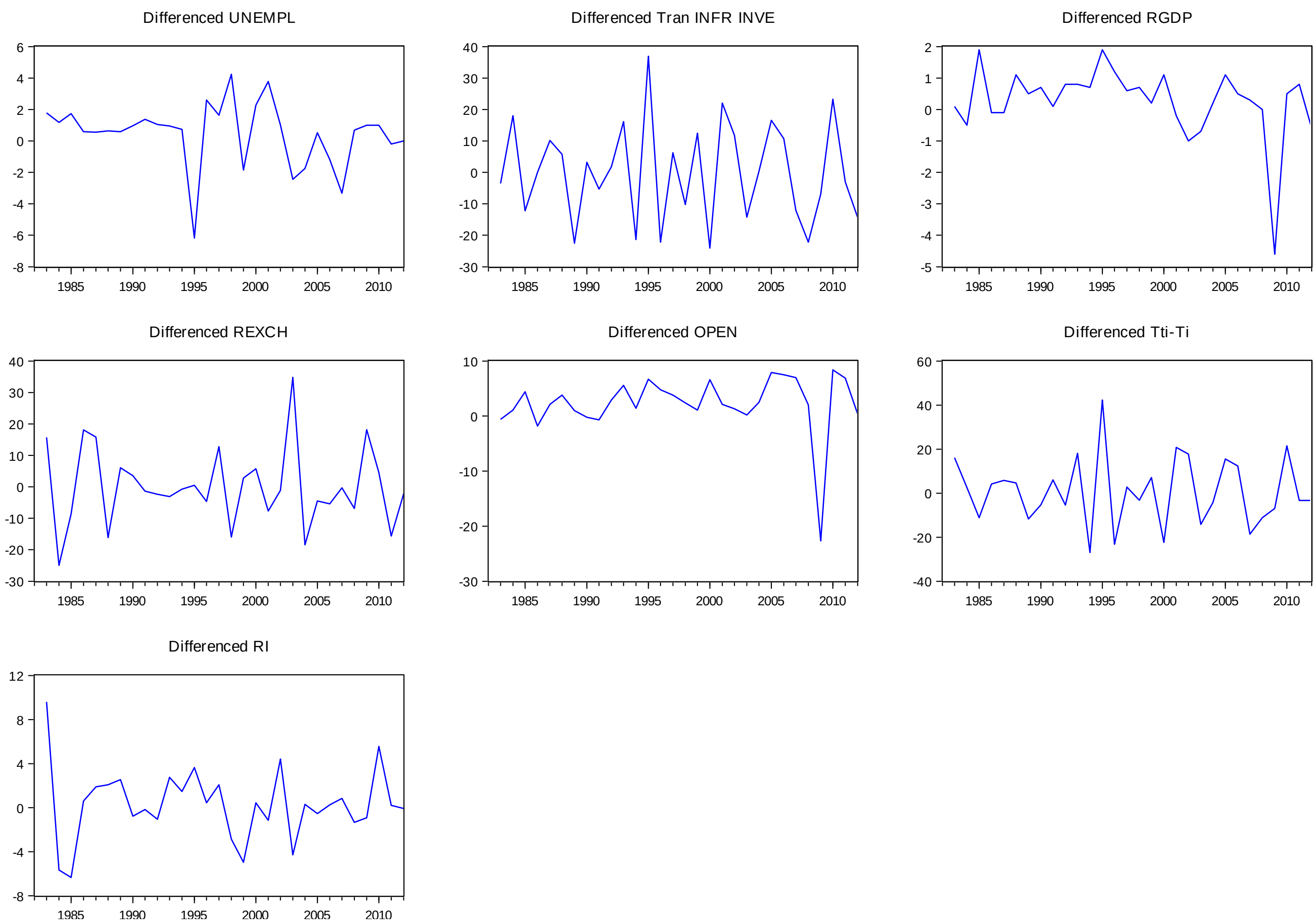


Figure 5.2 shows the time series data at first differencing. The trends from the variables (Unemployment, Tii, RGDP, RExch, OPEN, Ri and TT-Tii) follows a stationary process-white noise process, as they move closely around the mean. Formal tests stationarity are used to augment informal graphical analysis of stationarity. These formal tests are discussed in the subsequent section.

5.2.2 Testing for Stationarity/ Unit Root

The formal tests used in this study are the Augmented Dickey (ADF) and Phillips-Peron (PP). The results of these tests are reported in table 5.1, and these confirmed that differencing once was all that was required to bring these variables to stationarity.

These tests were applied to the data under different deterministic trend assumptions, that is, those that excluded constant and trend and have trend and intercept produced robust results. The option with constant and no trend produced 'explosive' results (especially under the ADF).

Granger and Newbold (1974) argued that when the dependent and independent variables have unit roots, traditional estimation methods using observations on levels of those variables will likely find a statistically significant relationship, even when a meaningful economic linkage is absent. For meaningful policy analysis, it is important, therefore, to distinguish between a correlation that arises from a shared trend and one associated with an underlying causal relationship. Thus, in this study, to achieve that, the data was subjected to two types of tests to establish their univariate time series behaviour in order to determine the basic unit of observation. These tests are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP).

The unit root tests considered both the null hypothesis of a random walk without a drift (untrended) and a random walk with a drift (trended). The results of these tests are reported in Table 5.1.

In this section, we follow the estimation techniques developed in the analytical framework given in Chapter 4. Thus, the following step involves subjecting the variable to stationarity.

The results are shown in table 5.1 below:

Table 5.1: Unit root tests 1982-2012 at levels and first differences (Δ)

Variables	Augmented Dickey-Fuller (ADF)			Phillips Peron (PP)			Order of Integration
	INTERCEPT	TREND AND	NONE	INTERCEPT	TREND AND	NONE	

		INTERCEPT			**INTERCEPT**		
UNEMPL Δ(UNEMPL)	-5.242942*** -6.528687***	-5.354462*** -6.398641***	0.731969* -5.131256***	-2.342435* -5.441617***	-2.056712 -7.554440***	0.853910 -5.135623***	I(1)
Ti Δ (Ti)	-4.691293*** -8.265613***	-4.987490*** -8.142329***	-3.523379*** -8.414018***	-4.683783*** -18.54074***	-4.946772*** -19.48874***	-3.466719*** -17.66655***	I(0)
RGDP Δ (RGDP)	-4.771845*** -4.479275***	-0.488928 -5.213531***	0.832469 -4.627427***	-1.680152 -4.759339***	-0.511978 -5.300405***	0.773073 -4.619777***	I(1)
RExch Δ(RExch)	-4.982391*** -6.937591***	-4.921890** -6.763648***	-5.052861*** -7.069887***	-6.109283*** -18.34451***	-7.267285*** -18.12989***	-6.103292*** -17.19374***	I(0)
R*i* Δ (R*i*)	-2.794733* -6.739867***	-2.922135 -6.677872***	-1.047434 -6.893383***	-2.857881* -6.878240***	-2.993088 -6.664359***	-0.795720 -7.042366***	I(0)
OPEN Δ(OPEN)	-5.623352*** -5.390222***	-5.511715*** -5.457232***	1.937265* -5.530860***	-0.228826 -7.517259***	-2.915481 -7.273865***	3.025153*** -4.838943***	I(1)
Tti-Ti Δ(Tti-Ti)	-4.690509*** -6.257001***	-5.813699*** -6.123816***	-4.746631*** -6.300522***	-4.685112*** -22.14774***	-6.248874*** -21.50399***	-4.742778*** -17.91749***	I(0)

Critical Values 1%	**-3.670170**	**-4.309824**	**-2.647120**	**-3.670170**	**-4.296729**	**-2.644302**
5%	**-2.963972**	**-3.574244**	**-1.952910**	**-2.963972**	**-3.568379**	**-1.952473**
10%	**-2.621007**	**-3.221728**	**-1.610011**	**-2.621007**	**-3.218382**	**-1.610211**

Values marked with *** represent a stationary variable at a 1% significance level, and ** represents a stationary variable at a 5% significant level. * 10% significant level.

The results in Table 5.1 show that the null hypothesis of non-stationarity cannot be rejected when variables are at levels. When the test is applied to first differences of the series, they all become stationary. We, therefore, can conclude that the variables in our co-integration regression are first difference stationary, that is, each series is characterized as integrated of order one I(I).

The graphical analysis serves as a benchmark for the formal measure of the unit root. Table 5.1 shows that it is apparent that the series (transport infrastructure investment, real exchange rate, real interest rate, and total infrastructure investment - transport infrastructure investment) are stationary at levels, except for variables of unemployment, real gross domestic product, and openness which exhibit non-stationarity at level series.

The indication of stationarity of variables means that variables exhibit some fluctuations around a zero mean.

5.3 VAR Lag Length Selection Criteria

Dimitrious and Hall (2001) state that the issue of finding the appropriate lag length is of importance because a model has to have standard normal error terms that do not suffer from non-normality, auto-correlation, and heteroskedasticity.

The most common procedure in choosing the optimal lag is to estimate a VAR model including all the variables in levels (non-differenced data). This VAR model should be estimated for a large number of lags, then reducing down by re-estimating the model for one lag less until zero lags are reached.

The common information criteria are the: Akaike Information Criteria (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQI), Final Prediction Error (FPE) and the Likelihood Ratio test (LR). An optimal lag length suggested by the above information criteria can be chosen as these criteria may sometimes produce conflicting lag length choices. However, decisions about the lag structure of a VAR model could be based on the fact that a given criterion produces a white noise residual and conserves degrees of freedom. Table 5.2 below presents the selection of an optimal lag length for this study.

Table 5.2: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria

Endogenous variables: UNEMPL Tii RGDP REXCH OPEN RI TT_Tii

Exogenous variables: C

Date: 08/28/14 Time: 15:46

Sample: 1982-2012

Included observations: 116

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2507.646	NA	1.59e+10	43.35597	43.52213	43.42342
1	-1313.421	2223.730	42.39801	23.61071	24.94003	24.15033
2	-1165.265	257.9953	7.738270	21.90112	24.39360 *	22.91293
3	-1136.048	47.35226	11.12957	22.24220	25.89783	23.72618
4	-1113.612	33.65399	18.37232	22.70021	27.51899	24.65636
5	-904.1923	288.8547	1.242791	19.93435	25.91629	22.36267
6	-794.3783	138.2141 *	0.486826 *	18.88583 *	26.03092	21.78633 *
7	-761.8590	37.00467	0.760859	19.16998	27.47823	22.54266

8	-725.0231	37.47107	1.180027	19.37971	28.85111	23.22456

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

In the empirical analysis, the choice of optimal lag length to be used in the estimation is imperative, especially in a VAR model. This is important to avoid spurious rejection or acceptance of estimated results. In addition, the lag length also influences the power of rejecting the null hypothesis. As reported in table 5.2, the information criterion are the Akaike Information Criteria (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQI), Final prediction error (FPE) and the Likelihood Ratio test (LR). Of the available information criteria, the LR test is regarded as the best approach in determining the lag length. Unlike the other information criteria, the LR is a formal test whilst the other information criteria operate like the adjusted R^2 measuring the goodness of fit of the model. However, the LR performs the best, given a bigger sample size. Thus, it is more reliable, given a bigger sample.

However, in the event that the information criteria produces conflicting results, Asteriou and Hall (2011) argue that decisions about the lag structure of a VAR model could be based on the fact that a given criterion produces a white noise residual and conserves degrees of freedom. In addition, Takaendesa (2006) argues that if there is no consensus from the information criteria, there is no conclusion which can be reached based on the multivariate approach. The standard approach would be to examine the model with the different lags.

The lag length results in Table 5.2 shows that a lag 2 is chosen by one information criterion, namely, the Schwarz information criterion (SC); lag 6 is chosen by four information criteria, namely, the sequential modified (LR) test statistic (each test at 5% level), Final prediction error (FPE), Akaike information criterion (AIC) and Hannan-Quinn information criterion (HQ). We therefore, chose a lag of 6.

5.4 Johansen Co-integration Test and the Vector Error Correction Model Results

5.4.1 Johansen Co-integration

Having tested for Stationarity and lag length and found that all variables I (1) were stationary (except for Unemployment, GDP and OPEN) at 0.05 and 0.01 levels of significance, we tested for possible co-integration among these variables.

The study applied the multivariate co-integration technique developed by Johansen and Juselius (1990) to the system variables. The Johansen was chosen based on the fact that it performs better than single-equation and alternative multivariate methods (lbrahim, 2000). The results of the Co-integration tests are reported in Table 5.5 below.

Table 5.3: Johansen Co-integration Test results

Date: 09/01/14 Time: 11:27
Sample (adjusted): 1983-2012
Included observations: 119 after adjustments
Trend assumption: Linear deterministic trend
Series: UNEMPL Tii RGDP REXCH OPEN RI TT_Tii
Lags interval (in first differences): 1 to 4

Unrestricted Co-integration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.520648	230.8087	125.6154	0.0000
At most 1 *	0.358054	142.5704	95.75366	0.0000
At most 2 *	0.298907	89.38037	69.81889	0.0006
At most 3	0.180171	46.76661	47.85613	0.0630
At most 4	0.102153	22.92741	29.79707	0.2497
At most 5	0.066526	9.996694	15.49471	0.2810
At most 6	0.014360	1.735638	3.841466	0.1877

Trace test indicates 3 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.520648	88.23829	46.23142	0.0000
At most 1 *	0.358054	53.19005	40.07757	0.0010
At most 2 *	0.298907	42.61376	33.87687	0.0035
At most 3	0.180171	23.83920	27.58434	0.1404
At most 4	0.102153	12.93072	21.13162	0.4586
At most 5	0.066526	8.261056	14.26460	0.3528
At most 6	0.014360	1.735638	3.841466	0.1877

Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Notes

- Both the Trace test and Ma-Eigen Statistic indicate 3 Co-integrating equations at a 0.05 level of significance;
- *denotes rejection of the null hypothesis at 0.05 level of significance;
- The series of estimation are: UNEMPL, Tii, RGDP, REXCH, OPEN, RI, TT_Tii, and critical values are from Mcknnon-Haug-Michells (1999); and
- The results are based on the assumption of a constant linear trend in the data with optimal lag length 4.

Source: *Author's Computation using* ***Eviews 7 Econometric Package***

From table 5.3 above, the null hypothesis of no co-integration was rejected at a 0.05 level of significance. This indicates that there are four co-integrating relationships among variables: Unemployment, Transport infrastructure investment, Real gross domestic product, Real exchange rate, Real interest rate, Openness, and Total infrastructure investment minus transport infrastructure investment. This implies an existence of a long run relationship among the variables in the study. Therefore, a Vector Error Correction Model (VECM) can be specified from the results of the regression analysis.

The study proceeded to estimate a VECM normalized on Unemployment where unemployment is a dependent variable.

5.5 The long run regression results

Table 5.5.1: The long run regression result table

Variable	Coefficient	Standard error	T-Stat

Constant	-28.33393	-	-
Unemployment	1.000000	-	-
Tii	2.761845	0.51312	5.38243
RGDP	2.716086	1.06291	-2.55533
RExch	0.153478	0.22730	0.67522
Ri	-2.095376	0.66100	3.17003
OPEN	0.294578	0.19537	1.50778
TT-Tii	4.009540	0.56342	-7.11641

Source: Author's own computation using Eviews 7

The results from the table above show the long-run relationship between explanatory variables (Tii, RGDP, RExch, Ri, OPEN and TT-Tii) and the dependent variable Unemployment. From the findings, the long-run co-integrating equation can be estimated as follows:

$Unempl_t$ = - 28.33393 - 2.761845Tii - 2.716086RGDP - 0.153478RExch + 2.095376Ri

-0.294578OPEN - 4.009540TT-Tii + μ_t……………………...……………………...…….. (5.1)

The standard procedure in interpreting the long-run VECM results was applied. All the variables enter the long-run equation significantly, and the signs and magnitudes also appear reasonable. In particular, the results suggest that transport infrastructure investment and other variables have a negative impact on unemployment in South Africa. However, real interest rates have a positive effect on unemployment in South Africa.

As indicated on the long-run equation, transport infrastructure investment is significant in specification; the negative coefficient of the variable in the regression suggests that an increase in investment in the transport infrastructure will lead to a decrease in unemployment, as suggested by the labour market theories. Smith (2003) states that if government spends more on the transport infrastructure, this would decrease unemployment.

RGDP, as a measure of economic activity, is significant in the specification model, and the negative coefficient in the regression suggests that a decrease in RGDP will result in an increase in unemployment. This is consistent with the *a priori* expectation that during the economic downswing, unemployment shows upward sloping or becomes positively sloped. When there is a decline in real gross domestic product, the unemployment rate becomes possibly (Barker, 2007).

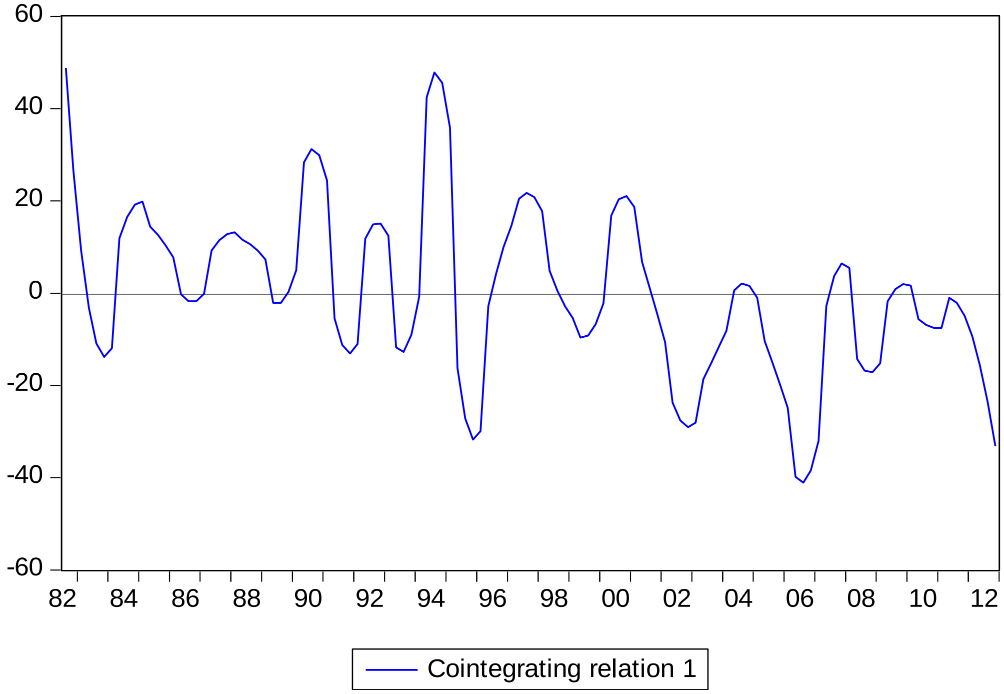
Real exchange rate, as a measure of external balances, is significant. The negative coefficient in the regression suggests that a decrease in real exchange rate will lead to an increase in unemployment. If the rand depreciates, exports are expected to increase, thereby increasing economic growth, which will lead to job creation. If the rand appreciates, exports are expected to decrease, thereby decrease economic growth which will lead to less jobs; imports are expected to increase causing a deterioration of the current account in the balance of payment, and this may result in a decline in economic growth (Appleyard & Field, 2005). This does corroborate the *a priori* expectations.

Real interest rates have a positive relationship in the regression results, thus indicating that an increase in real interest rates will lead to an increase in unemployment. This does corroborate the *a priori* expectations, as supported by Phillips' curve theory which states that there is a positive relationship between real interest rate and unemployment; as real interest rate increases unemployment will also increase (Phillips, 1958).

Trade openness was expected to be negative or positive in the *a priori* expectations. There is a negative relationship in the regression results indicating that a decrease in trade openness will lead to an increase in unemployment of the country.

TT-Tii is significant in the specification model, and the negative coefficient in the regression suggests that a decrease in TT-Tii will result in an increase in the unemployment; this corroborates the a *priori* expectations.

Figure 5.4: Co-integration Graph



Source: Author's own computation using Eviews 7

The residual tests of the co-integrating equation are stationary, graphically. From the graph above, the residuals are stationary further confirming the goodness of fit of our model.

5.5.2 Short run relationships: Error- Correction Model

Short run analysis is intended to capture the short run determinants of unemployment. Comparing the coefficients of the error correction terms (CointEq1), of Table 5.5 below, for the first Vector shows that the D(TT-Tii) has the most significant coefficient and has a correct positive sign. Other variables have less significance, suggesting that the total investment minus transport investment equation constitutes the true co-integrating relationship in the first co-integration vector in Table 5.

Table 5.5: Vector Error Correction

Error Correction:	D(UNEMPL)	D(Tii)	D(RGDP)	D(REXCH)	D(OPEN)	D(RI)	D(TT_Tii)

CointEq1	-0.002156	K2 0.089155	0.004436	-0.026326	0.012210	0.008800	0.149973
	(0.00382)	(0.03489)	(0.00199)	(0.02540)	(0.01038)	(0.00519)	(0.03277)
	[-0.56430]	[2.55497]	[2.23184]	[-1.03667]	[1.17585]	[1.69438]	[4.57695]

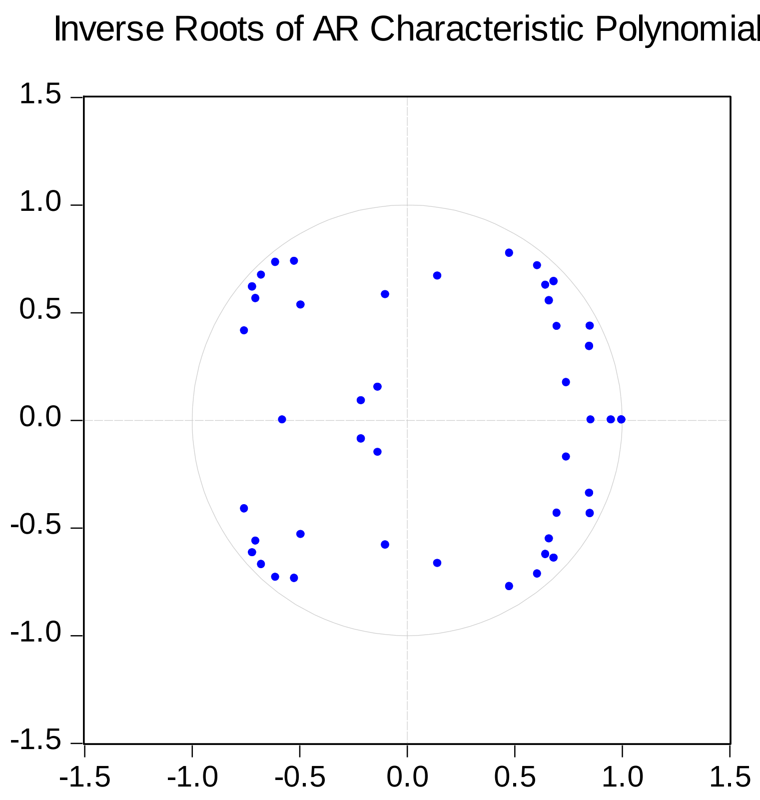
In table 5.5, the speed of adjustment is indicated by the coefficient of the error correction terms. Unemployment and REXCH have coefficients that are negative, indicating that these variables converge to their long-run equilibrium. However, Tii, RGDP, OPEN, RI and TT-Tii have a positive coefficient indicating that any disequilibrium in them continues to decline. However, it should be noted that a positive coefficient in an error correction model could also signify incomplete specifications. The adjustments entail short-run dynamics. They reveal the speed of adjustments of the variables in response to a standard deviation from a long-run equilibrium. For example, Unemployment changes by -0.002156 units in response to the one unit deviation from long-run equilibrium, REXCH by -0.026326 units and so on. According to Enders (1995), in order for the system to return to the long-run equilibrium, the movements of at least some of the variables must respond to the magnitude of the disequilibrium.

This is so because if all adjustment coefficients were equal to zero, there would be no long-run relation and no error correction. Since most of the short-run effects from the VECM were insignificant, more information on the short-run dynamics can be obtained from impulse response and variance decomposition analyses. However, before considering impulse response and variance decomposition analyses, there is need to confirm that the results from the VECMs just reported are derived from efficient models with well-behaved residuals. Thus, the next step was to perform diagnostics test on the residual from alternative specification.

5.6 Diagnostic checks

The VAR model was subjected to rigorous diagnostic tests. Diagnostic checks are crucial in this analysis because if there is problem in the residuals from the estimation of a model, it is an indication that the model is not efficient, such that parameter estimates from such a model may be biased. The VAR was tested for AR Roots test and serial correlation, and the results are indicated in Figure 5.4 below.

Figure 5.4 AR Roots Graph



The AR Roots Graph reports the inverse roots of the characteristic AR polynomial. The estimated VAR is stable (stationary) if all roots have modulus less than one and lie inside the unit circle. If the VAR is not stable, certain results such as impulse response standard errors are not valid. Figure 5.4 shows that all roots lie inside the unit circle, which is an indication that our VAR is stable.

Of importance in this analysis are the residual diagnostic checks for serial correlation, normality and heteroskedasticity. As mentioned in Chapter 4, the three tests are based on the null hypothesis that there is no serial correlation, there is no normality and there is no heteroskedasticity problem for the LM, Jarque-Bera and White heteroskedasticity tests, respectively.

5.6.1 Auto-correlation LM test

The Lagrange Multiplier (LM) test was carried out to check for auto-correlation based on residual auto covariances. The null hypothesis of the test is that there is no serial correlation in the residuals up to the specified lag order.

Table 5.6: Langrange Multiplier Test results

VEC Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Date: 08/28/14 Time: 16:35		
Sample: 1982-2012		
Included observations: 30		
Lags	LM-Stat	Prob
1	42.09273	0.7471
2	62.37848	0.0949
3	39.85503	0.8212
4	195.1493	0.0000
5	45.84075	0.6020
6	39.00083	0.8461
7	18.23311	1.0000
8	309.6684	0.0000
9	55.43142	0.2451
10	31.25139	0.9773
11	24.46229	0.9987
12	224.8972	0.0000
Probs from chi-square with 49 df.		

There is serial correlation when the residuals show correlation with its values in past periods. A zero probability value would indicate the presence of serial correlation and if the probability of the

LM statistic is high, we fail to reject the null that there is no serial correlation. In the above table, probability of 0.8461 is high (greater than 0.05). Therefore, we fail to reject the null hypothesis and, thus, conclude: there is no serial correlation among our variables.

Table 5.7: Residual Normality Test

Null hypothesis: Residual are multivariate normal		
	Chi-Squ	**P-Value**
Skewness	**1.722483**	**0.1894**
Kurtosis	**2.279648**	**0.1311**
Jarque Bera	**4.002132**	**0.1352**

The probabilities of the Kurtosis (p-value 0.1311) and Skewness (p-value 0.1894) are both insignificant, thus we fail reject the null hypothesis which is a clear indication of normality. The diagnostic test results reveal that the model is relatively well-specified. The study moved on and checked the impulse response and variance decomposition of the series.

5.7 Other Diagnostic Tests

Table 5.8 Diagnostic Tests

Test	H_0	Conclusion
Jarque-Bera	Residuals are normally distributed	Errors are normally distributed
VEC Residual Serial Correlation LM Tests	There is no serial Correlation in the residuals.	No 2nd-order auto-correlation
VEC Residual Heteroskedasticity Tests	The residuals are homoscedastic	No Heteroskedasticity

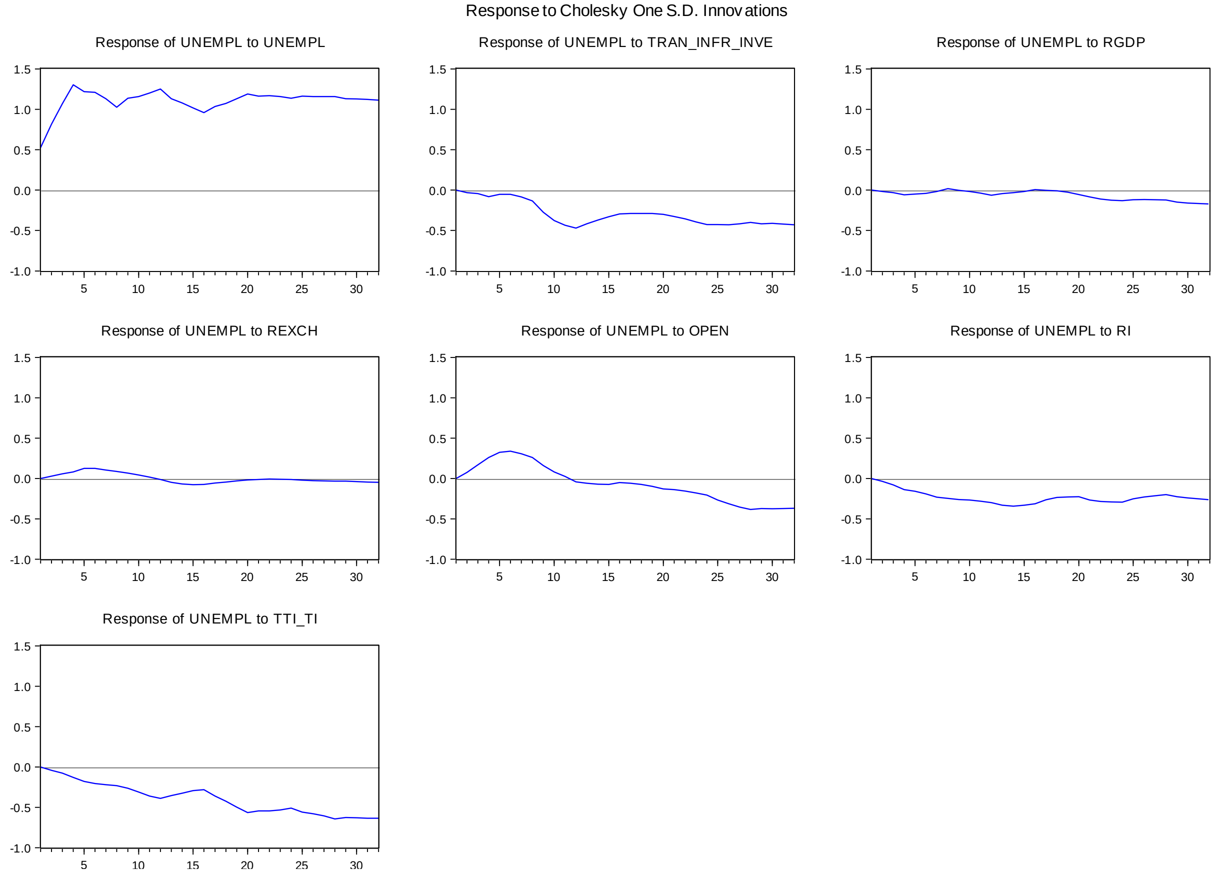
Table 5.8 shows that the results do not suffer from auto-correlation, non-normality and heteroscedasticity. The results obtained from analysis are, therefore, robust.

5.8 Impulse response of Unemployment to its independents

Since this study focuses on the determinants of the yield curve, only the responses of the yield spread to shocks in its determinants are reported in figure 5.5. These impulse response functions show the dynamic response of the real exchange rate to a one-period standard deviation shock to the innovations of the system and also indicate the directions and persistence of the response to each of the shocks over a 32 year period.

Thus, as indicated in chapter 4, the impulse response function traces the temporal and directional response of an endogenous variable to a change in one of the structural innovations. Impulse response functions give an indication of the lag structure in the economy, showing the responses of a particular variable to a one-time shock in each of the variables in the system. It follows that the interpretation of the impulse response functions should take into consideration the use of first differencing of the variables as well as the vector error correction estimates. Thus, a one-time shock to the first difference in a variable is a permanent shock to the level of that variable.

Figure 5.5: Impulse response of Unemployment to its independents



To outline the responsiveness of the dependent variable (Unemployment) in a VAR to shocks from each of the explanatory variables (Tii, RGDP, REXCH, OPEN, RI and TT_Tii), impulse response tests are employed. In the study, impulse response analysis traces out the responsiveness of Unemployment to unanticipated shocks from its explanatory variables. Figure 5.5 shows the results of impulse response analysis in this study.

The response of unemployment to its own shocks show that from 1982, the response was positive and increasing, and during 1990, it started decreasing but still remained positive. After 2002, it then started showing a constant trend up until 2012.

5.9 Variance decomposition of unemployment to its explanatory variables

As mentioned in Chapter 4, variance decomposition analysis provides a means of determining the relative importance of shocks in explaining variations in the variable of interest. In the context of this study, it, therefore, provides a way of determining the relative importance of shocks to each of the determinants of unemployment. The results of the variance decomposition analysis are presented in Table 5.9, and these show the proportion of the forecast error variance in the unemployment explained by its own innovations and innovations in its determinants.

Table 5.9: Variance decomposition

Period	S.E.	UNEMPL	Tii	RGDP	REXCH	OPEN	RI	TT_Tii
1	0.526578	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	2.701180	92.15971	0.199900	0.123442	0.573006	4.372691	1.210991	1.360264
10	**3.638035**	**88.23989**	**1.930803**	**0.074513**	**0.497624**	**3.873823**	**2.595100**	**2.788243**
15	4.657115	83.70210	5.010626	0.086078	0.365058	2.440558	3.916184	4.479391
20	5.411913	81.88782	5.169368	0.077534	0.311428	1.936878	4.019793	6.597174
25	6.232292	79.00710	5.827420	0.229062	0.237064	1.951452	4.027245	8.720653
30	7.012919	75.74475	6.355165	0.366121	0.198245	2.865410	3.686646	10.78366
31	7.159073	75.13749	6.442468	0.404551	0.194194	3.020979	3.661786	11.13853

32	7.301982	74.55254	6.536267	0.444218	0.191002	3.161807	3.651374	11.46279

Cholesky Ordering: UNEMPL Tii RGDP REXCH OPEN RI TT_Tii

The variance decomposition is reported over 32 quarters. The results show that for the 32 periods, the predominant source of variation in unemployment is own shock, which accounts for between 80% and 100%. This is consistent with Brooks (2002) and Goyenko et al (2008). Another important source of variation in unemployment is total infrastructure investment-transport investment, which accounts for nearly 12% in the variation in the long-run. Transport infrastructure investment and real interest rate are also important factors determining unemployment; this is consistent with *a priori* expectations and supports the long-run results.

5.10 Conclusion

This chapter focused on interpreting the results of models estimated in chapter 4. The chapter began with analyzing the time series properties of the data using three methods of testing for unit root. All two methods confirmed that the variables are integrated of order one *I(1)*. Having determined the order of integration of the variables, the lag length used in the estimation for the Johansen co-integration was determined empirically, with the majority of the information criteria settling for the lag of 1 whilst the LR suggested a lag of 6. The two lag lengths were, therefore, used in the estimation. At a lag of two, the Johansen co-integration test established that there is one co-integrating equation whilst at a lag of 6, there were seven (3) co-integrating equations. This, therefore, implied that there is a long-term relationship between unemployment and its determinants. The VECM was also estimated to analyze both the long-run and the short-run interaction between the variables. The long-run equation showed that all the variables employed in the model are significant and carried the correct signs. The results established that financial sector development has facilitated the accumulation of unemployment in South Africa, which was the aim of the study. These results were all confirmed by the variance decomposition. The results also observed all the assumptions which underlie the classical linear regression model.

CHAPTER SIX

STUDY SUMMARY, CONCLUSIONS, POLICY IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter focuses on conclusion based on the results of the study and makes recommendations for future policy formulation as well as articulates the implications of the findings on South Africa and the global context on developing and emerging market economies.

6.2 Summary of the study and conclusions

The purpose of this study was to investigate the nature of the relationship between transport infrastructure investment and unemployment in South Africa using the annual data from the period of 1982-2012. The study also reviewed whether the trends of unemployment in transport infrastructure investment, RGDP, REXCH, OPEN, RI, TT_Tii are closely related.

Chapter 3 reviewed theoretical and empirical literature which looked at demand for labour, supply of labour, standard competitive model and structural unemployment. These theories complement each other in that the limitation of one theory is overcome by the advantage of the other. Some empirical studies supported the theoretical foundations that there is a positive relationship between transport infrastructure investment and unemployment did receive sufficient attention in the South African studies that were reviewed. Most of the empirical literature looked at transport infrastructure investment and economic growth in South Africa; there are few studies which looked at unemployment in South Africa.

The explanatory variables used in this study are: transport infrastructure investment, real gross domestic product, real exchange rate, real interest rate, trade openness, and total infrastructure investment minus transport infrastructure investment. All these explanatory variables carried coefficient signs that conformed to unemployment. Annual data for the period 1982-2012 was used for the purpose of running a regression.

In order to determine both long-run properties of the models, the Johansen co-integration and error correction methods were preferred to the other techniques. These techniques were chosen because of the advantages they have over those alternative techniques. In applying these methods, the time series was subjected to both informal and formal tests for stationarity. The variables in the co-integration regression were found to be first difference stationary, that is, each series is characterized as integrated of order on I(1). Johansen co-integration tests provided evidence that there is co-integration between unemployment and its targets, which were included in these models. Evidence of co-integration allowed the estimation of VECM's, which simultaneously provided the parameter estimated for both the long-run and short-run. In both cases, the estimated models were robust and passed all the relevant diagnostic test. The results conform to theoretical literature reviewed for the study.

6.3 Policy recommendations and areas of further study

The results of the study revealed a number of policy implications which affect transport infrastructure investment and unemployment. A negative relationship between transport infrastructure investment and unemployment means that if transport infrastructure investment increases, unemployment will decrease, and there is an inverse relationship between the two variables.

This study, therefore, recommends that efforts should be made to lower the level of unemployment in South Africa. To this end, the government of South Africa should invest more on the transport infrastructure as it is an important engine to reduce unemployment. The policies that focus on transport infrastructure will, in turn, increase the economic growth of South Africa, meaning that the more resources the government spends on transport infrastructure, the more growth in the economy.

It is recommended that the government should improve the transport infrastructure in both rural and in urban areas as this will lead to a decline in the level of unemployment in South Africa.

6.4 Limitations of the study and areas for further research

The study focused on selected macro-economic variables determining the unemployment in South Africa that can be accommodated by the models. Furthermore, this work only considered the period of 1982 up to 2012. The study is limited to the South African economy, and the consequence is that the results obtained may not be directly applicable to other economies. Nonetheless, the study remains significant as the conclusions draw from it may prove to be useful in South Africa context. Applications to other economies must be done with caution, given different economic structures and the nature of the monetary policy and interest rate regimes.

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APPENDICES

APPENDIX 1: Data

Year	UNEMPL	Tii	RGDP	Rexch	OPEN	TT-Tii	Ri	employ In mining	employ in agric.
1982	10.755	-13.8964	10	-3.9	41.6	0.9900	0.08392	20	16.9
1983	12.543	8.145393	10.1	11.8	41	-5.2083	9.69664	20	19.3
1984	13.718	6.85772	9.6	-13.2	42.1	16.521	4.02347	20	21
1985	15.452	-0.63199	11.5	-21.8	46.5	-0.87719	-2.3307	20	25.2
1986	16.049	-6.614	11.4	-3.7	44.7	-0.88495	-1.7446	16.9	23.3
1987	16.592	9.383115	11.3	12.1	46.8	8.870967742	0.13033	16.9	25
1988	17.238	0.20311	12.4	-4	50.6	3.875968992	2.1956	16.9	25.4
1989	17.829	-17.6015	12.9	2.1	51.6	5.147058824	4.7424	16.9	27.2
1990	18.784	-9.03458	13.6	5.6	51.4	0.729927007	3.96233	19.3	27.1
1991	20.162	-26.6636	13.7	4.2	50.7	5.517241379	3.7834	19.3	24.7
1992	21.213	7.160207	14.5	1.8	53.6	5.22875817	2.71539	19.3	23.8
1993	22.163	-8.30379	15.3	-1.3	59.2	4.375	5.46501	19.3	22.6
1994	22.89	23.50162	16	-2	60.6	10.61452514	6.93468	21	22.3
1995	16.71	0.400871	17.9	-1.5	67.3	6.282722513	10.5756	21	22.5
1996	19.321	15.28239	19.1	-6.2	72.1	3.045685279	11.0017	21	23.7

1997	20.952	-7.87671	19.7	6.6	75.9	3.431372549	13.0733	21	24.9
1998	25.197	-8.06438	20.4	-9.4	78.3	0.970873786	10.205	25.2	24.8
1999	23.346	-31.4367	20.6	-6.6	79.4	5.069124424	5.22974	25.2	24.9
2000	25.61	21.16294	21.7	-0.9	86	-0.9302325	5.66925	25.2	24.7
2001	29.395	16.88533	21.5	-8.6	88.1	-4.87804878	4.51519	25.2	25.1
2002	30.409	9.601983	20.5	-9.7	89.4	-3.5353535	8.91339	23.3	26.2
2003	27.961	8.272895	19.8	25.1	89.6	1	4.62507	23.3	27.7
2004	26.207	4.356005	20	6.7	92.1	5.213270142	4.91284	23.3	27.7
2005	26.727	12.60275	21.1	2.2	100	2.314814815	4.35479	23.3	26.6
2006	25.542	7.150694	21.6	-3.2	107.5	1.369863014	4.59847	26.7	26.6
2007	22.228	-16.8702	21.9	-3.5	114.5	0	5.42037	26.7	29.3
2008	22.909	-2.32757	21.9	-10.4	116.5	-26.589595	4.07758	23.3	29.3
2009	23.936	12.46442	17.3	7.8	93.8	2.808988764	3.16009	23.3	28.4
2010	24.907	-32.1259	17.8	12.3	102.2	4.301075269	8.71896	24.6	28.4
2011	24.7	-33.0291	18.6	-3.3	109.1	-3.33333333	8.92046	24.6	26.4
2012	25	44.91611	18	-5.5	109.5	2.621	7.88941	26.2	26.4

Q data

Dates	western Cape	eastern Cape	Northern Cape	KZN	Free States	Gauteng	Males	Females	Blacks	Coloureds	Whites
2008/03/31	5.1	28	24.4	22.5	24.6	19.2	27.5	28.6	25	17.7	5.1
2008/06/30	5.2	24.8	23.8	21.9	25.4	17.9	23.1	26.7	26.2	17.8	5.2
2008/09/30	4	27.2	22	21.7	22.5	18.6	26.3	28.2	29.1	17.4	4
2008/12/31	4	25.2	21.2	20.5	22	17.6	23	27.5	23.3	15.9	4
2009/03/31	4.6	28.3	26.9	22.1	24.8	18.9	26	30.6	27.2	16.1	4.6
2009/06/30	4.2	27.7	25.7	18.9	26.4	21	25.4	30.1	31.2	17.8	4.2
2009/09/30	5.1	26.8	29.3	18.3	28.1	23.5	26.3	27.3	33.6	20.6	5.1
2009/12/31	5.7	26.6	24.5	19	24.8	23.8	27.3	25.9	31.5	19.3	5.7
2010/03/31	7.8	29.7	27.2	19.1	26.7	24.1	29	30.4	27.1	19.9	7.8
2010/06/30	7.6	27.4	29	20.6	27.7	23.5	27.8	26.9	30.8	20.6	7.6

2010/09/30	6.9	26.7	25.3	19.5	29.7	23.9	25.1	28.4	33.9	21.8	6.9
2010/12/31	5.6	24.2	24.3	19.4	27.1	23.7	24.4	24.1	32.5	21.3	5.6
2011/03/31	5.6	26.7	31.1	19.8	27.9	23.3	27	26.4	31.2	22.1	5.6
2011/06/30	4.2	28.4	28.4	20	28	25.2	26.6	30.3	32.2	20.9	4.2
2011/09/30	5.5	26.8	28	18.7	25	25.6	25.8	27.8	31.4	24.1	5.5
2011/12/31	6	26.9	26.4	18.8	29.2	23.1	25.4	28.5	30.6	20.8	6
2012/03/31	5.3	28	25.3	20	31.9	23.2	26.6	29.4	32	23.1	5.3
2012/06/30	7	28.5	29.9	19.3	32.7	23.7	27.6	29.4	32.4	22	7
2012/09/30	6.5	28.8	29.6	20.6	31.6	22	28.7	28.9	34.7	24.3	6.5
2012/12/31	4.8	29.5	28.3	21.9	32.7	21.2	27.3	31.9	32.8	23.6	4.8
2013/03/31	7.1	29.8	29.3	20.5	31.2	23.2	29.7	30	32	22.9	7.1
2013/06/30	5.4	30.2	29.5	22.2	32.8	22.1	30.6	29.7	33.3	24.1	5.4

2013/09/30	5	30.4	27.9	20.6	33.7	22.1	31.2	29.5	32.7	23.6	5
2013/12/31	6.5	27.8	24.9	19.9	33	22.4	27.5	28.2	30.4	20.8	6.5
2014/03/31	7.1	29.4	29	20.7	34.7	23.6	30	28.8	31	19.8	7.1
2014/06/30	6.6	30.4	32.3	23.7	35	22.2	30	30.8	31.3	24.1	6.6
2014/09/30	7.5	29.5	29.7	24.1	34.6	21.5	31.1	27.7	33.6	23.1	7.5
2014/12/31	6	29.1	28.7	20.8	32.2	21.8	30.9	27.2	33.2	22.1	6

APPENDIX 2: JOHANSEN COINTEGRATION TESTS RESULTS

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.950448	209.5272	125.6154	0.0000
At most 1 *	0.841479	122.3899	95.75366	0.0002
At most 2	0.733420	68.97573	69.81889	0.0582
At most 3	0.419718	30.63534	47.85613	0.6860
At most 4	0.298648	14.85237	29.79707	0.7896
At most 5	0.121453	4.564766	15.49471	0.8532
At most 6	0.027534	0.809675	3.841466	0.3682

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.950448	87.13732	46.23142	0.0000
At most 1 *	0.841479	53.41413	40.07757	0.0009
At most 2 *	0.733420	38.34039	33.87687	0.0137
At most 3	0.419718	15.78297	27.58434	0.6841
At most 4	0.298648	10.28760	21.13162	0.7172
At most 5	0.121453	3.755091	14.26460	0.8842
At most 6	0.027534	0.809675	3.841466	0.3682

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-622.7142	NA	1.71e+10	43.42857	43.75860	43.53193
1	-477.1712	210.7864	24348706	36.77043	39.41072*	37.59734
2	-406.4062	68.32485*	10625851*	35.26939*	40.21995	36.81984*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Choosing the appropriate model

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend

Trace	2	3	2	3	3
Max-Eig	2	3	3	3	3

*Critical values based on MacKinnon-Haug-Michelis (1999)

APPENDIX 3: VECTOR ERROR CORRECTION ESTIMATES RESULTS

Error Correction:	D(UNEMPL)	D(Tii)	D(RGDP)	D(REXCH)	D(RI)	D(OPEN)	D(TT_Tii)
CointEq1	-0.028809	-0.005282	-0.007085	0.406338	0.063788	0.028618	0.012719
	(0.02036)	(0.12990)	(0.00954)	(0.07260)	(0.02333)	(0.04871)	(0.12145)
	[-1.41466]	[-0.04066]	[-0.74280]	[5.59663]	[2.73413]	[0.58758]	[0.10473]
D(UNEMPL(-1))	-0.072106	2.883382	-0.074909	1.607849	0.202875	0.031879	2.738614
	(0.23784)	(1.51704)	(0.11140)	(0.84794)	(0.27247)	(0.56883)	(1.41835)
	[-0.30317]	[1.90067]	[-0.67246]	[1.89619]	[0.74458]	[0.05604]	[1.93085]