THE IMPACT OF CRIME ON THE SOUTH AFRICAN ECONOMIC GROWTH

NOKUZOLA JULIA MTATI

2012
THE IMPACT OF CRIME ON THE SOUTH AFRICAN ECONOMIC GROWTH

BY

NOKUZOLA JULIA MTATI

Submitted in partial fulfillment of the requirements for the degree
Masters in Development Studies

In the

Faculty of Business and Economic Sciences

At the

NELSON MANDELA METROPOLITAN UNIVERSITY
PORT ELIZABETH

Supervisor: Prof. R. Ncwadi

November 2012
DECLARATION

I, NOKUZOLA JULIA MTATI, do hereby candidly and solemnly affirm that this thesis

Submitted for the fulfillment of the degree

MASTERS IN DEVELOPMENT STUDIES

Is my original and independent work, and has never been presented for degree purposes at any other university.

.............................................
NOKUZOLA JULIA MTATI

November 2012

Nelson Mandela Metropolitan University

Port Elizabeth
Acknowledgements

I would like to express my sincere gratitude and appreciation to the following:

- **To the Most High God who is the pillar of my strength for all the understanding assimilated through this study.**

- Prof R. Ncwadi my supervisor, for selflessly spending his time in assisting me with insight in statistical analysis. For all the guidance, encouragement and constructive criticism which now has led to this research be a success.

- I would also like to acknowledge my interactive colleagues who were always eager to assist and come up with renewed ideas.

- **To my friends who have been nothing but supportive and very encouraging**

- A special thanks and dedication to my daughter, Lithe-Tha Mtati for her patience during the course of this study

I also dedicate this study to my late mother Nontobeko Mtati, who has always encouraged me to reach beyond my abilities and to never
Abstract

Crime in South Africa has been escalating over the past few years. Crime affects all societies in South Africa. It occurs amongst the rich and the poor, in the suburbs as well as in the townships. Serious and violent crimes are reported in most of the national newspapers almost on daily basis. There is no single satisfactory answer as to the causes of crimes and its impact on the economy of South Africa.

The aim of this research report is to assess the impact of crime in the South African economy. In order to formulate a conceptual and theoretical framework of the study, growth theories, namely neoclassical growth theory, Harrod-Domar growth model classical growth theory and endogenous growth theory were presented. Although all these growth theories relate to this study as crime cuts-across all sectors of the economy the endogenous growth theory was chosen as a theoretical framework on which to base this study. Endogenous growth theory deals with domestic absorption. Crime interferes with this absorption as it constitutes a cost to the economy. Firms lose profits whilst the opportunity cost of running prisons using a tax payers’ money continues to grow.

This study is based on a quantitative research technique, using a vector error correction model (VECM) on a quarterly time series data over a period 2003 to 2011. The variables used to explain variations in economic growth over this period are crime, real interest rates, real exchange rates, unemployment and poverty.

The findings of this study suggest that crime exerts a negative impact on economic growth in a long run in South Africa. However, this relationship is not statistically significant both in a short run and a long run. However, no evidence of short run adjustments between crime and economic growth were found. There is a long run negative relationship between real interest rates and economic growth. This relationship is also statistically significant in a long run but not in a short run. However, the relationship between real interest rates and economic growth is positive in a short run. This can be explained by the fact that high interest rates attract foreign investments causing a rise in economic growth but in a long run high interest rates dampen domestic investments thereby aggravating the unemployment problem. Rising unemployment is likely to lead to increase levels of crime in South
Africa. The results also show that unemployment has a negative relationship with economic growth both in the short run and a long run. However this relationship is not statistically significant in a short run but in a long run. Poverty has a negative relationship with economic growth in a short run but a positive relationship in a long run. However, in both instances the relationship between poverty and economic growth is not statistically significant. Real exchange rate has a positive relationship with economic growth in a long run but a negative relationship in a short run. This relationship is statistically significant in a long run but not in a short run. This means that the benefits of a weak currency in South Africa are realised in a long run.

The implications of this study with regard to the variable of interest namely crime, is that crime constitutes a cost to the economy of South Africa. The econometric modelling used in this study suggests a negative relationship between crime and economic growth. This means that the problem of crime in South Africa goes beyond just simple counts on a number of offenses.

Based on the findings of this study it is recommended that crime prevention is better than cure. Crime prevention should use a wide range of ideas and abilities found throughout the society. Community planning, neighbourhood action, juvenile advocacy, security planning, education and training are some of the ways in which crime actions can be mitigated in South Africa.
# TABLE OF CONTENTS

Declaration \hspace{1cm} i  
Acknowledgements \hspace{1cm} ii  
Abstract \hspace{1cm} iii  
Table of contents \hspace{1cm} v  
List of figures \hspace{1cm} vii  
List of tables \hspace{1cm} viii  
List of acronyms \hspace{1cm} ix  

**Chapter 1: Introduction and background**  
1.1 Introduction \hspace{1cm} 1  
1.2 Problem Statement \hspace{1cm} 2  
1.3 Research Question \hspace{1cm} 6  
1.4 Aims and Objectives of the study \hspace{1cm} 6  
1.5 Research Methodology \hspace{1cm} 6  
1.6 Significance of the study \hspace{1cm} 7  
1.7 Deployment of the study \hspace{1cm} 8  
1.8 Concluding remarks \hspace{1cm} 8  

**Chapter 2: Literature Review**  
2.1 Introduction \hspace{1cm} 9  
2.2 Neoclassical growth theory \hspace{1cm} 9  
2.3 Harrod-Domar growth model \hspace{1cm} 11  
2.4 Classical growth theory \hspace{1cm} 13  
2.5 Endogenous growth theory \hspace{1cm} 14  
2.6 The assessment of a theoretical literature review \hspace{1cm} 15  
2.7 Empirical literature \hspace{1cm} 15  
2.8 Assessment of the empirical literature \hspace{1cm} 19  
2.9 Concluding remarks \hspace{1cm} 20
Chapter 3: An overview of crime and economic growth in South Africa

3.1 Introduction
3.2 Overview of selected crime types
3.3 Robbery
3.3.1 Common Robbery
3.3.2 Aggravated Robbery
3.4 Murder
3.5 Attempted murder
3.6 Sexual offences
3.7 Common Assault and Assault GBH (grievous bodily harm)
3.8 Overview of economic growth in South Africa
3.9 Relationship between economic growth and crime in South Africa
3.10 Concluding remarks

Chapter 4: Research methodology

4.1 Introduction
4.2 Model specification
4.3 Definition of variables and data sources
4.4 Expected relationships
4.5 Estimation techniques
4.5.1 Testing stationarity/unit root
4.5.1.1 Dickey-Fuller
4.5.1.2 Augmented Dickey Fuller test
4.5.2 Cointegration and error correction
4.6 Diagnostic tests
4.6.1 Autocorrelation LM Test
4.6.2 Heteroscedasticity test
4.6.3 Residual normality test
4.7 Impulse response and variance decomposition
4.7.1 Impulse response
4.7.2 Variance decomposition
4.8 Concluding remarks
Chapter 5: Presentation and analysis of empirical findings

5.1 Introduction
5.2 Unit root/stationarity test results
5.3 Test for cointegration
5.4 Vector error correction model (VECM)
5.5 Diagnostic checks
5.6 Impulse response analysis
5.7 Variance decomposition analysis
5.8 Granger causality
5.9 Concluding remarks

Chapter 6: Summary, Conclusions and Recommendations

6.1 Introduction
6.2 Summary of the main findings
6.3 Implications of the findings
6.4 Validity and reliability of the results
6.5 Conclusions
6.6 Recommendations
6.7 Limitations of the study
6.8 Recommendations for future research

List of references

Appendix A

List of figures

Figure 3.1: GDP growth rates 1980-2010
Figure 3.2: Relationship between economic growth and crime in South Africa
Figure 5.1(a): Plots of variables in levels for 2003-2011
Figure 5.1(b): Plots of first differenced variables for 2003-2011
Figure 5.2(a): Relationship between crime and poverty
Figure 5.2(b): Relationship between crime and unemployment
Figure 5.3: Cointegration vector 57
Figure 5.4: Actual versus Fitted residuals 61
Figure 5.5: Inverse Roots of AR Characteristic Polynomial 62
Figure 5.6: Impulse response of GDP 65

List of tables

Table 4.1: A priori expectations 35
Table 5.1: Stationarity results of the Augmented Dickey-Fuller test 51
Table 5.2: Pair-wise correlation results 53
Table 5.3: Lag order selection criteria 55
Table 5.4(a): Cointegration Tank Test (Trace) 56
Table 5.4(b): Cointegration Rank Test (Maximum Eigenvalue) 56
Table 5.5: Results of the long run cointegration equation 58
Table 5.6: Vector error correction model results 59
Table 5.7: Serial correlation test 62
Table 5.8: Heteroscedasticity test 63
Table 5.9: Normality test 63
Table 5.10: Ramsey Reset test 64
Table 5.11: Variance decomposition of GDP 67
Table 5.12: Pairwise Granger Causality test 68
### List of acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td>Augmented Dickey-Fuller</td>
</tr>
<tr>
<td>ANC</td>
<td>African National Congress</td>
</tr>
<tr>
<td>ASGISA</td>
<td>Accelerated and Shared Growth Initiative for South Africa</td>
</tr>
<tr>
<td>GBH</td>
<td>Grievous Bodily Harm</td>
</tr>
<tr>
<td>GEAR</td>
<td>Growth, Employment and Redistribution</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>LGDP</td>
<td>Natural log of gross domestic product</td>
</tr>
<tr>
<td>LCRIME</td>
<td>Natural log of crime</td>
</tr>
<tr>
<td>LREER</td>
<td>Natural log of real effective exchange rates</td>
</tr>
<tr>
<td>LRIR</td>
<td>Natural log of real interest rates</td>
</tr>
<tr>
<td>LUE</td>
<td>Natural log of unemployment</td>
</tr>
<tr>
<td>LPOVERTY</td>
<td>Natural log of poverty</td>
</tr>
<tr>
<td>NGP</td>
<td>New Growth Path</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Squares</td>
</tr>
<tr>
<td>RDP</td>
<td>Reconstruction and Development Programme</td>
</tr>
<tr>
<td>RSA</td>
<td>Republic of South Africa</td>
</tr>
<tr>
<td>REER</td>
<td>Real Effective Exchange Rates</td>
</tr>
<tr>
<td>RIR</td>
<td>Real Interest Rate</td>
</tr>
<tr>
<td>SAPS</td>
<td>South African Police Service</td>
</tr>
<tr>
<td>VECM</td>
<td>Vector Error Correction Model</td>
</tr>
<tr>
<td>VAR</td>
<td>Vector-Auto-Regression</td>
</tr>
</tbody>
</table>
Chapter 1

Introduction and background

1.1 Introduction

Economic development refers to the sustained, concerted actions of policy makers and communities that promote the standard of living and economic health of a specific area. It is a policy intervention endeavour with the aims of economic and social well-being of people. Economic growth is the increase in the amount of goods and services produced by an economy over time. It is usually associated with technological changes. Economic growth is concerned with the underlying long-run growth of economic capacity rather than with short-run variations in its utilization (Dornbusch & Fischer, 2008). Economic growth can be achieved by employing resources and human resources that are available in an improved manner. Economic growth is required in order to achieve higher standards of living for the society as a whole.

South African economy is the largest in Africa (source: http://en.wikipedia.org/wiki/economyofsouthafrica). It has a comparative advantage in the production of agriculture, mining and manufacturing products relating to these sectors. South Africa has rich mineral resources; the only major mineral products it lacks is petroleum and bauxite. It is the world’s largest producer and exporter of gold and coal (Todaro: 2000: 201). When the South African democratic government took place in 1994, it took over an economy that was wracked by long years of internal conflict and external sanctions. The African National Congress (ANC) government had a formidable task of restoring order to an economy which was harmed by sanctions. The democratic government then embarked on a programme to reconstruct and develop South Africa with the aims of providing an economic and social well-being of its people. Reconstruction and development Programme (RDP) is a basic social development policy. RDP addresses the basic human needs such as housing, land, health, education and services. In order to promote economic growth in South Africa, the government implemented a number of macroeconomic policies, namely RDP, GEAR, ASGISA; and recently NGP to drive economic
transformation in South Africa. However, these policies have not been as successful in alleviating poverty as anticipated failed in achieving economic freedom (Rogerson: 2000:397). Without any doubts the South African government made significant progress in improving the lives of millions of people through poverty reduction and job creation. However, the envisaged growth through the various macroeconomic policies in South Africa has not been realised to its optimal level due to a number of obstacles of which one of them is crime. The prevalence of crime is a challenge facing the process of transformation in South Africa. Crime distorts good governance thus undermining development and is very harmful to developing countries such as South Africa.

1.2 Problem Statement

South Africa has an extremely high rate of crime and this is perceived as a hindrance in the country’s economic growth. As a result the status of South Africa in the international markets as a participant is jeopardised by its image of being a country that does not adequately address the consequences of crime. Crime is considered a threat to the stability and to the welfare of the citizens of the country as a whole. Statistics show that while certain crimes might be decreasing, violent crimes aimed at individuals are still rising (source: http://en.wikipedia.org/wiki/economyofsouthafrica). Therefore, violent crime in South Africa remains a serious problem. Except for South Africa’s political history which instilled violent behaviour in South Africans through apartheid policies, there is no satisfactory explanation for South Africa’s high levels of crime, especially violent crime after 1994.

Interviews with offenders jailed for violent crime revealed evidence for a structural contradiction between the exclusion from the formal economy or belief that they would never be incorporated in it. In explaining the motives for their violent actions, these offenders expressed an intense desire to acquire consumer goods, not simply for their material value but as a marker of ‘success’ and status. Economists and sociologists have postulated a number of theories for the apparent links between economic inequality and crime. Economists hold that the incentives for individuals to commit crime are determined by the differential returns from legitimate and illegitimate pursuits. They tend to focus on the perceived gains from illegal activity as
opposed to legal activity in contexts where unemployment is high or wages from work may be low in particular sections of society. Ultimately, income inequality and lower growth rates appear to contribute to increases in crime across most countries (Geneva Declaration:2010:35).

In South Africa for instance, the country’s native black Africans still live in an entire different world from the whites. South African whites which makes 14% of the population own 88% of the country’s private property and, along with foreign investors, over 90% of commerce and industry. Over half of the black population lives below the poverty line, and about 40% of the rural black children are stunted by malnutrition with a black illiteracy rate of about 33% and over three-quarters of black teachers unqualified for their jobs. The education system still maintains a vicious cycle of deprivation and discrimination. The distribution of income between whites and blacks is among the most unequal in the world (Todaro:2000:201). This inequality amongst South Africans is one of the contributing factors in the country’s high rate of crime.

The rate of different types of crime is South Africa is still appalling. For example, News 24 recently reported that four men were arrested for Armed Robbery in KwaZulu Natal province. The five suspects who allegedly robbed a Spar Supertrade store were apparently dressed in a Spar uniform during the execution of this crime. Not all crimes are motivated by inequality. For example, the City Press newspaper has recently reported that a six year old boy and his seven year old sister were both allegedly raped by a teacher in their own school. This incident occurred in Grahamstown in the Eastern Cape. The teacher was then arrested after the parents of the child opened a criminal case. A comparison of crime rates also reveals that Johannesburg has the highest volume of serious crime, followed by Pretoria, Cape Town then Durban (Source: http://www.iss.co.za/pubs/Papers/49/Paper49.html). Crime and related social problems are identified as the most important impediment to capital expenditure and an on-going investment by foreign investors. While political instability may be a concern for foreigners outside the country, crime is the most tenacious concern for investors within the country.. Crime is considered a major or a very severe constraint on investment by approximately 30% of enterprises in

Crime in South Africa is hurting investment and growth causing a negative impact on employment opportunities. The threat of crime diverts resources to protection efforts, exacts health costs through increased stress, and generally creates an environment not conducive to productive activity. Emigration of South African professionals in recent years is also attributable in part to their desire to escape a high crime environment. All of these effects are likely to discourage investment and stifle long-term growth in South Africa (Demombynes & Özler, 2002:2). The following mechanisms are commonly asserted as restraints of growth caused by crime:

- Crime imposes costs on business (direct losses plus the costs of security and prevention) that reduce profits and divert funds that could be invested in productive capacity;
- It induces government to spend money on law enforcement, crime prevention, and the administration of justice that would otherwise be available to stimulate growth;
- Crime induces households to spend money on health care and security precautions rather than on school fees and other investments;
- It erodes human capital by encouraging emigration and by injuring and killing skilled workers;
- Crime keeps workers out of the labour market by discouraging them from accepting jobs in off-hours and far from home;
- Crime discourages foreign investment;
- Crime disrupts schooling and other public investments to support long-term growth (such as public transport), blunting the effectiveness of these investments (Stone:2006:10).

Criminal syndicates by foreigners are also widespread in South Africa. For example, in Cape Town, where there are a lot of charming tourist attractions a British National tourist was charged for murder and kidnapping. Mr Shrien Dewani was accused of hiring a South African, Mr Zola Robert Tongo to murder his wife Anni
Dewani on their honeymoon visit in the country. Later, Mr Tongo was found guilty and sentenced to 18 years in jail. The case is still pending against Mr Dewani who was exposed as the one who plotted the murder of his wife. With South Africa’s economy reliant on tourism, tour operators reported an immediate drop in bookings as potential visitors were made aware of the violent crime rate. The Shrien Dewani’s case in 2010 scared many tourists and painted a negative image of South Africa’s rate of crime.

Another fast growing type of crime in South Africa is corruption, both in the private and public sector. Corruption can be defined as an illegal use of occupational power for personal benefit, or as an abuse of public power for private benefit. Corruption distorts the sectoral allocation of investible resources by diverting resources from potentially productive sectors to unproductive sectors thus interfering with growth. Corruption is also committed by the members of the South African Police Service and this is a deterrent effective fighting of crime. For example, the National Commissioner of police Bheki Cele is currently suspended pending corruption charges against him. Before him it was former National Police Commissioner Jackie Selebi who was convicted in 2010, on corruption charges also. Because of police corruption, there is an increase in other types of crime also.

Even though there is an increase in some types of crime, there have been some successes in the combating of crime over the last decade by the South African Police Service. There are high levels of police visibility in a number of areas in South Africa in order to prevent crime and also many more strategies have been developed in the fight against crime. Some of the strategies are as follows:

- The improvement on the efficiency and effectiveness on the Criminal Justice System by enhancing detective and forensic environments;
- Application of technology solution in order to modernize the criminal justice system;
- Improve the skills and increase the number of investigators and forensic experts;
• Mobilizing the population in the fight against crime;
• Accelerate efforts to reduce serious and violent crimes by the set target of 7-10% per annum;
• Intensify efforts to combat crimes against women and children and the promotion of the empowerment of victims of crime;
• Establishing a border management agency to manage migration, customs and land borderline control services and to efficiently coordinate other relevant departments in the ports of entry environment; and
• Combat corruption in the public and private sector (SAPS Strategic Plan 2010-2014:13).

The growth of the South African economy is being inhibited by the high cost of crime and unless crime is confronted and dealt with without compromise there is no hope of developing South Africa to its full potential.

1.3 Research Question

To what extent does crime affect economic growth in South Africa?

1.4 Aims and Objectives of the study

• To determine the extent of crime in South Africa
• To determine the impact of crime in the South African economy
• To provide policy recommendations

Hypothesis

H₀: Crime has a negative impact on economic growth in South Africa

Hₐ: Crime does not have a negative impact on economic growth in South Africa.

1.5 Research Methodology

This research is based on a quantitative research method. A quantitative approach is based on both descriptive and analytical statistical modelling. The validity of the
hypothesis was tested by collecting the relevant data, and employing various statistical techniques in order to detect if any underlying tendencies and meanings exist. For the purposes of the statistical analysis, where accurate figures relating to economic growth, crime, unemployment, poverty, real exchange rates and real interest rates are required, the study made use of official figures published by Statistics South Africa. The statistical measure which is applied to a time series data relating to economic growth, crime, unemployment, poverty, real exchange rates and real interest rates in South Africa is a regression analysis using a vector error correction model.

A vector error correction model (VECM) has several advantages in terms of the interpretability of results and application, because it allows the identification of dynamic processes and the forecasting analysis. Moreover, it does not need to distinguish in advance the endogenous variables from exogenous ones. On the other hand, it needs a large number of observations (rarely available for crime variables) to guarantee the robustness of the estimators and the performance of the statistical tests. An autoregressive model, in which the GDP variations are explained by its past history and a crime variable, was chosen as the best model to explain the impact of crime on economic growth in South Africa.

Details on research methodology are provided in chapter four of this research report.

1.6 Significance of the study

The vast empirical growth literature recently surveyed by Durlauf et al. (2005) has looked at almost as many growth determinants as there are countries for which data are available, ranging from the so-called Solow determinants to trust and other aspects of social capital (Knack and Keefer, 1997; Zak and Knack, 2001), but none of these studies has assessed the role of crime in the economy of South Africa. This study attempts to fill this gap.
1.7 Deployment of the study

Chapter 1
Provides introduction and background to the study; the problem statement; the aims and objectives of the study; significance of the study; and research methodology.

Chapter 2
Provides literature review.

Chapter 3
Provides an overview of crime and economic growth in South Africa.

Chapter 4
Presents a research methodology

Chapter 5
Provides empirical findings

Chapter 6
Provides summary, conclusions and recommendations

1.8 Concluding remarks
This chapter provided the introduction and background of the research. The problem statement, research objective and research methodology were outlined in this introductory chapter. This chapter has set the scene for the next chapter on literature review.
Chapter 2

Literature Review

2.1 Introduction

There are three components that are of primary importance in the economic growth in any society, and they are capital and labour “factor accumulation”, and technological progress (Todaro, 2009:97). Capital accumulation, includes all new investments in land, physical equipment and human resources through improvements in health, education and job skills. Also, population growth and hence eventual growth in the labour force. Technological progress, broadly, new ways of accomplishing tasks. Capital accumulation has long been thought essential to the process of economic growth. But according to Fedderke (2002a), in the recent accounting growth in South Africa, capital formation was the second most important proximate cause of South African economic growth over the last decade.

The aim of this chapter is to discuss the various theories of economic growth. The chapter begins by outlining neoclassical growth theory. This is followed by a discussion on Harrod-Domar growth theory and classical growth theories. The second section of the chapter presents empirical literature on the impact of crime on economic growth in various countries. Concluding remarks are provided towards the end of the chapter.

2.2 Neoclassical growth theory

The basic neoclassical growth model was originally developed by Robert Solow and Trevor Swan in 1956. It is known particularly for its use of the production function. Solow’s neoclassical growth model exhibit diminishing returns to labour and capital separately and constant returns to both factors jointly. Technological process become the residual factor explaining the term growth, and its level was assumed by Solow and other neoclassical growth theorists to be determined exogenous, that is, independently of all other factors (Todaro and Smith, 2009:122).

More formally, the standard exposition of the Solow neoclassical growth model uses an aggregate production function in which

\[ Y = K \alpha (AL)^{1-\alpha} \]  

(2.1)
Where \( Y \) = gross domestic product (GDP)

\[
K = \text{stock of capital (which may include human capital as well as physical capital)}
\]

\[
L = \text{labour and}
\]

\[
A = \text{represent the productivity of labour, which grows at an exogenous rate (Todaro and Smith: 2009:122).}
\]

This rate has been estimated at 2% per annum for developed countries whereas for developing countries it depends on whether they are stagnating or catching up with developed countries. The Solow neoclassical model is sometimes called an “exogenous” growth model to be contrasted with endogenous growth model because of the rate of technological progress is given exogenously (2% per year). Symbol \( \alpha \) represents the elasticity of output with respect to capital (the percentage increase in GDP resulting from a 1% increase in human and physical capital). The physical capital component is usually measured statistically as the share of capital in a countries national income accounts. Since \( \alpha \) is assumed to be less than 1 and private capital is assumed to be paid its marginal product so that there are external economies, this formulation of neoclassical growth theory yields diminishing returns both to capital and labor. According to traditional neoclassical growth theory, output growth results from one or more of three factors: increases in labor quantity and quality (through population growth and education) increases in capital (through savings and investment), and improvement in technology (Todaro and Smith, 2009:122).

The model assumes that, first, the labor force growth is constant, second, all saving is invested, that is, saving, investment and the propensity to save (sY), are all equal; and, output, Y, is determined by the interaction of capital and labor, that is, \( Y=F(K,L) \). The production function the event of other factors being held constant (Todaro and Smith, 2009).

According to Dornbusch, Fischer and Kearney (2008:56) an increase in the rate of growth of the technology or total factor productivity of the economy results in an increase in output per worker growth. The strength of the other of these effects (the amount by which an increase or decrease affects GDP per worker growth) depends
on a parameter which is best interpreted as the share of national product that is earned by owners of capital (rather than suppliers of labor) and on the economy’s output-to-capital ratio \((Y/K)\). If the capital share is multiplied by the output to capital ratio, the marginal rate of capital is obtained.

The neoclassical growth model assumes that technological process is exogenously determined and its level is the same across countries. This assumption involves an implication that the economy will reach a steady state level of growth. According to Dornbusch et al (2008:50), at the steady state the per capita output is constant.

The neoclassical growth model has weaknesses, namely, an assumption of perfect competitive market. The enclosure of assumption was necessary to ensure that all resources were optimally allocated. Todaro and Smith (2009) point out that under this assumption equilibrium will be achieved, ensuring maximum allocation of resources by markets themselves. Neoclassical theorists believe markets do not fail to clear. However, in reality markets do fail. Therefore, at least government interference is necessary. In real world situation, markets have to be regulated, in the real world; some groups have power over some markets.

The neoclassical growth theory is related to this study because an increase in the rate of growth of the technology or total factor of productivity of the economy results in an increase in output per worker growth. When the country is losing some of its skilled people through acts of violent crime productivity of the country becomes affected, that is, productivity will decrease.

### 2.3 Harrod-Domar growth model

Harrod-Domar growth model, a Keynesian economist, perceives growth as the outcome of the equilibrium between savings and investment. It was named after two famous economists: Sir Roy Harrod of England and Professor Evsey Domar of the US who independently formulated the model in the early 1950s. The basic model assumes that it is a closed economy and that there is no government, no depreciation of existing capital so that all investment is net investment and that all investment comes from saving (Todaro and Smith, 2009).

In coming up with the growth model, Harrod wanted to establish the rate of growth of income that would encourage equilibrium between saving and investment and to
note whether the equilibrium is self-correcting if concerned. According to Todaro and Smith (2009), the fundamental variables in the Harrod-Domar growth model include capital accumulation and the ratio of increase in output to increase investment, \( \Delta K/\Delta Y \), since \( \Delta K=I \).

Where, \( \Delta K \) = change in capital, \( \Delta Y \) = change in output, and I is investment. The change in capital stock is due to investment. Therefore, \( \Delta K=I \). The change in output is a result of a change in the capital stocks.

The model seeks to ascertain whether or not the actual economic growth rate will create a condition in which desired investment equals desired saving. This is where the concept of the warranted rate growth and the natural rate of growth play a role. According to Todaro and Smith (2009), the warranted rate growth is a rate of growth which is sanctioned by the values of two other crucial variables, that is, the planned national rate of savings, and the average value of the capital: output ratio as planned by producers. Planned savings represents the sum of the spending power which individuals and firms plan to withhold from consumption in a given period. The capital: output ratio represents the value of the capital needed to produce a given output divided by the value of that output (Todaro & Smith, 2009). More specifically warranted rate of growth is a growth rate that encourages investment in order to have investment and saving in equilibrium and the capital stock fully utilized.

Therefore, entrepreneurs are willing to continue to investing at the same rate as previously. At the warranted output growth rate, desired expenditure equals output, that is, \( g=g_w \) where \( g \) represents growth and \( g_w \) represents warranted rate of growth. In order to grow, economies must save and invest a certain proportion of their GDP. The more they save and invest, the faster they can grow, that is, as long as investment equals saving, the economy continues to grow (Todaro and Smith, 2009).

Harrod-Domar growth model is related to this study because the model seeks to determine whether or not the actual economic growth rate will create a condition in which desired investment equals desired savings and in that case the concept of warranted rate growth and the natural rate of growth play a role. Certain proportion of GDP must be saved and invested in order for the economies to grow. It therefore
follows that any increase in crime may results to a decrease of savings, investment and economic growth.

2.4 Classical growth theory

The first body of economists under consideration is the classical economists. Adam Smith developed a supply sided growth model to come up with following production function.

\[ Y = (L, K, T) \]  \hspace{1cm} (2.2)

Where \( Y \) = output,  
\( L \) = labor,  
\( K \) = capital and  
\( T \) = land.

Output would therefore be related to labor, capital and land inputs. Thus output growth was directly related to population growth, investment, land growth and increase in productivity.

Adam Smith again believed that countries undergo increasing returns to scale and that investment is a function of savings and hence economic growth (Reid, 1989). Classical growth theory state that the increase in real GDP per person will be temporary because prosperity will induce a population explosion and the population explosion will decrease real GDP per person. When the classical economists were developing their ideas about population growth, an unprecedented population explosion was under way. To explain the high rate of population growth, the classical economists used the idea of a subsistence real income (real GDP per person). In classical theory, when real income exceeds the subsistence real income, the population grows. The increasing population decreases capital per hour of labor and eventually decreases real income to less than subsistence real income. If the actual real income is less than the subsistence real income, some people cannot survive and the population decreases. No matter how much technological change occurs, real income (real GDP per person) is always pushed back toward the subsistence level. The classical growth theory has been widely criticized because of its failure to
capture the effect of technology on economic growth. Notwithstanding the neoclassical growth theory does provide some useful insights to understanding the economy.

2.5 Endogenous growth theory

Endogenous growth theorists seek to explain the factors that determine the size of $\lambda$, the rate of growth of GDP that is left unexplained and exogenously determined in the Solow neoclassical growth theory equation (i.e. Solow residual). Models of endogenous growth bear some structural resemblance to their neoclassical counterparts, but they differ considerably in their underlying assumption and the conclusions drawn. Endogenous growth theory seeks to explain the existence of increasing returns to scale and the divergent long-term growth patterns among countries. While technology still plays an important role in these models, exogenous changes in technology are no longer necessary to explain long run growth. A useful way to contrast the endogenous growth theory with traditional neoclassical theory is to recognize that many endogenous growth theories can be expressed by the simple equation $Y=AK$ as Harrod-Domar model. Where $A$ is intended to represent any factor that affects technology and $K$ includes both physical and human capital. According to Todaro and Smith (2011) there is no diminishing returns to capital in this formula and the possibility exists that investments in physical and human capital can generate external economies and productivity improvements that exceed private gains by an amount sufficient to offset diminishing returns.

Endogenous growth theory re-emphasizes the importance of savings and human capital investments for achieving rapid growth, it also leads to several implications for growth that are in direct conflict with traditional theory. First, there is no force leading to the equilibration of growth rates across closed economies; national growth rates remain constant and differ across countries, depending on national savings rate and technology levels. Furthermore, there is no technology for per capita income levels in capital poor countries to catch up in rich countries with similar savings and population growth rates (Todaro and Smith, 2011). A serious consequence of these facts is that temporary or prolonged recession in one country
can lead to a permanent increase in the income gap between itself and wealthier countries.

2.6 The assessment of a theoretical literature review

It is clear from the above discussion that the neoclassical growth theory does in some way related to this study in that an increase in the rate of growth of technology or total factor of productivity of the economy results in an increase in output per worker growth. When the country is losing some of its skilled people through violent crimes for example, productivity of the country will decrease. Harrod-Domar growth model is also related to this study because the model seeks to determine whether or not the actual economic growth rate will create a condition in which desired investment equals desired savings and in that case the concept of warranted rate growth and the natural rate of growth play a role. Certain proportion of GDP must be saved and invested in order for the economies to grow. An increase on people killed results to a decrease of savings, investment and economic growth. Endogenous growth theory will be adapted to this study because it relates a great deal to domestic absorption. In fact crime presents a cost to the economy in that firms lose profits whilst tax payers’ money is spent on running prisons.

2.7 Empirical literature

Crime has a significant impact on the society. On one hand, criminal activity allows the consumption of illicit goods or services which could not otherwise be consumed. On the other hand, crime imposes great costs to the public and private actors, such as stolen and damaged goods, lost lives, security spending, pain and suffering. The estimation of such social cost of crime has become an important field of study in the last few decades (Czabanski, 2008), which shows how crime imposes a significant burden onto society. For example, Brand and Price (2000) estimate the total crime costs in Wales and England for the Home Office using survey data. They estimate a total expenditure equals to the 6.5% of the Gross Domestic Product (GDP). Anderson (1999) finds that the total annual cost of criminal activity in the United States accounts for 11.9%of the GDP. A recent work of Detotto and Vannini (2009) evaluates the burden of a subset of crime offenses in Italy (about 65% of all crime
offenses) during the year 2006. The estimated total social cost exceeds the 2.6% of Italian GDP.

Although the identification and the estimation of crime costs have received wide attention in economic literature, the detrimental effect of crime to the (legal) economic activity is still neglected. Crime acts like a tax on the entire economy: it discourages domestic and foreign direct investments, reduces the competitiveness of firms, and reallocates resources, creating uncertainty and inefficiency. Crime has been recognized as one of the major causes for human and economic losses in both developed and developing countries.

This problem is of greater concern in developing countries such as South Africa largely because of limited resources to develop the necessary counter measure regime to effect a reduction in crime. On the other hand, developed countries have designed and implemented different strategies to reduce the scale and severity of this problem through education, enforcement and engineering. In the World Bank’s most recent Investment Climate Survey, 30 percent of enterprises in South Africa rated crime as a major or very severe constraint on investment, putting crime among the four most frequently mentioned constraints (World Bank, 2005). A study of growth across several Brazilian cities finds that a ten percent increase in baseline homicide rates reduces city growth by 1.1 percent over the next decade (da Mata, et al., 2005) and Glaeser (2005) has found that “high murder rates are associated with low growth rates” across U.S. cities. The South African government itself routinely lists the high level of crime, particularly violent crime, as an impediment to growth. Yet the evidence is much weaker about specifically how crime constrains growth (Stone:2006:2).

According to the World Bank’s Investment Climate Survey, the costs of crime in South Africa for firms at the median are 1.1 percent of sales, 3 percent of net value-added, and 5 percent of labour costs. What distinguishes South Africa from these other middle-income countries is the composition of these costs. South African firms bear more of the costs in direct losses to crime, where the costs in other countries are more heavily weighted toward prevention. Moreover, the prevention costs in
South Africa are almost all for security, without the unofficial payments to organized crime or local officials that are common elsewhere” (Stone:2006:11).

Many people who undertake criminal activities end up in prison and are unable to supply labour in the market with a negative effect on the level of production in the economy. This effect is not irrelevant if one think that the number of people ending up in jail are relatively high in many countries and that this people are mainly male of working age. People who are endowed with a low level of education have also a lower expected level of wage income, and since the wage forgone is the major alternative cost for being imprisoned after committing a crime, these agents have also a higher incentive to commit criminal offences. This would explain why for low level of capital accumulation, when the wage rate is low, and income inequality might be particularly severe, the economy might experience high crime rates. The role of government, in this framework, is not only to directly redistribute resources trough taxation, but also to supply the necessary infrastructure and services, like public education and schooling, in order to increase individuals’ labour productivity and wage income. Such a role is hindered in presence of a large number of individuals who do not participate to the legal process of output and income production – for example because they are in jail. Indeed, in such circumstances, not only government revenues are particularly low because of a lower actual amount of taxable resources, but also because a large portion of those resource are diverted from productive investments, such as investment in education, to unproductive investments, such as investments in security. This would explain the negative impact of crime on the process of capital accumulation and growth (Capasso:2004:3).

Tourism has also become one of the exciting and fascinating industries across the globe. Theoretically many scholars worldwide have touched the issue of crime and tourism. In South Africa the tourism industry began thriving after the democratic government came into power (Nkosi, 2010:77). The industry’s contribution to national and trans-national economies is as enormous as its growth potential. The Tourism Industry in South Africa has become one of the leading economic contributors to the country’s economy. Crimes committed against tourists are not, new phenomena that come with the development of the tourism industry. Giddens
(1990), states that crimes against travellers affect many people besides the victims and their families. This fact is very true, because unpleasant experiences of tourists at a particular destination are widely covered by the media or reported by tourist themselves to friends and families by the word of mouth. The destination then gets a bad publicity and the number of tourists visiting the area declines. In South Africa, tourists have been exposed to criminal attacks. This harms the tourists as individuals emotionally and physically. At times this goes to an extent where even the family and friends of that particular tourists are affected by the criminal act committed against the tourist. This occurs when criminal attacks such as rape and murder have been committed.

Mauro (1995) shows a significant negative relationship between crime and the growth rate among 70 countries in the early 1980s; Lambsdorff (2003) finds that corruption reduces the capital productivity in a panel of countries; Forni and Paba (2000), examine the impact of several socio-economic variables on the economic performance of the Italian provinces during the period 1971–1991 and find that crime has a negative impact on economic growth in these countries. Peri (2004), using a larger data set (from 1951 to 1991), shows that the annual per capita income growth is negatively affected by murders after controlling for other explanatory variables.

Pellegrini and Gerlagh (2004) find that the impact of corruption on economic growth reduces the ratio of investment to GDP and the country’s openness. Cardenas (2007) focused on the relationship between crime and growth rate in an unbalanced panel of 65 countries during the period 1971–1999 and found similar results as in other studies, namely that crime impacts negatively to economic growth. Gaibulloev and Sandler (2008) measure the impact of domestic and transnational terrorism on income per capita growth for 1971–2004 in a panel of 18 Western Europe countries. Their findings suggest that crime has a negative impact on economic growth in these countries.

Enders and Sandler (1996), employing a VAR model, assess the impact of terrorist incidents on net foreign direct investment in Greece. Their findings suggest a negative relationship between foreign direct investments and crime in Greece. Masih and Masih (1996) estimated the relationship between different crime types
and their socioeconomic determinants within a multivariate co-integrated system for the Australian case. Narayan and Smyth (2004) employed a Granger causality tests to examine the relationship among seven different crime typologies, unemployment and real wage in Australia within an Autoregressive Distributed Lag (ARDL) model. Their findings suggest a positive relationship between crime and unemployment. This finding suggests that as unemployment increases so will crime increase. Accordingly unemployment granger causes crime. Mauro and Carmeci (2007) empirically explored a link between crime, unemployment and economic growth using Italian regional data. Their findings are no different from the other scholars in that crime imposes a downward pressure on economic growth.

Other scholars who found that crime depresses growth are Cardenas (2007) who analysed Colombia’s annual GDP growth between 1951 and 2005; Habibullah and Baharom (2009) who applied an ARDL model to the Malaysian case to analyse the relationship between real gross national product and different crime offences. Recently, Detotto and Pulina (2009) applied an ARDL model to the Italian data (1970–2004) to assess the relationship between several crime offences, deterrence indicators and economic variables. Chen (2009) implements a Vector Autoregressive (VAR) model to examine the long-run and causal relationships among unemployment, income and crime in Taiwan. All these studies confirm that crime leads to negative economic growth.

2.8 Assessment of the empirical literature

It is clear from the above empirical literature that time series approach have several advantages in terms of the interpretability of results and application, because it allows the identification of dynamic processes and the forecasting analysis. Moreover, it does not need to distinguish in advance the endogenous variables from exogenous ones. This study employs a vector error correction model to analyse the impact of crime on economic growth in South Africa. Accordingly, this study modifies the model used by Enders and Sandler (1996) which has been discussed above.
2.9 Concluding remarks

The aim of this chapter was to discuss the various theories of economic growth. The chapter began by outlining neoclassical growth theory. This was followed by a discussion on Harrod-Domar growth theory and classical growth theories. The neoclassical growth model is underpinned by a philosophical thinking of Robert Solow and Trevor Swan in 1956. More formally, the standard exposition of the Solow neoclassical growth model uses an aggregate production function. Solow’s neoclassical model is also considered as an exogenous growth model to be contrasted with endogenous growth model because of the rate of technological progress which is given exogenously. Solow’s growth model does relate to this study in that crime does impact negatively on capital and productivity in the country. For example Lambsdorff (2003), found that corruption reduces the capital productivity in a panel of countries.

Harrod-Domar who was a Keynesian economist, perceives growth as the outcome of the equilibrium between savings and investment. Harrod-Domar model assumes that all investment is net investment and that all investment comes from saving. The model seeks to ascertain whether or not the actual economic growth rate will create a condition in which desired investment equals desired saving. This is where the concept of the warranted rate growth and the natural rate of growth play a role. Harrod-Domar growth model is related to this study because the model seeks to determine whether or not the actual economic growth rate will create a condition in which desired investment equals desired savings. It therefore follows that any increase in crime may results to a decrease of savings, investment and economic growth.

The classical growth theory was also discussed. Adam Smith believed that countries undergo increasing returns to scale and that investment is a function of savings and hence economic growth. Classical growth theory state that the increase in real GDP per person will be temporary because prosperity will induce a population explosion and the population explosion will decrease real GDP per person. The classical growth theory has been widely criticized because of its failure to capture the effect of technology on economic growth. Notwithstanding the neoclassical growth theory does provide some useful insights to understanding the economy.
The endogenous growth model was also discussed in this chapter. Models of endogenous growth bear some structural resemblance to their neoclassical counterparts, but they differ considerably in their underlying assumption and the conclusions drawn. Endogenous growth theory reemphasizes the importance of savings and human capital investments for achieving rapid growth, it also leads to several implications for growth that are in direct conflict with traditional theory. A serious consequence of these facts is that temporary or prolonged recession in one country can lead to a permanent increase in the income gap between itself and wealthier countries.

Despite the shortcomings of the theories discussed in this chapter the impact of crime is a cross cutting phenomenon and irrespective of the fundamental theoretical standpoints the effect of crime is assumed to be negative in all instances. Accordingly, all the theories discussed in this chapter are relevant to this study.

In addition to the theoretical framework, empirical literature was presented in this chapter. The empirical literature provided an exposition of the various methods of research applicable to the impact of crime on the economy. The majority of the empirical literature presents similar and consistent results. Nevertheless much of the empirical analysis has been done using data in overseas countries. Very little or almost no research of this nature has been done in South Africa. This chapter has provided some significant insights into the types of econometric modelling that can be applied when analysing the impact of crime. Accordingly the model used by Enders and Sandler (1996) has been adapted in the analysis of results this study.

Having outlined the theoretical foundation of this study as well as the empirical literature underpinning this research, the next chapter presents an overview of the magnitude and the impact of crime in South Africa.
Chapter 3
An overview of crime and economic growth in South Africa

3.1 Introduction

Criminal activity is a phenomenon associated with money and the acceptance of law-breaking behaviour. Dutta and Husain, (2009) point out that crime has serious consequences for the government’s ability to promote development. In fact, an increase in government expenditure on security crowds out some key investments in infrastructure.

Crime remains an indisputable fact of life for many, if not most members of modern society. This is true despite the frequent declarations that crime continues to fall and is reaching levels not seen in years. Crime has a significant impact on the society. Criminal activities lead to increased consumption of unlawful goods such as drugs and substance abuse and this in turn aggravates criminal activities in the society. Crime also imposes great costs to the public and private sectors such as stolen and damaged goods, lost lives, security spending, pain and suffering (Detotto and Otranto, 2010:330). According to (Czabanski, 2008) high crime causes a burden and a social cost to society.

The relationship between crime and economic growth seems obvious to most people. Crime increase uncertainty and the cost of doing business. Therefore crime discourages entrepreneurial activities that cause growth. However, the relationship between crime and growth is much more complex than it appears.

The aim of this chapter is to provide an overview of the extent of crime and economic growth in South Africa. The chapter begins by providing crime statistics in South Africa. This is followed by a presentation of economic growth in South Africa. Concluding remarks are provided towards the end of the chapter.
3.2 Overview of selected crime types

During 2010/2011 a total of 2 071 487 (approximately 2,1 million) serious crime cases were registered in the RSA, compared to the 2 121 887 cases registered during 2009/2010. This means that the total number of serious crimes was reduced by -2.4% or 50 400 cases. This decrease exceeds the target determined by Government, namely to reduce the total volume of serious crime by -1.0% to -1.8% per annum. The ratio of serious crime per 100 000 of the population decreased by -7% (from 4 302.1 to 4 143.6), (SAPS Crime Report, 2010/2011).


3.3 Robbery

Business robberies and house robberies have significantly increased prior to 2009/2010. During the period 2009/2010 there was a decrease in house robbery by 23.6% yet there was a marginal increase of 0.9% in business robberies. The South African economic growth depends on these businesses in general. This indicates a negative impact on the job creation (SAPS Crime Report: 2010/2011: p.16).

3.3.1 Common Robbery

Common robbery decreased by -5.9%, from 116.7 per 100 000 to 109.8 per 100 000 of the population. The decrease recorded during 2009/2010 stood at -4.1%.

3.3.2 Aggravated Robbery

Aggravated robbery decreased by -12.0% from 230.6 per 100 000 to 203.0 per 100 000. Except for the -12.2% decrease in attempted murder and the -12.7% decrease in shoplifting, this represents the most significant decrease among the 20 categories of crime in table 1 and exceeds the government target by a considerable margin. It is also the largest decrease in this crime recorded since 2003/2004. The -7.5% decrease in 2009/2010 is the second-largest decrease in aggravated robbery recorded since 2003/2004.
Robbery with aggravating circumstances includes the following subcategories of robbery:

- Carjacking;
- truck hijacking;
- robbery at residential premises (house robbery);
- robbery at non-residential premises (business robbery);
- cash-in-transit (CIT) robbery;
- bank robbery; and
- other aggravated robberies not mentioned elsewhere on this list, which are mainly aggravated robberies occurring on the streets and in other public or open spaces. These are described as “street robberies” (SAPS Crime Report: 2010/2011: p.12-13).

3.4 Murder

It should constantly be kept in mind that at least 20,0% - 30% of murders, 40,0% of attempted murders, 25,0% of sexual offences and 10,0% of assaults occur between strangers (often as a result of other crimes). The latter figures consequently in most cases represent people killed, assaulted and raped during robberies, intergroup conflict (e.g. taxi related and gang fights) and vigilantism. Self-defense as well represents a response to criminal behavior. An example of this is where the owner of a house shoots a robber during a house robbery.

The South African Police Service statistics revealed that there has been a decline in Murder from 42.7 to 39.1 between the financial year (i.e. 1st April 2003 to 31 March 2004) 2003/2004 to 2010/2011. Therefore murder has decreased by 38.11% in eight years. This is a type of crime that is most threatening to tourists. It should be noted that between 2004/2005 and 2005/2006 the rate of murder dropped from 40.3 to 39.5 then between 2005/2006 and 2006/2007 the murder rate rose from 39.5 to 40.5 which was higher than 2004/2005 and 2005/2006 financial years. But overall, in 2003/2004 there were 19 824 cases reported and 15 940 in 2010/2011 which gives us a decrease by 38.11% in seven years.
The -6.5% decrease in the murder ratio between 2009/2010 and 2010/2011 represents a decrease of 894 murders, from 16 834 to 15 940 cases. This is significant for the following reasons:

- In the history of the SAPS (which came into being during 1995), the murder figure fell below the 16 000 mark. In 1995/1996 a total of 26 887 murders were recorded, while in 2010/2011 the figure decreased to 15 940 murders. That represents a 40,7% decrease (which translates into a ratio decrease of 53,2%), while South Africa’s population increased by at least 28,0% (excluding the massive influx of undocumented immigrants). This means that murder decreased by 50,0% in the face of rapid population growth and massive urbanization, both also stimulated by the additional influx of undocumented immigrants. Murder, being the one crime trend which should virtually not be influenced by over or under-reporting and/or the non-registration of cases, is consequently believed to be the most consistent indicator of increases and decreases in crime.

- The -6.5% decrease in the murder ratio, which relates to a -5,3% decrease in real figures, is the second-most significant decrease in the murder figure since the implementation of the 7 – 10% reduction target during January 2004. In terms of raw figures, a decrease of 1 314 cases was recorded between 2008/2009 and 2009/2010, followed by a decrease of 894 cases between 2009/2010 and 2010/2011. This represents a substantially larger decrease than that recorded during the preceding four years between 2004/05 and 2009/10.

- Extremely high levels of police visibility were maintained since the first quarter of the 2009/2010 financial year (April – June 2009) as a result of events such as the 2009 general elections, the inauguration of President Zuma and the international cricket and Confederation Cup Football tournaments. These were then sustained by the (at that stage new) management of the Department between the Confederation Cup and the subsequent World Cup soccer tournament of June/July 2010 - and even beyond the World Cup,
particularly in provinces such as Gauteng and Kwa-Zulu Natal which account for a major share of the country’s crime. These high levels of visibility may not have had any noticeable effect on social contact crime, but it would have reduced the number of robberies (and thus also murders and attempted murders committed by robbers and deaths and injuries inflicted by their victims acting in self-defense), as well as murders committed during intergroup violence.

- Significant successes were achieved against robbers during the reporting period. If robberies are reduced as indicated above, it is logical that murders will also drop significantly. The same applies to attempted murder, which is to a large degree also associated with robberies.

- The arrest of robbers (sometimes ending in casualties among them, particularly if they offer violent resistance) will in all probability not only reduce murders as a result of robbery, but in addition remove perpetrators of social contact crime from society.

If these robbers had been arrested and in that way prevented from committing social assaults and resultant murders, the assault GBH and common assault figures did not decrease as significantly as the murder, attempted murder and robbery figures. The explanation could be that analysis of trends during big events over the past decade has consistently indicated that the more policeable crimes such as robbery, housebreaking, theft of motor vehicle and theft out of/from motor vehicle, etc decreased significantly. At the same time the less policeable and more purely social contact crimes such as assaults and sexual offences usually increased, particularly as a result of more socializing and a rise in alcohol consumption(SAPS Crime Report: 2010/2011: p.6-8).

3.5 Attempted Murder

with robbery because of excessive force used by robbers. Robbery has two types, common robbery and aggravated robbery. Common robbery has decreased by 5.9% during 2010/2011 and aggravated robbery which includes carjacking, truck hijacking, robbery at residential premises (house robbery), business robbery, cash-in-transit robbery and bank robbery has decreased by 12.0%.

Attempted murders decreased by -12.2% during 2010/2011. This is, with the exception of the decrease in shoplifting, the largest decrease among all the categories of crime discussed in this report during 2010/2011 and double the decrease recorded in 2009/2010 which stood at -6.1% (SAPS Crime Report: 2010/2011: p.8).

3.6 Sexual offences

According to the South African Police Service crime report 2010/2011, sexual offenses include rape which was previously defined as vaginal penetration by male sexual organ. From the December 2007, the definition for rape was changed by the current sexual offense legislation to include vaginal, oral and anal penetration of a sexual nature by whatever means and thus male rape. The Criminal Law (Sexual Offences and Related Matters) Amendment Act, No. 32 of 2007 which covers the new definition of sexual offences came into effect on the 16th of December 2007 after being signed into law by former President Thabo Mbeki. The concept of sexual offences then also goes further to add a whole range of transgressions which never previously formed part of rape or indecent assault – such as sex work, pornography, public indecency and human trafficking. Sexual offenses often result in other crimes such as Murder and attempted murder and affecting mostly children that are between the ages 0 – 17. According to Statistics South Africa (2011) more than 90% of the perpetrators of sexual offences used physical force, followed by using a gun (31.5%) and a knife (24.5%). Between the financial year 2003/2004 and 2010/2011, there was a decline from 142.5 to 132.4 per 100 000 population in sexual offenses if male rape is excluded. As much as other types of crime are falling but sexual offenses seems to be rising, between financial year 2009/2010 and 2010/2011 for instance, there was an increase in sexual offences by 2.1% in South Africa. Only five of the nine South African provinces experienced a decrease in sexual offenses
but the remaining four provinces had a significant increase in sexual offenses. The highest incidence of all recorded sexual offenses was in the Western Cape.

If all sexual offences cases registered in 2010/2011 which would have qualified as rape and indecent assault cases prior to 16 December 2007 are identified and counted, the result adds up to 56 272 cases. If the same calculation is done for 2008/2009 and 2009/2010, the combined rape and sexual assault figures for these three years are as follows:

- 2008/2009       54 126
- 2009/2010       55 097
- 2010/2011       56 272

This means that between the 2008/2009 and 2009/2010 financial years an increase of 1,8% and from 2009/2010 to 2010/2011 an increase of 2,1% was recorded. It should again be emphasized that the average of approximately 55 165 rape and sexual assault cases recorded over the past three financial years since the implementation of the current sexual offences legislation should not be compared to the average of ±53 000 rapes recorded during the financial years prior to 2007/2008 (SAPS Crime Report 2010/2011:p.10).

3.7 Common Assault and Assault GBH (grievous bodily harm)

According to the South African Police Service Crime Report 2010/2011, assaults (GBH and common) are a social phenomenon occurring between people knowing each other, with alcohol and drug abuse also considered as conducive to these crimes. It is further known that these crimes frequently occur in localities not readily covered by conventional policing (patrols, roadblocks, stop-and-search operations) such as the privacy of homes and places of employment, as well as clubs, shebeens, taverns, bars and other social gathering places. To reduce these crimes significantly, communities will have to alter their lifestyle. People will find it difficult and even impossible to change their lifestyle if their living conditions are bleak and their present lifestyle represents an adaptation to such conditions. Assault common has fallen by 7,1% and Assault GBH has fallen by 4,5% in the financial year 2010/2011. When comparing these figures to the figures in 2004/2005 Assault GBH which was 4,5% has not changed and Assault common has risen from 5,1% to 7,1%.
However, the -4.5% and -7.1% reductions recorded during 2010/2011 represent a clear improvement on the -0.5% reduction in assault GBH and 1.0% increase in common assault recorded during 2009/2010. These mainly social contact crimes together account for nearly 80.0% of all social contact crime. It remained difficult to achieve this target since the implementation of the 7 – 10% annual reduction targets per contact crime category during January 2004.

3.8 Overview of economic growth in South Africa

Figure 3.1 below portrays economic growth rates from 1980 to 2010.

**Fig 3.1 GDP growth rates 1980-2010**

Source: StatsSA(2012)

Figure 3.1 above shows that economic growth rates have been fluctuating since the 1980s. from 1980 to 1982 economic growth spiralled downwards and was followed by a rise in 1983 but soon declined in 1986 and recorded a -2% decline in 1992. However there was an upward trend of economic from 1994 but declining again in 1998.
In 2000 GDP grew at a rate of 3.5% but slowed slightly in 2001 and the slowdown continued to 2003 where a growth rate of 2.4% was registered. South African real GDP rose by 3.7% in 2002 and slightly rose by 3.1% in 2003 and further increased by 4.9% in 2004 and in 2005 it rose by 5% and in 2006 it was 5.4% the highest since 1981. Figure 3.1 shows that there was a low average GDP before 2005, and after that an increase in GDP was experienced.

In 2000 the GDP growth rate increased but slowed slightly in 2001 and during this period that is when South Africa experienced the rapid depreciation of the exchange rate and the slowdown continued to 2003. South Africa real growth rate increased in 2004 and in 2005 and the highest growth was experienced in 2006 that is the highest growth since 1980 and during this period the rand had also gained its momentum (Du Plessis and Smith, 2007).

Until the global economic crisis hit South Africa in late 2008, economic growth had been steady and unprecedented. According to (StatsSA, 2012), GDP rose by 2.7% in 2001, 3.7% in 2002, 3.1% in 2003, 4.9% in 2004, 5% in 2005, 5.4% in 2006, 5.1% in 2007 and 3.1% in 2008. From the first quarter of 1993 to the second quarter of 2008, the country enjoyed an unprecedented 62 quarters of uninterrupted economic growth. But as the crisis made itself felt, GDP contracted in the third and fourth quarters of 2008, officially plunging the economy into recession. This contraction continued into the first and second quarters of 2009, with GDP growth at -6.4% and -3% respectively.

South Africa's economy has been completely overhauled since the advent of democracy in the country in 1994. Bold macroeconomic reforms have boosted competitiveness, growing the economy, creating jobs and opening South Africa up to world markets.
3.9 Relationship between economic growth and crime in South Africa

Figure 3.2 below portrays a relationship between economic growth and crime in South Africa.

Figure 3.2: Relationship between economic growth and crime in South Africa


Figure 3.2 above shows a negative relationship between economic growth and crime. Generating equitable economic growth is a priority for the government of South Africa, and the high level of violent crime in the country is frequently mentioned as a constraint on growth (Stone, 2006). The threat of crime diverts resources to protection efforts, exacts health costs through increased stress, and generally creates an environment unconducive to productive activity. Additionally, the widespread emigration of South African professionals in recent years is attributable in part to their desire to escape a high crime environment. All of these effects discourage investment and stifle long-term growth in South Africa. Reasons cited for a negative relationship between economic growth and crime are, amongst others, as follows:
• Crime imposes costs on business (direct losses plus the costs of security and prevention) that reduce profits and divert funds that could be invested in productive capacity;

• Crime induces government to spend money on law enforcement, crime prevention, and the administration of justice that would otherwise be available to stimulate growth;

• Crime induces households to spend money on health care and security precautions rather than on school fees and other investments;

• Crime erodes human capital by encouraging emigration and by injuring and killing skilled workers;

• Crime keeps workers out of the labor market by discouraging them from accepting jobs in off-hours and far from home;

• Crime discourages foreign investment; and

• Crime disrupts schooling and other public investments to support long-term growth (such as public transport), blunting the effectiveness of these investments (Stone, 2006).

3.10 Concluding remarks

This chapter provided an overview of crime statistics and economic growth in South Africa. On the whole crime statistics presented in this chapter gives impression that crime has tapered down over the last few years. However, despite the reported moderate decline in crime figures, crime is still high in South Africa.

The South African government and its citizens still have a lot to do in the fight against crime. The rates mentioned above are not good enough for a country that aspires to be a developed country and fit in well in the global market. Crime has a negative impact on economic growth. The reasons for a negative relationship between economic growth and crime were outlined in this chapter. The main insights from this chapter are that crime not only costs the society but the economy as a whole. This means that everyone suffers from reduced income levels as a result of crime.

Having outlined the magnitude of crime and economic growth in South Africa, the next chapter presents a research methodology.
Chapter 4
Research methodology

4.1 Introduction

This chapter presents the methodology employed in the investigation of the impact of crime on the South African economy. The empirical model and the relevant data issues are presented. The first part of the chapter specifies the model. This is followed by specifying the data that was used, the definition of variables and expected results. The last part of the chapter looks at various tests for the model including stationarity, cointegration error correction and diagnostic testing.

4.2 Model specification

In examining the impact of crime on economic growth in South Africa the choice of variables was informed by the literature reviewed in chapter two of this research report. The explanatory variables in this study are crime, unemployment, GDP, poverty, real interest rates, real exchange rates and foreign direct investments. Crime is used as a main explanatory variable to test for its impact on economic growth. Accordingly, this study modifies the model used by Enders and Sandler (1996) which has been discussed in chapter two. Since all variables are considered endogenous the econometric model to be used in the analysis of data will take the following functional form:

\[ \text{GDP}_t = B_0 + \beta_1 \text{CRIME}_t + \beta_2 \text{REER}_t + \beta_3 \text{Pov}_t + \beta_4 \text{UE}_t + \beta_5 \text{RIR}_t + \varepsilon \] ……………(4.1)

Where:
\[ B_0, \beta_1, \beta_2, \beta_3, \beta_4, \text{ and } \beta_5, \] are the coefficients of the variables to be estimated.

GDP = economic growth
CRIME= Annual Crime Statistics
REER=Real exchange rates
Pov = Poverty
UE= Unemployment
RIR=Real interest rates
$\varepsilon = \text{stochastic error term}$

t = \text{time period}

Expressed in logarithms the regression model takes the following functional form:

$$\text{LGDP}_t = B_o + \beta_1 \text{LCRIME}_t + \beta_2 \text{LREER}_t + \beta_3 \text{LPov}_t + \beta_4 \text{LUE}_t + \beta_5 \text{LRIR}_t + \varepsilon \quad \ldots \ldots (4.2)$$

4.3 **Definition of variables and data Sources**

A number of variables were included in the regression equation which estimates the impact of crime on economic growth in South Africa. These include the following:

Gross Domestic Product (GDP) of a country is the market value of all final goods and services produced within the country in a given period of time. Quarterly time series data for GDP (current market prices) from the first quarter of 2003 to the fourth quarter of 2011 was used in the estimation and was sourced from the Department of Trade and Industry (DTI) Economic Database.

Crime statistics is the various types of crimes taking place in South Africa. Quarterly time series data on aggregated crime statistics from 2003 to 2011 was used. Data on crime was sourced from South African Police Services crime statistics reports.

Real exchange rate refers to the currency of the country, specifically South Africa, in this case the Rand. Quarterly time series data on the real effective exchange rate of South Africa from 2003 to 2011 was used. Quarterly data on the real exchange rate was sourced from the South African Reserve Bank (SARB).

Poverty refers to percentage of population living below R388.00 per month (in 2008 constant Rands). Quarterly time series data from the first quarter of 2003 to the fourth quarter of 2011 on the population living below R388.00 per month was sourced from Development Indicators (2010).

Unemployment is the number of people in South Africa who are willing and able to work, but are unable to get a job. Quarterly time series data on the unemployment of South Africa from 2003 to 2011 was used. Quarterly data on unemployment was sourced from the statsSA (2012).
Real interest rate is the interest that is charged on borrowing and/or loans adjusted for inflation as measured by the GDP deflator. The repo lending rate that is charged by the South African reserve Bank was used as it is directly charged on loans and investments. Quarterly time series data on the repo interest rate in South Africa was used. The quarterly data was sourced from the South African Reserve Bank (SARB).

4.4 Expected relationships

Table 4.1  A priori expectations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description of Variable</th>
<th>Expected, a prior</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCRIME</td>
<td>Log of Crime</td>
<td>- (negative)</td>
</tr>
<tr>
<td>LREER</td>
<td>Log of Real exchange rate</td>
<td>-/+ (negative/positive)</td>
</tr>
<tr>
<td>LPOVERTY</td>
<td>Log of poverty</td>
<td>- (negative)</td>
</tr>
<tr>
<td>LUNEMPLOYMENT</td>
<td>Log of unemployment</td>
<td>- (negative)</td>
</tr>
<tr>
<td>LRIR</td>
<td>Log of real interest rates</td>
<td>+/- (negative/positive)</td>
</tr>
</tbody>
</table>

In estimating a regression equation, all economic variables are expected to conform to economic theory. This research follows on literature reviewed in chapter 2 and estimates a relationship that conforms to economic theory. The coefficient $\beta_1$ ($CRIME$) is expected to have a negative impact on GDP.

The coefficient $\beta_2$ ($REAL\, EFFECTIVE\, EXCHANGE\, RATES$) is expected to have either a positive or a negative relationship in that when the rand appreciates imports increase to the detriment of economic growth. However when the rand depreciates, exports increase to the benefit if economic growth (Appleyard, Field & Cobb, 2005).

The coefficient $\beta_3$ ($POVERTY$) is expected to be negative in that poverty leads to low demand for outputs and therefore reduce economic growth (Todaro & Smith, 2010).

The coefficient $\beta_4$ ($UNEMPLOYMENT$) is expected to negative because of low demand with a resultant decline in economic growth (Todaro & Smith, 2010).

The coefficient $\beta_5$ ($REAL\, INTEREST\, RATE$) is expected to have either a negative or a positive sign in that when interest rates increase domestic investments decrease leading to a decline in economic growth (Mohr & Fourie, 2008) whilst on the other
hand an increase in economic growth attracts foreign portfolio investment leading to an increase in economic growth (Appleyard, Field & Cobb, 2005).

4.5 Estimation techniques

There are several techniques available for parameter estimation, ranging from classical regression methods to cointegration based techniques. The former is based on the assumption that all the variables to be included in a regression are stationary. However, most economic series are not stationary in their levels such that estimations based on this technique will be meaningless (spurious). Differencing the variables to mechanically turn them stationary has been the preferred approach to deal with this problem, but it throws away useful long run information that may be in the data. These problems gave birth to a new generation of models based on cointegration and error correction modelling. There are also several cointegration based but the majority of them suffer from numerous problems when applied to multivariate models. The technique in this category that has emerged as the most powerful and popular is the Johansen technique, which is the technique employed in this study.

The Johansen (1991, 1995) technique has become an essential tool in the estimation of models that involve time series data. This approach is preferred as it captures the underlying time series properties of the data and is a systems equation test that provides estimates of all cointegrating relationships that may exist within a vector of nonstationary variables or a mixture of stationary and nonstationary variables (Harris, 1995: 80). The Johansen technique has several advantages over other cointegration based techniques, which will be discussed in the following sections. This technique is preferred in this study as it allows us to estimate a dynamic error correction specification, which provides estimates of both the short and the long run dynamics in our growth model. A number of steps are required in estimating the Johansen technique and these include, to determine the stationarity of the variables (equation 4.1), the next is performing cointegration tests in order to identify any long run relationships in the variables, a short run vector error correction model is then estimated on condition of finding cointegration in the previous step and finally, residual diagnostics tests form the last step. Impulse response and variance
decomposition will also be performed if the variables pass the necessary diagnostics tests (Takaendesa, 2006).

4.5.1 Testing stationarity/unit root

A series is referred to as (weakly or covariance) stationary if its mean and variance are constant over time and “the value of the covariance between the two time periods depends only on the distance or lag between the two time periods, not on the time at which the covariance is calculated” (Gujarati, 2003:797). A series that is not stationary is referred to as nonstationary. In addition, a series is said to be integrated and is denoted as I (d), where d 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.

In the classical regression model, we deal with the relationship between stationary variables, but most of the economic indicators usually follow a nonstationary path. Variables that have a linear relationship (non-stationary) can lead to misleading results as they might show trends. Stationarity refers to testing and making sure that the series are integrated of the same order. Gujarati (2003: 806) shows that if the dependent variable is a function of a nonstationary process, the regression will produce spurious results (a nonsense regression). In other words, the dependent variable will follow the trend of its explanatory variables. In such a case, the results will be meaningless. In fact, it is likely that significant t-ratios and a high R2 will be obtained even though the trending variables are completely unrelated. Consequently, unit root or stationarity tests should be done on all the variables before proceeding with the tests for cointegration and estimation of parameters. There are of stationarity tests applied in econometric modelling, however this study adopts the Dickey-Fuller (DF) and Augmented Dickey Fuller (ADF) in its analysis.

4.5.1.1 Dickey-Fuller

The Dickey Fuller involves estimating one (or more) of the equations below (equations 4.2-4.4) using OLS in order to obtain the estimated value of γ and the associated standard error. It also involves comparing the t-statistics with the appropriate value reported in the DF tables which allows the researcher to determine
whether to accept or reject the null hypothesis $\gamma = 0$, which means there is unit root against the alternative hypothesis, there is not unit root $\gamma < 0$.

The DF test considers three different regression equations that can be used to test for the presents of unit root. This means three models can be estimated for each variable and these are; without a constant and a trend, with a constant and no trend and with both a trend and a constant. These equations are presented by the equations below.

The equation with no constant and no trend is represented by:

$$\Delta y_t = \delta y_{t-1} + \epsilon_t.$$……………………………………………………………………………………………………………….. (4.3)

The equation with a constant and no trend is represented

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \epsilon_t.$$................................................................ (4.4)

The equation with both a trend and a constant is given by;

$$\Delta y_t = \beta_1 + \beta_2t + \delta y_{t-1} + \epsilon_t.$$ ................................................................................... (4.5)

The difference between the three regression concerns the presence of a deterministic elements where $t$ is the trend. However Eviews 7 does not provide the third equation (4.4) for the Dickey Fuller test. The parameter of interest in all regression equations is $\gamma$, if $\gamma = 0$, the $y_t$ sequence has unit root. The methodology to get of estimation and getting critical values for t-statistics is the same regardless of which of the three forms of the equation is estimated. The error term in the Dickey Fuller test should satisfy the assumptions of normality, constant error variance and independent (uncorrelated) error terms. If the error terms are not independent in the equations above, results based on the DF test will be biased. The weakness of the DF test is that it does not take account of possible autocorrelation in the error and to cater for this the ADF test may be used. The Dickey-Fuller test, as with other unit root tests, has its own weaknesses.

Even if the test seems to give a precise answer about stationarity or nonstationarity, this is not the case. The test is weak in its ability to detect a false null hypothesis. Brooks (2002: 381) and Gujarati (2003: 819) show that unit root tests have low power if the process is stationary but with a root close to the nonstationary boundary.
This lack of power means that the Dickey-Fuller test fails to detect stationarity when the series follows a stationary process (Thomas, 1997: 410). This could occur either because the null hypothesis was correct or because there is insufficient information in the sample to enable rejection.

There are several ways of solving this problem, including increasing the sample size and using a stationarity test among others. The former solution could be limited by data unavailability, while the latter could be a good alternative without changing the sample size.

4.5.1.2 **Augmented Dickey Fuller test**

The ADF test is a stricter version of the DF test. The ADF test estimates three models for each of the variable as shown below;

The equation with no constant and no trend is represented by;

\[ \Delta y_t = \gamma y_{t-1} \sum_{i=2}^{p} \beta_i \Delta y_{t-1+i} + \epsilon_t \]  
\[ (4.6) \]

The equation with a constant and no trend is represented

\[ \Delta y_t = a_0 + \gamma y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta y_{t-1+i} + \epsilon_t \]  
\[ (4.7) \]

The equation with both a trend and a constant is given by;

\[ \Delta y_t = a_0 + a_2 + \gamma y_{t-1} \sum_{i=2}^{p} \beta_i \Delta y_{t-1+i} + \epsilon_t \]  
\[ (4.8) \]

In these models;

\[ \gamma = \gamma - (1 - \sum_{i=1}^{p} a_i) \]

and

\[ \beta = - \sum_{i=1}^{p} a_i \]

The ADF test corrects for high-order serial correlation by adding a lagged differenced term on the right-hand side in the DF equations. The null (\( \gamma = 0 \)) and alternative hypothesis for the ADF test is the same as the DF test. In both tests, if the calculated statistic is less (in absolute terms) than the MacKinnon (1991, 1996) values, which are used by the E-views 5 software, the null hypothesis is accepted and will
therefore mean that there is a unit root in the series. In other words, it means the
time series is not stationary. The opposite is true when the calculated statistic is
greater than the MacKinnon critical values. However, in this ADF equation the
coefficient of interest is $\gamma$, if $\gamma = 0$, the equation is entirely in first difference form and
so has no unit root. If the coefficients of a difference equation sum up to 1, at least
one characteristic root has unity. On the equations, if $\sum a_i = 1$, $\gamma = 0$ and the system
has a unit root.

4.5.2 Cointegration and error correction

In order to proceed to this stage, all the series of interest should be integrated of the
same order, preferably I (1). The reason for this is that if the series display level
stationarity, or are I (0), standard regression and statistical inference could be carried
out, since there would be no problem of spurious regressions. On the other hand, if
they are integrated of different orders the norm used to be to difference all the
variables to be included in regressions. The remaining cases of both I(1) or both I(2)
variables is the case of interest here, because an estimation of regressions based on
first differenced variables could result in committing a ‘sin’ of misspecification and
loss of long run information embodied in the data. However, Harris (1995: 80) shows
that it is not necessary for all the variables in the model to have the same order of
integration, especially if theory a priori suggests that such variables should be
included. Thus, a combination of I (0), I (1) and I (2) can be tested for cointegration.

Cointegration has practical economic implications. Many time series are
nonstationary individually, but move together over time, that is, there are some
influences in the series (for example, market forces), which imply that the two series
are bound by some relationship in the long-run. A cointegrating relationship may also
be seen as a long term or equilibrium phenomenon, since it is possible that
cointegrating variables may deviate from the relationship in the short run, but their
association would return in the long-run (Takendesa, 2006). This concept is
particularly important in this study where we seek to identify and distinguish those
variables that have a long term relationship with the economic growth (GDP).

There are several ways of testing for cointegration. These can be divided into two
broad categories, the residual based such as the Granger test (Engle and Granger,
1987) and those based on the maximum likelihood estimation of the VAR such as the Johansen and Juselius (1990) technique. The Engle-Granger test uses a two-step procedure. Firstly the residual error is tested for stationarity. Where variables X and Y might individually be non-stationary but if the estimate of their residual error is stationary, X and Y are said to be cointegrated. The Granger test seeks to determine whether the residual has an equilibrium relationship or are stationary. Therefore this implies that X and Y form a long run relationship and the regression is not spurious. Engle and Granger (1987) showed that any cointegrated series has an error correction representation, implying that the residual error of the estimation in the first step is stationary; the error correction model therefore can be estimated. Secondly, the error correction model is estimated, which represents the short run dynamics of the model. Thus, this two-step procedure covers both the long run equilibrium and the short-run adjustment process. The residual-based cointegration tests are inefficient and can lead to contradictory results, especially when there are more than two I (1) variables under consideration (Gujarati, 2004). The Engle-Granger cointegration test suffers from numerous problems, such as the usual finite sample problem of a lack of power in unit root and cointegration tests, inability to perform any hypothesis tests about the actual cointegrating relationships and their inability to detect more than one cointegrating relationship (Gujarati, 2004).

In light of the highlighted problems with the residual based cointegration tests, the study shall employ the maximum likelihood based test in determining cointegration. The purpose of this cointegration test is to determine whether the variables in our growth model are cointegrated or not. The Johansen methodology can be described as follows,

Assume a vector: $X_t = [LGDP, LCRIME, LREER, LPOVERTY, LUE, LRIR,]$ and assume the vector is in VAR representation of the form;

$$X_t = z + \sum_{i=1}^{p} \prod_i X_{t-1} + \epsilon_t$$

Where $z$ is a $(n \times 1)$ vector of deterministic variables, $\epsilon$ is a $(n \times 1)$ vector of white noise error terms and $\prod_i$ is a $(n \times n)$ matrix of coefficients. In order to use the Johansen test, the VAR (4.10) above needs to be turned into a VECM; specification (Brooks, 2002: 403), which may be specified as;
\[ \Delta X_t = z + \sum_{i=1}^{P} B_i \Delta X_{t-1} + \epsilon_t \] .................................(4.10)

Where \( X \) is a vector of I (1) variables defined above, \( \Delta tX \) are all I (0) variables, \( \Delta \) indicates the first difference operator, \( 1B \) is a \((n \times n)\) coefficient matrix and \( \prod \) is a \((n \times n)\) matrix whose rank determines the number of cointegrating relationships. The Johansen's cointegration test is to estimate the rank of the \( \prod \) matrix \((r)\) from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of \( \prod \). If \( \prod \) is of full rank \((r = n)\), it suggest that variables are level stationary and if it is of zero rank \((r = 0)\), no cointegration exists among the variables. On the other hand, if \( \prod \) is of reduced rank \((r < n)\), then there exists \((n \times r)\) matrices \( \alpha \) and \( \beta \) such that;

\[ \prod = \alpha \beta^\prime \] .................................(4.11)

where \( \alpha \) represents the speed of adjustment matrix, indicating the speed with which the system responds to last period's deviations from the equilibrium relationship and \( \beta \) is a matrix of long run coefficients (Brooks, 2002: 404).

However before one attempts to rank the cointegrating relationship two steps need to be followed. An optimal lag length \((k)\) needs to selected and the choice of the deterministic assumption that the Johansen test requires. The reason for the selection of the lag length is because the Johansen test can be affected by the lag length of the Vector Error Correction Model (VECM). A number of information criteria are used in the selection of the optimal lag length, these includes; the sequential modified likelihood ratio (LR), Akaike information criterion (AIC), Final prediction error (FPE) Schwarz, information criterion (SC) and the Hannan-Quinn information criterion (HQ). These information criteria usually centre around one lag length but if they are conflicting than the AIC and SC are considered the best predictors because of the prediction power.

The second issue is the choice of the deterministic assumption that the Johansen test requires in testing for cointegration. Various types of VARs can be estimated based on five deterministic trend assumptions, for example, with or without a constant and trend in cointegrating term and with or without a constant in the VAR equations. E-views 7 specifically provides the following deterministic trend assumptions: Case 1 assumes no deterministic trend in the data and no intercept or
trend in the VAR and in the cointegrating equation (CE); Case 2 assumes no deterministic trend in the data, but an intercept in the CE and no intercept in VAR; Case 3 assumes a linear deterministic trend in the data and no intercept in CE and test VAR; Case 4 allows for a linear deterministic trend in data, intercept and trend in CE and no trend in VAR; and Case 5 allows for a quadratic deterministic trend in data, intercept and trend in CE and linear trend in VAR. As a guide, E-view 7 recommends the use of Case 2 if none of the visual plots of the series and unit root tests show the presence of a trend in the series, Case 3 if the series have stochastic trends, Case 4 if some of the series are trend stationary, while Cases 1 and 5 are rarely used in practice.

Once the appropriate VAR order \((k)\) and the deterministic trend assumption have been identified, the rank of the \(\Pi\) matrix can then be tested. The Johansen and Juselius (1990) has two variants of the reduced rank test for determining the cointegration space. The two variants are maximum eigenvalue \((\lambda_{\text{max}})\) and the trace statistics \((\lambda_{\text{trace}})\) and we shall employ the superior Johansen and Juselius cointegration test. In interpreting the results if the null hypothesis of no cointegrating vector can be rejected, it indicates that there is a long run relationship among the variables in the model.

The Johansen and Juselius tests are represented by the following equations;

\[
\lambda_{\text{max}} (r, r + 1) = -T \sum_{i=r}^{n} \ln (1 - \lambda_i) \tag{4.12}
\]

\[
\lambda_{\text{trace}} (r) = -T \sum_{i=r}^{n} \ln (1 - \lambda_i) \tag{4.13}
\]

Where: \(r\) is the number of cointegrating vectors, \(\lambda_i\) is the estimated values of the characteristics root (also called eigenvalues) and the \(T\) is the number of usable observations. The larger is \(\lambda_i\), the more large and negative will be the test statistic. Therefore if the eigenvalue is non-zero, then \(\ln(1 - \lambda_i) < 0 \forall i > 1\). That is, for it to have a rank of 1, the largest for it to have a rank of 1, the largest eigenvalue must be significantly non-zero, while other eigenvalues will not be significantly different from zero.

The trace statistic sequentially tests the null hypothesis that the number of cointegrating relations is \(r\) against the alternative of \(k\) cointegrating relations, where \(k\)
is the number of endogenous variables. The maximum eigenvalue conducts separate tests on each eigenvalue and has as its null hypothesis that there are \( r \) cointegrating vectors against an alternative of \( r+1 \) (Brooks, 2002: 405). Both these tests compare the eigenvalue and trace statistic values to critical values. For both tests, if the test statistic is greater than the critical values, the null hypothesis that there are \( r \) cointegrating vectors is rejected in favour of the corresponding alternative hypothesis.

However, the trace and maximum eigenvalue statistics may yield conflicting results. To deal with this problem, Johansen and Juselius (1990) recommend the examination of the estimated cointegrating vector and basing one’s choice on the interpretability of the cointegrating relations. Alternatively, Luintel and Khan (1999: 392) show that the trace test is more robust than the maximum eigenvalue statistic in testing for cointegration. The two approaches will be considered in this study when faced with such a problem.

Once the cointegrating vectors have been identified then a VECM may be estimated. A VECM is merely a restricted VAR designed for use with nonstationary series that have been found to be cointegrated. The specified cointegrating relation in the VECM restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationships, while allowing for short run adjustment dynamics. Once estimation is complete, the residuals from the VECM must be checked for normality, heteroskedasticity and autocorrelation.

### 4.6 Diagnostic tests

Any econometric estimation technique whether OLS or VAR is not considered robust and valid unless diagnostics tests are done. Diagnostics checks test the validity and usefulness of the estimated model. Diagnostic checks test the stochastic properties of the model, such as residual autocorrelation, heteroskedasticity and normality, among others.
4.6.1 **Autocorrelation LM Test**

The Lagrange Multiplier (LM) test will be used in this study is 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 Vector Autoregressive (VAR). The test statistic for the chosen lag order \( (m) \) is computed by running an auxiliary regression of the residuals \((t\mu)\) on the original right-hand explanatory variables and the lagged residuals \((m t-\mu)\). Johansen (1995: 22) presents the formula of the LM statistic and provides detail on this test. The LM statistic tests the null hypothesis of no serial correlation against an alternative of autocorrelated residuals (Salvatore and Reagle, 2002).

4.6.2 **Heteroscedasticity test**

According to Brooks (2002, pg. 148), there are a number of formal statistical tests for heteroscedasticity. One such popular test is the White’s (1980) general test for heteroscedasticity. The test is useful because it has a number of assumptions such as that it assumes that the regression model estimated is of the standard linear. After running the regression residuals are obtained and then test regression is run by regressing each product of the residuals on the cross products of the regressors and testing the joint significance of the regression. The null hypothesis for the White test is homoskedasticity and if we fail to reject the null hypothesis then we have homoskedasticity. If we reject the null hypothesis, then we have heteroskedasticity.

4.6.3 **Residual normality test**

The residual normality test that will be used in this study is the multivariate extension of the Jarque-Bera test which compares the third and fourth moments of the residuals to those from the normal distribution. The joint test is based on the null hypothesis that residuals are normally distributed. A significant Jarque-Bera statistic, therefore, points to non-normality in the residuals. However, the absence of normality in the residuals may not render cointegration tests invalid (Gujarati, 2004).

4.7 **Impulse response and variance decomposition**

The reaction of the dependant variable (GDP) to shocks to each of the other variables is of great importance in VAR estimation. This is because it shows how
these transmitted shocks affect GDP and how long it takes GDP to recover from such shocks to the system.

4.7.1 Impulse response

Impulse response analysis traces out the responsiveness of the dependent variable in the VAR to shocks to each of the other variables. It shows the sign, magnitude and persistence of shocks to GDP (in our context). A shock to a variable in a VAR not only directly affects that variable, but is also transmitted to all other endogenous variables in the system through the dynamic structure of the VAR. For each variable from the equations separately, a unit or one-time shock is applied to the forecast error and the effects upon the VAR system over time are observed. The impulse response analysis is applied on the VECM and, provided that the system is stable, the shock should gradually die away (Brooks, 2002: 341).

4.7.2 Variance decomposition

Measure the proportion of forecast error variance in a variable that is explained by innovations (impulses) in itself and the other variables. Variance decompositions performed on the VECM may provide some information on the relative importance of shocks to the growth model. Variance decompositions give the proportion of the movements in the dependent variables that are due to their ‘own’ shocks (innovations), versus shocks to the other variables (Brooks, 2002: 342).

4.8 Concluding remarks

This chapter set an analysis framework in which the impacts of crime the economic growth in South Africa were identified. The potential impact of crime included among others, real interest rates, labour productivity, unemployment and real exchange rates. The model employed Dickey fuller test and Augmented Dickey Fuller test for unit root test. The Johansen cointegration technique has been chosen as the preferred parameter estimation technique for the GDP model, because of its several advantages over alternative technique. A number of diagnostic tests will be done including among others, autocorrelation Lagrange Multiplier test, residual normality tests, heteroscedasticity test, impulse response and variance deposition to see whether the residual passes all these diagnostic tests.
Chapter 5
Presentation and analysis of empirical findings

5.1 Introduction
The main aim of this chapter is to address some of the questions raised in the first chapter. Results from this chapter explain the impact of crime on economic growth in South Africa using quarterly data for the period 2003 to 2011. The analysis follows the analytical framework presented in chapter four. The chapter is divided into six subsections. The unit root test is presented first, followed by cointegration tests. This leads to the formulation of the vector error correction model (VECM) which shall be followed by diagnostic checks, impulsive response and variance decomposition. A conclusion for the chapter is finally given.

5.2 Unit root/stationarity test results
The opening stage of the Johansen procedure is to test for stationarity in time series. There are two main methods to test whether time series are stationary or not namely the graphical method which is informal and the formal test. This study first presents the visual plot of graphs before the formal tests. The formal tests conducted is the Augmented Dickey-Fuller. This test is very important as it gives insights into the structural breaks, trends and stationarity of the data set (Brooks, 2002). The graphical results from the test for stationarity are presented in figure 5.1(a) which shows data in levels and figure 5.1(b) for first differenced data. The Augmented Dickey-Fuller test results are shown in tables 5.1(a)

Figure 5.1(a) shows that Gross domestic product (GDP), crime, real exchange rate, real interest rate, poverty and unemployment show a trendy behaviour. All these variables except GDP show a downward trend. The series in levels is clearly non-stationary. Figure 5.1(b) shows that all the differenced variables fluctuate around the zero mean hence all the variables are integrated of order one I(1) except LGDP which is integrated of order two I(2).

Using the graphical method data that fluctuate around the zero mean indicate stationarity. It can be noted that figure 5.1(a) shows series before differencing and hence are non stationary as the mean is not zero. Figure 5.1(b) however shows
stationary series after differencing and the means are fluctuating around zero. It can therefore be concluded that figure 5.1(b) shows stationary data after differencing. This implies that the data is stationary if integrated of order one. The first order integrated series ensure that economic data is stationary for the purpose of avoiding spurious regressions. The informal method however, is not enough to conclude that data is stationary as it is informal, hence the need for a more formal method to complement it. Therefore, other formal tests are conducted to support findings from the graphical findings. In this regard, the Augmented Dickey-Fuller test is adopted and the results are presented in table 5.1.
Figure 5.1(a) Plots of variables in levels for 2003 - 2011

Source: Author’s own computation
Figure 5.1 (b) Plots of first differenced variables for 2003-2011

Source: Author’s own computation
Table 5.1: Stationarity results of the Augmented Dickey-Fuller test.

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller</th>
<th>Order of integration</th>
<th>Variable</th>
<th>intercept</th>
<th>Trend and intercept</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>LGDP</td>
<td>-1.759026</td>
<td>-1.874451</td>
<td>1.970846</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LGDP</td>
<td>-2.504301</td>
<td>-2.811381</td>
<td>-1.460281</td>
</tr>
<tr>
<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; difference</td>
<td>LGDP</td>
<td>-5.406559***</td>
<td>-5.322196***</td>
<td>-5.493266***</td>
</tr>
<tr>
<td></td>
<td>Level</td>
<td>LCRIME</td>
<td>-2.406087</td>
<td>-1.5666985</td>
<td>-1.482446</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LCRIME</td>
<td>-6.040834***</td>
<td>-6.682315***</td>
<td>-5.744563***</td>
</tr>
<tr>
<td></td>
<td>Level</td>
<td>LPOVERTY</td>
<td>-0.904207</td>
<td>-2.735345</td>
<td>-1.824324*</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LPOVERTY</td>
<td>-6.229491***</td>
<td>-0.998762</td>
<td>-0.969894</td>
</tr>
<tr>
<td></td>
<td>Level</td>
<td>LREER</td>
<td>-2.031381</td>
<td>-1.864442</td>
<td>-0.323407</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LREER</td>
<td>-4.289840***</td>
<td>-4.294818***</td>
<td>-4.353009***</td>
</tr>
<tr>
<td></td>
<td>Level</td>
<td>LRIR</td>
<td>-2.552026</td>
<td>-2.390937</td>
<td>-1.009675</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LRIR</td>
<td>-5.624290***</td>
<td>-5.574748***</td>
<td>-5.634426***</td>
</tr>
<tr>
<td></td>
<td>Level</td>
<td>LUE</td>
<td>-2.190451</td>
<td>-1.924145</td>
<td>0.844361</td>
</tr>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; difference</td>
<td>LUE</td>
<td>-11.52393***</td>
<td>-6.432433***</td>
<td>-13.84951***</td>
</tr>
<tr>
<td>1%</td>
<td>Critical values</td>
<td></td>
<td>-3.639407</td>
<td>-4.252879</td>
<td>-2.634731</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td></td>
<td>-2.951125</td>
<td>-3.548490</td>
<td>-1.951000</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td>-2.614300</td>
<td>-3.207094</td>
<td>-1.610907</td>
</tr>
</tbody>
</table>

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

Source: Author’s own computation
Table 5.1 shows the Augmented Dickey-Fuller results. The test has a null hypothesis of unit root. The calculated value of ADF is compared with the critical value. If the calculated \( \tau \) statistics is lower than the critical \( \tau \) statistics, we reject the null hypothesis that the series have unit root, thus confirming that the series are stationary. The ADF tests variables in (a) intercepts, (b) trends and intercepts and (c) no trend and no intercept. For variables in levels, the test in intercepts revealed that all variables are not stationary. For the intercept, all the data in levels are not stationary as reflected by the non-rejection of the null hypothesis at both 1% and 5% significance levels. All the differenced variables are stationary at 1% significant level hence the null hypothesis of unit root is rejected. For the test under trend and intercept and trend and no intercept data series are all non stationary in levels but became stationary at 1% significant level when first differenced. Therefore, the series are integrated of the same order I(1).

5.3 Tests for cointegration

If the variables are integrated of the same order, it is important to determine whether there exists a long-run equilibrium relationship amongst them. Cointegration describes the existence of an equilibrium or stationarity relationship among two or more times series each of which is individually nonstationary. For the purposes of this study cointegration examines the long run relationship between the gross domestic product and its determinants in this study. It is important to assess whether there exist, long run relationships between gross domestic product and the chosen determinants, in order for a viable economic conclusion to be reached from the results obtained. The cointegration approach allows researchers to integrate the long run and short run relationship between variables within a unified framework (Brooks, 2002). The Johansen cointegration approach is preferred over the Engle and Granger residual-based methodology to test for cointegration because of the obvious reasons mentioned in chapter 4.

Since all variables are non stationary in level the next procedure is to test for the existence of long-run relationship among the variables in the model. The cointegration test using Johansen test requires the estimation of a VAR equation. The variables i.e. LGDP, LCRIME, LREER, LRIR, LPOVERTY and LUE are entered as endogenous variables. According to Brooks (2002) two conditions must be met
for two or more variables to be cointegrated. First, they must be integrated of the same order. Secondly, linear combinations of the variables from the regression of the non stationary variables (in levels form) must be stationary. The Johansen’s (Johansen and Juselius 1990) maximum likelihood approach is used to test for cointegration.

Table 5.2: Pair-wise correlation results

<table>
<thead>
<tr>
<th></th>
<th>LGDP</th>
<th>LCRIME</th>
<th>LPOVERTY</th>
<th>LRER</th>
<th>LIR</th>
<th>LUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGDP</td>
<td>1.000000</td>
<td>-0.861997</td>
<td>-0.933146</td>
<td>0.475064</td>
<td>-0.181957</td>
<td>-0.695371</td>
</tr>
<tr>
<td>LCRIME</td>
<td>-0.861997</td>
<td>1.000000</td>
<td>0.761425</td>
<td>-0.420121</td>
<td>0.294217</td>
<td>0.848903</td>
</tr>
<tr>
<td>LPOVERTY</td>
<td>-0.933146</td>
<td>0.761425</td>
<td>1.000000</td>
<td>-0.336202</td>
<td>0.277733</td>
<td>0.563889</td>
</tr>
<tr>
<td>LRER</td>
<td>0.475064</td>
<td>-0.420121</td>
<td>-0.336202</td>
<td>1.000000</td>
<td>0.495346</td>
<td>-0.250272</td>
</tr>
<tr>
<td>LIR</td>
<td>-0.181957</td>
<td>0.294217</td>
<td>0.277733</td>
<td>0.495346</td>
<td>1.000000</td>
<td>0.401466</td>
</tr>
<tr>
<td>LUE</td>
<td>-0.695371</td>
<td>0.848903</td>
<td>0.563889</td>
<td>-0.250272</td>
<td>0.401466</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

From the pair-wise correlation results shown in table 5.2, it is observed that poverty is highly and is negatively correlated with GDP (-0.93), followed by crime (-0.86)and unemployment (-0.69). This negative correlation is in line with theoretical underpinnings which suggest that increase in crime leads to a decline in economic growth. Similarly increases in unemployment in South Africa leads to a decline in economic growth. Real interest rate variable is also negatively related to GDP(-0.18). Increases in interest rates discourage investment and thus reducing economic growth. It is also notable in table 5.2 that there is a strong positive correlation between poverty and crime(0.76). Further there is also a strong positive correlation between unemployment and crime (0.84). The results in table 5.2 on relationship between crime and poverty as well as unemployment and poverty are depicted in figures 5.2(a) and 5.2 (b):

Both figures 5.2(a) and 5.2(b) display a positive relationship between crime and poverty as well as between crime and unemployment. This means that as poverty and unemployment increase, it can be expected that crime will also increase.
The information criteria approach is applied in this study as a direction to choose the lag order. It is a requirement of the Johansen technique to show an indication of the
lag order and the deterministic trend assumption of the VAR. Table 5.3 confirms the lag lengths selected by different information criteria.

### Table 5.3: Lag order selection criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>282.4371</td>
<td>n/a</td>
<td>3.49e-15</td>
<td>-16.26101</td>
<td>-15.99165</td>
<td>-16.16915</td>
</tr>
<tr>
<td>1</td>
<td>470.6736</td>
<td>298.9638*</td>
<td>4.67e-19*</td>
<td>-25.21609</td>
<td>-</td>
<td>23.33059*</td>
</tr>
</tbody>
</table>

**Notes**

* 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

Table 5.3 confirms that the criteria selected 2 lag. Consequently, using the information criteria approach the Johansen cointegration test is conducted using 2 lag for the VAR.

The trace test results based on the Johansen cointegration are shown in table 5.4(a). The null hypothesis of the trace test is that the number of cointegrating equations is greater than the number of variables involved. If the test statistic is smaller than critical values of the trace tests we do not reject the null hypothesis. Table 5.4(b) presents the results of the Johansen cointegration test based on the maximum eigenvalue. The maximum eigenvalue test is conducted on a null hypothesis of the number of cointegrating equations \( r \) against the alternative hypothesis of number of cointegration equations plus one \( (r + 1) \). We do not reject the null hypothesis if the test statistic is smaller than the maximum eigenvalue test’s critical values.
Table 5.4(a): Cointegration Rank Test (Trace)

<table>
<thead>
<tr>
<th>No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Statistic</th>
<th>Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None         *</td>
<td>0.883012</td>
<td>159.3708</td>
<td>95.75366</td>
<td>0.0000</td>
</tr>
<tr>
<td>At most 1    *</td>
<td>0.548500</td>
<td>88.56341</td>
<td>69.81889</td>
<td>0.0008</td>
</tr>
<tr>
<td>At most 2    *</td>
<td>0.536968</td>
<td>62.32244</td>
<td>47.85613</td>
<td>0.0013</td>
</tr>
<tr>
<td>At most 3    *</td>
<td>0.513954</td>
<td>36.91376</td>
<td>29.79707</td>
<td>0.0064</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.324375</td>
<td>13.10587</td>
<td>15.49471</td>
<td>0.1110</td>
</tr>
<tr>
<td>At most 5</td>
<td>0.005018</td>
<td>0.166026</td>
<td>3.841466</td>
<td>0.6837</td>
</tr>
</tbody>
</table>

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author’s own computation

Table 5.4(b): Cointegration Rank Test (Maximum Eigenvalue)

<table>
<thead>
<tr>
<th>No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Stat-Eigen</th>
<th>Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None         *</td>
<td>0.883012</td>
<td>70.80743</td>
<td>40.07757</td>
<td>0.0000</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.548500</td>
<td>26.24097</td>
<td>33.87687</td>
<td>0.3062</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.536968</td>
<td>25.40868</td>
<td>27.58434</td>
<td>0.0925</td>
</tr>
<tr>
<td>At most 3    *</td>
<td>0.513954</td>
<td>23.80789</td>
<td>21.13162</td>
<td>0.0205</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.324375</td>
<td>12.93985</td>
<td>14.26460</td>
<td>0.0801</td>
</tr>
<tr>
<td>At most 5</td>
<td>0.005018</td>
<td>0.166026</td>
<td>3.841466</td>
<td>0.6837</td>
</tr>
</tbody>
</table>

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author’s own computation
Table 5.4(a) shows the results of the trace test which reflected that at least four cointegrating equation exist at 5% significance level. The null hypothesis of no cointegrating vectors is rejected since the trace (test) statistic of 159.3708, 88.56341, 62.32244 and 36.91376 respectively is greater than the 5% critical value. For that reason, the trace statistics specified 4 cointegrating relationship at 5% significance level. The maximum eigenvalue test in table 5.4(b) put forward that there is only 1 cointegrating relationship in the gross domestic product model. The maximum eigenvalue test also rejects the null hypothesis of no cointegration, since the test statistic of about 23.80789 is greater than the 5% critical value of about 21.13162. Therefore, it can be concluded that there are four significant long run relationships between the given variables (using the trace test). Since variables can either have short or long run effects, a vector error correction model (VECM) is used to disaggregate these effects.

Table 5.4(a) indicates the existence of four cointegration vector. The cointegration vector represents the deviations of the endogenous variable from its long run equilibrium level. Figure 5.3 shows that over the period 2003 to 2011 the deviations of economic growth from equilibrium were stationary and this is critical for its use as an error correction model.

**Figure 5.3: Cointegration vector**

Source: Author’s own computation
5.4 Vector error correction model (VECM)

The detection of a cointegration equation in the previous section means that a VECM can be used. This has led to a distinction between the long and short run impacts of variables so as to establish the extent of influence that crime has on economic growth. Using the results from the cointegration test the VECM shall be specified. The VECM results are presented in tables 5.5 and 5.6.

**Table 5.5: Results of the long run cointegration equation**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-15.33336</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LGDP(-1)</td>
<td>1.0000000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LCRIME(-1)</td>
<td>-0.100028</td>
<td>0.07400</td>
<td>-1.35167</td>
</tr>
<tr>
<td>LPOVERTY(-1)</td>
<td>0.767458</td>
<td>0.07400</td>
<td>-1.35167</td>
</tr>
<tr>
<td>LREER(-1)</td>
<td>0.096491</td>
<td>0.03197</td>
<td>3.01838</td>
</tr>
<tr>
<td>LRIR(-1)</td>
<td>-0.128112</td>
<td>0.02187</td>
<td>-5.85707</td>
</tr>
<tr>
<td>LUE(-3)</td>
<td>-0.101850</td>
<td>0.04514</td>
<td>-2.25654</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

Table 5.5 shows that LCRIME and LRIR and LUE have a negative long run relationship with LGDP. LREER and LPOVERTY on the other hand show a positive long run relationship with GDP. The variables LREER, LRIR and LUE are statistically significant in explaining economic growth since they have absolute t-values greater than 2. LPOVERTY AND LCRIME are statistically insignificant in a long run. The results suggest that a percentage increase in LCRIME reduces economic growth by approximately 0.10. A percentage increase in LRIR also reduces economic growth by approximately 0.12 whilst a percentage increase in LUE reduces GDP by approximately 0.10. The results further suggest that a percentage increase in the number of people (LPOVERTY) who live below the poverty line will lead to an increase in economic growth by approximately 0.76. Whilst LPOVERTY is statistically insignificant in a long run it is worth explaining its long run relationship with economic growth. This finding is against the priori expectation and also sounds nonsensical in that poverty is positively related to GDP. However this may be explained by the fact that the sample used as a proxy for poverty in this study consists of people earning at least R388.00 per month since annual data on poverty
is not available in South Africa. The earnings to the poor, albeit low, contribute towards consumption in the economy and it therefore increase economic growth. Furthermore a number of poor people in South Africa have access to low cost (RDP) housing, free electricity and water which in turn is expected to increase consumption which will ultimately contribute positively to economic growth in a long run. Evidence of a relationship between poverty and economic growth in South Africa is portrayed under the section on impulse response decomposition (see fig 5.5). Figure 5.5 portrays a negative response of GDP to poverty for at least 8 quarters (2 years) before adjusting towards equilibrium. It is not surprising therefore that the results show a long run positive relationship between poverty and economic growth. Nevertheless it is not the intention of this research report to suggest that poverty must be welcomed or ignored by the policy makers since it the results show a positive long run relationship with economic growth. These results are based on a limited time series data.

The positive relationship between LREER and economic growth is compatible with economic theory. The traditional exchange rate approach holds that devaluations or depreciations makes domestically produced goods cheaper abroad and this increases exports and hence economic growth. Evidence of vector error correction model is shown by results in table 5.6.

Table 5.6: Vector error correction model results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LGDP)</td>
<td>0.032670</td>
<td>0.05234</td>
<td>0.62425</td>
</tr>
<tr>
<td>D(LCRIME)</td>
<td>0.207924</td>
<td>0.26801</td>
<td>0.77580</td>
</tr>
<tr>
<td>D(LREER)</td>
<td>-1.002437</td>
<td>0.65226</td>
<td>-1.53687</td>
</tr>
<tr>
<td>D(LRIR)</td>
<td>2.085680</td>
<td>1.07617</td>
<td>1.93806</td>
</tr>
<tr>
<td>D(LUE)</td>
<td>-0.639766</td>
<td>0.78045</td>
<td>-0.81974</td>
</tr>
<tr>
<td>D(POVERTY)</td>
<td>-0.413684</td>
<td>0.36401</td>
<td>-1.13646</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

The vector error correction model estimates the speed at which a dependent variable Y returns to equilibrium after a change in the independent variable X. If variables have a long run relationship (cointegrated) there may still be a short-run deviation in their behaviour, thus there is disequilibrium in the system. The vector error correction
model is therefore used to correct the disequilibrium or tie down the short run relationship to its long run behaviour. If the gap between the long run rates is large relative to the long run relationship, the error correction model must be applied.

The VECM results in table 5.6 above show evidence of error correction. A comparison of the coefficients of the error correction term shows that real exchange rate $D(LREER)$ has a significant coefficient, t-value and has a correct and negative sign. The other coefficients that have a correct and negative sign are unemployment $D(LUE)$ and poverty $D(POVERTY)$, albeit that these variables are statistically insignificant. The variable $D(CRIME)$ and real interest rates $D(LRIR)$ are statistically insignificant but have positive coefficients meaning that any disequilibrium in $D(CRIME)$ and $D(LRIR)$ continues to grow. The coefficient of $D(LGDP)$ of 0.032670 shows that the speed of adjustment is approximately 3 per cent. This means that if there is a deviation from equilibrium, only 3 per cent is corrected in one year as the variable moves towards restoring equilibrium. Therefore, this means that there is no strong pressure on economic growth to restore long run equilibrium whenever there is a disturbance. This speed of adjustment is statistically insignificant with an absolute t-value of approximately 0.62425. The low speed of adjustment by economic growth may reflect the existence of some other factors affecting economic growth in South Africa not specified in the model.

The model also shows that the residuals are normally distributed and that the model was correctly specified. Figure 5.4 below shows that the estimated model tracks the actual or fitted data quite well although there is still a margin of error, the model fits the data in a fairly reasonable way. The residuals are also stationary, thus suggesting a robust model.
Diagnostic checks

The VAR model was subjected to rigorous diagnostic tests. Diagnostic checks are crucial in this analysis because if there is a problem in the residuals from the estimation of the model, it will be 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. 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 5.5 shows that all roots lie inside the unit circle which is an indication that our VAR is stable.
The model was also tested for normality, serial correlation, autoregressive conditional heteroskedasticity and stability. Diagnostic checks are performed to the GDP model in order to validate the parameter evaluation of the outcomes achieved by the model. Any problem in the residuals from the estimated model makes the model to be not efficient and the estimated parameters will be biased. For the purposes of this study, the VAR model was subjected to diagnostic checks.

The diagnostic test results are presented in Table 5.7 below and these assist in checking for serial correlation, normality and heteroskedasticity. These diagnostic checks are based on the null hypothesis that: there is no serial correlation for the LM test; there is no normality for the Jarque-Bera test, there is no heteroskedasticity for the White heteroskedasticity test and there is no misspecification in the model.

### 5.5.1 Serial correlation test

**Table 5.7 Serial correlation test**

<table>
<thead>
<tr>
<th>Test</th>
<th>Null Hypothesis</th>
<th>t-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langrange Multiplier (LM)</td>
<td>No serial correlation</td>
<td>42.26983</td>
<td>0.2184</td>
</tr>
</tbody>
</table>

Source: Author’s own computation
Results from Table 5.7 shows that the test for serial correlation produced an LM statistic of 42.26983 with a probability of 0.2184. A null hypothesis therefore cannot be rejected.

5.5.2 Heteroscedasticity test

Table 5.8 Heteroscedasticity test

<table>
<thead>
<tr>
<th>Chi-sq</th>
<th>Null Hypothesis</th>
<th>Df</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>521.3414</td>
<td>No conditional heteroskedasticity</td>
<td>546</td>
<td>0.7698</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

Results in Table 5.8 indicate heteroskedasticity tests which show a Prob. of 0.7698 meaning that the null hypothesis of no heteroskedasticity cannot be rejected.

5.5.3 Normality test

Table 5.9 Normality test

<table>
<thead>
<tr>
<th>Component</th>
<th>Null Hypothesis</th>
<th>Jarque-Bera</th>
<th>DF</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint</td>
<td>There is no normal distribution</td>
<td>352.1623</td>
<td>10</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

The Jarque-Bera is highly significant and has a probability is 0.000, meaning that the null hypothesis of no normality can be rejected.

All the diagnostic tests suggest that the residuals are homoscedastic. The results for the diagnostic checks for serial correlation and heteroskedasticity show that the data is fairly well behaved.

5.5.4 Stability test

One of the tests for a regression model specification is the Ramsey Regression Specification test (RESET) (Studenmund, 2001: 193). The Ramsey RESET test is a general test that determines the likelihood of an omitted variable or some other specification error by measuring whether the fit of a given equation can be
significantly improved. The results of the Ramsey RESET test are shown in Table 5.10:

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-statistic</td>
<td>1.207257</td>
<td>29</td>
<td>0.2371</td>
</tr>
<tr>
<td>F-statistics</td>
<td>1.457469</td>
<td>(1, 29)</td>
<td>0.2371</td>
</tr>
<tr>
<td>Likelihood ratio</td>
<td>1.765275</td>
<td>1</td>
<td>0.1840</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

Since the F statistics (1.457469) < F-statistic\textit{critical} (3.32) at p value 0.2371 > \( \alpha \) (0.05), the null hypothesis of no misspecification cannot be rejected. This shows that the model has no specification error.

5.6 Impulse response analysis

Impulse response analyses trace out the responsiveness of the dependent variables in a VAR to shocks from each of the variables (Brooks 2002). Results of the impulse response analysis are shown by figure 5.6 below.
Figure 5.6: Impulse response of GDP

These impulse response functions show the dynamic response of economic growth 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 10 quarters or 2.5 years. For the most part, the impulse response functions have the expected pattern and confirm the results from the short run relationship analysis. Shocks to all the variables are significant although they are not persistent. Shock to crime (LCRIME), real interest rates (LRIR), unemployment (LUE) and poverty...
(LPOVERTY) have an enormous dampening impact on economic growth. Figure 5.5 shows that a shock in crime has a negative impact on economic growth which persists from the second quarter to the sixth quarter and from the seventh quarter through to tenth quarter economic growth remains negative. A shock to real exchange rates has a positive impact on economic growth. This could be as a result of a weak currency which leads to an increase in exports thereby generating positive spin-offs for the economy. This growth as a result of a shock in real exchange rate persists throughout the period of ten quarters. A response of GDP to a shock in interest rates is negative throughout ten quarters. Increase in real interest rates has a negative impact on domestic investments leading to reduced incomes and output in the country. A response of GDP to unemployment is positive during a second quarter but takes a dip from the third quarter through to the tenth quarter. This suggests a negative relationship between unemployment and economic growth in South Africa. Figure 5.5 also shows that a GDP response to shocks in poverty is negative particularly from the second quarter through to the tenth quarter. The results in figure 5.5 are in line with the priori expectations and confirm that crime in South Africa has a negative impact on the economy.

5.7 Variance decomposition analysis

Variance decomposition analysis provides for a means of determining the relative importance of shocks in explaining variations in the variable of interest (Brooks, 2002). Variance decomposition provides a way of determining the relative importance of shocks to crime in explaining variations in economic growth. The results of the variance decomposition analysis are presented in table 5.10 and these show the proportion of the forecast error variance in economic growth as explained by its own shocks and shocks in crime.
Table 5.1: Variance decomposition of GDP

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LGDP</th>
<th>LCRIME</th>
<th>LREER</th>
<th>LRIR</th>
<th>LUE</th>
<th>LPOVERTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.004624</td>
<td>100.0000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>2</td>
<td>0.010124</td>
<td>90.72070</td>
<td>0.035437</td>
<td>5.540904</td>
<td>2.336348</td>
<td>1.326290</td>
<td>0.040321</td>
</tr>
<tr>
<td>3</td>
<td>0.015461</td>
<td>78.07105</td>
<td>2.588317</td>
<td>12.58881</td>
<td>5.586548</td>
<td>0.895394</td>
<td>0.269885</td>
</tr>
<tr>
<td>4</td>
<td>0.021171</td>
<td>69.25928</td>
<td>6.609032</td>
<td>15.12940</td>
<td>7.402573</td>
<td>0.554065</td>
<td>1.045649</td>
</tr>
<tr>
<td>5</td>
<td>0.027118</td>
<td>65.55010</td>
<td>10.33971</td>
<td>14.37453</td>
<td>8.058895</td>
<td>0.376373</td>
<td>1.300386</td>
</tr>
<tr>
<td>6</td>
<td>0.032680</td>
<td>62.21597</td>
<td>14.01516</td>
<td>13.21434</td>
<td>8.926332</td>
<td>0.260628</td>
<td>1.367575</td>
</tr>
<tr>
<td>7</td>
<td>0.037571</td>
<td>59.03796</td>
<td>16.76563</td>
<td>12.32664</td>
<td>10.18198</td>
<td>0.240589</td>
<td>1.447204</td>
</tr>
<tr>
<td>8</td>
<td>0.041774</td>
<td>56.86385</td>
<td>18.52554</td>
<td>11.70431</td>
<td>11.14700</td>
<td>0.251021</td>
<td>1.508281</td>
</tr>
<tr>
<td>9</td>
<td>0.045449</td>
<td>55.37887</td>
<td>19.86184</td>
<td>11.29940</td>
<td>11.63611</td>
<td>0.269924</td>
<td>1.553850</td>
</tr>
<tr>
<td>10</td>
<td>0.048736</td>
<td>54.20882</td>
<td>20.97886</td>
<td>11.00267</td>
<td>11.92185</td>
<td>0.290987</td>
<td>1.596814</td>
</tr>
</tbody>
</table>

Source: Author's own computation

Since this study focuses on the movements of economic growth following shocks to itself or crime, the study reports only the variance decomposition in economic growth and analyse the relative importance of crime in influencing its movements.

The study allows the variance decompositions for 10 quarters or 2.5 years in order to ascertain the effects when the variables are allowed to affect economic growth for a relatively longer time. In the first quarter all of the variance in economic growth is explained by its own innovations (shocks), as suggested in Brooks (2002: 342). It can be noted in table 5.11 above that throughout the ten quarters the variations in economic growth are explained mainly by itself, followed by unemployment and then crime as compared with other variables. For example in quarter 5 65% of variations in economic growth is explained by itself whilst 37% of this variations is explained by unemployment, and crime 10 % respectively. In quarter ten, 54% of variations in economic growth is explained by itself, whilst unemployment explains about 29% of this variations and 20% is explained by crime. On the whole the results in table 5.10 suggest that over and above macroeconomic variables such as real interest rates and real exchange rates, crime and unemployment are the ones that have a greater impact on the variations in economic growth in South Africa.
5.8 Granger causality

One application of distributed lag models is to test the direction of causality in economic relationships. Such a test is important when it is known that the two variables are related but it is not known which variable causes the other to move. Granger causality does not necessarily test for theoretical causality but test for Granger causality. Granger causality or precedence is a circumstance in which one time series variable consistently and predictably changes before another variable does (Granger, 1969). Granger causality is important in that it allows us to analyse which variable precedes the other one. For example in order to see if B Granger causes Y, we run the following equation:

\[ Y_t = f(Y_{t-1}, Y_{t-1}, ... Y_{t-p}, B_{t-1}, B_{t-2}, ... B_{t-p}) + \varepsilon_t \] ....................(5.1)

If a null hypothesis using the F-test can be rejected, then we have evidence that B Granger causes Y. Granger causality results are provided in table 5.12 below:

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>Obs</th>
<th>F-statistic</th>
<th>Prob</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPOVERTY does not Granger Cause LCRIME</td>
<td>34</td>
<td>0.13698</td>
<td>0.8726</td>
<td>Do not Reject</td>
</tr>
<tr>
<td>LCRIME does not Granger Cause LPOVERTY</td>
<td></td>
<td>0.57028</td>
<td>0.5716</td>
<td>Do not Reject</td>
</tr>
<tr>
<td>LUE does not Granger Cause LCRIME</td>
<td>34</td>
<td>1.19313</td>
<td>0.3177</td>
<td>Do not Reject</td>
</tr>
<tr>
<td>LCRIME does not Granger Cause LUE</td>
<td></td>
<td>0.10456</td>
<td>0.9011</td>
<td>Do not Reject</td>
</tr>
</tbody>
</table>

Source: Author’s own computation

Based on the results in table 5.12 it can be noted that the F-statistic is less than critical F-statistic and that p-value is greater than \( \alpha \) at 5% level of significance. This means that the null hypotheses cannot be rejected in all variables listed in table 5.12 above. It can thus be concluded that there is no sufficient evidence to suggest that poverty granger causes crime and that crime granger causes poverty. There is also
no sufficient evidence to suggest that unemployment granger causes crime and that crime granger causes unemployment.

5.8 Concluding remarks

This chapter is divided into six sections. The first section presented the unit root test where the Augmented Dickey-Fuller test was used to test for stationarity. The Augmented Dickey-Fuller test revealed that the data series are non-stationary in levels and stationary when first differenced. Therefore, the series are integrated of the same order I(1).

Following the unity root tests was the cointegration tests in the second section. The cointegration tests were done using the Johansen maximum likelihood approach. Also presented in this section was the pair-wise correlation matrix, the lag order selection criteria and a maximum of 2 lags was used permit adjustments in the model and accomplish well behaved residuals. The trace and maximum eigen-value cointegration tests were used to test for cointegration. The results indicate that both the Trace and Maximum Eigen value tests reject zero in favour of at least one cointegration vector. The results are significant at 5 percent level. These results prove that the variables are tied together in a single way in the long run, that is, there is one unique long run equilibrium relationship.

The third section presented the (VECM) model since variables can either have short or long run effects. All the variables had a statistically significant effect on economic growth in South Africa. The results showed that crime, real interest rates and unemployment have a negative effect on economic growth.

The last section presented the results of the diagnostic tests carried in the study. A number of residual diagnostics tests were carried out and these revealed the fitness of the model. All of the diagnostic tests support the statistical appropriateness of the equation. Diagnostic checks are performed to the GDP model in order to validate the parameter evaluation of the outcomes achieved by the model. Any problem in the residuals from the estimated model makes the model to be not efficient and the estimated parameters will be biased. Both the impulse response and variance decomposition were found to be compatible with economic theory. Granger causality test was presented and the results suggest that there is no sufficient
evidence to prove that poverty granger causes crime. There is also no sufficient evidence to prove that unemployment granger causes crime.
Chapter 6
Summary, Conclusions and Recommendations

6.1 Introduction
The aim of this chapter is to provide a highlight of the main findings. The chapter begins by providing a brief summary of the various chapters included in this research report. This is followed by providing conclusions that can be drawn from the findings of this study. The chapter concludes by providing some recommendations based on the findings.

6.2 Summary of the main findings
The aim of this research report was to assess the impact of crime of economic growth in South Africa. The report began by presenting an introduction and background to the study. Problem statement, aims and objectives of the study were outlined in chapter. In order to provide a theoretical background to the study, a literature review was presented in chapter two. Although all growth theories discussed in chapter two do in some relate to this study, endogenous growth theory was chosen as the one that underpins this study because thus theory relates a great deal to domestic absorption. In fact crime presents a cost to the economy in that firms lose profits whilst tax payers’ money is spent on running prisons.

An overview of the extent of selected types of crimes and economic growth were presented in chapter three. On the whole crime statistics in South Africa portrays a marginal decrease in the selected types of crimes reported in this research report. Nevertheless crime is still generally considered too high in South Africa and calls for a serious attention. An overview of economic growth from 1980 to 2010 shows a moderate increase over the period under review. Until the global recession hit South Africa in 2008, economic growth had been steady. In viewing the crime statistics and economic growth over the period under review shows a negative relationship meaning that crime exerts a downward pressure on economic growth.

In chapter four a research methodology used to analyse the data was presented. The statistical measure which was applied to a time series data relating to economic
growth, crime, unemployment, poverty, real exchange rates and real interest rates in South Africa was a regression analysis using a vector error correction model. The Johansen technique has several advantages over other cointegration based techniques. This technique is preferred in this study as it allows us to estimate a dynamic error correction specification, which provides estimates of both the short and the long run dynamics in our growth model.

The empirical findings were presented in chapter five. The empirical results suggest that crime and economic growth are negatively related in the long run. However there is no evidence of any short run adjustments between crime and economic growth. This finding suggests that the effects of crime may not be evident in a short run but certainly in a long run the effects of crime on economic growth are negative. However, the relationship between crime and economic growth is not statistically significant both in a long run and in a short run. Both interest rates and unemployment have a negative relationship with economic growth in a long run and are both statistically significant in a long run. Rising interest rates discourage domestic investment and this in turn leads to high unemployment levels in the country. There is a negative relationship between unemployment rate and economic growth both in a long run and in a short run. The relationship between unemployment rate and economic growth is statistically significant in a long run. Real effective exchange rates have a negative relationship with economic growth in a short run but a positive relationship in a long run. However, the relationship between economic growth and real effective exchange rate is statistically significant in a long run but not in a short run. Poverty was found to be negatively related to economic growth in a short run but positively related in a long run. This could be as a result of consumption spending amongst the poor. As consumption increases, economic growth also increases which in turn has a potential to alleviate poverty to a certain extent. Real effective exchange rates have a negative relationship with economic growth in a short run but a positive relationship in a long run.

6.3 Implications of the findings

The results of this study suggest that the null hypothesis that crime imposes a negative effect on economic growth cannot be rejected. The main finding is that crime is costly to economic growth. In particular, our estimations uncover a strong
negative impact of crime on economic growth. The estimates suggest that a percentage increase in crime will reduce economic growth by approximately 10%. This finding is robust to the inclusion of other variables capturing a potential direct impact on growth in South Africa. The evidence is thus consistent with the interpretation that crime has an adverse affect on the economy by depressing the economic growth in a long run.

The results of this study imply that the problem of crime goes beyond just simple counts of the number of offenses. Crime has a number of different impacts on both the economy and the society. In many ways these impacts surpass the size and scope of crime statistics. Economic loss, injuries, the need for medical care and lost time from work are external costs of crime. Anderson (1999) considers a wide range of societal costs, including the production of activities due to crime, e.g. correctional services, law enforcements expenditures, safety devices and security forces, lost time of production and the value of lost life. Considering all these costs it is no wonder that crime is exerts a downward pressure on economic growth in South Africa.

6.4 Validity and reliability of the results

The results of this study are consistent with the work of Mauro (1995), who shows a significant negative relationship between crime and the growth rate among 70 countries in the early 1980s; Lambsdorff (2003), who finds that crime reduces the capital productivity in a panel of countries; Forni and Paba (2000), who examine the impact of several socio-economic variables on the economic performance of the Italian provinces during the period 1971–1991; Peri (2004), who, using a larger data set (from 1951 to 1991), shows that the annual per capita income growth is negatively affected by murders after controlling for other explanatory variables; Pellegrini and Gerlagh (2004), who find that the impact of corruption on economic growth acts by reducing the ratio of investment to GDP and the country’s openness; Cardenas (2007), who focuses on the relationship between crime and growth rate in an unbalanced panel of 65 countries during the period 1971–1999.
6.5 Conclusions

Crime increase uncertainty and the cost of doing business. Therefore crime discourages entrepreneurial activities that cause growth. Scholars have theorised how crime can reduce growth. This study has provided evidence using econometric modelling to prove that crime imposes a negative effect on the economy. Although there is no sufficient evidence to prove that poverty and unemployment granger causes crime, certainly this study provided evidence that there is a strong positive correlation between crime and poverty as well as between unemployment and crime. In an analysis of a variance decomposition it was found out that crime explains most of the variations in economic growth at least from the 6th quarter (after 1 year). This means that crime has a larger impact on economic growth in a long run compared with other variables included in the model. This finding calls for the attention of policy makers to look beyond just crime statistics into its impact on economic growth in South Africa.

6.6 Recommendations

Based on the findings of this research the following policy recommendations are made:

Prevention is always better than cure. This means that crime should be prevented instead of being cured in that there are costs in correctional services. The opportunity cost of curing crime through correctional services is high. Crime prevention should utilise a wide range of ideas and abilities found throughout the society. Community planning, neighbourhood action, juvenile advocacy, security planning, education and training amongst many other systems should be considered in order to mitigate the impact of crime in the economy.

Education is important in developing a behaviour. According to Cohen(1955), Cloward and Ohlin (1960) and Merton (1968) point out that a sense of blocked attainment and feelings of failure are a source of deviant behaviour. Individuals are faced with little or no chance of success in legitimate endeavours, turn to deviant avenues for sources of success and support. This is particularly important in South
Africa in that South Africa has enormous amount unskilled and uneducated people who are unable to eke themselves out of poverty.

The government should also consider a number of poverty alleviation measures. It has been found out in this research that there is a strong and positive relationship between crime and poverty. Expanded social assistance and other grants by the Department of Social Development should be streamlined such that these grants reach the targeted population in order to improve the living conditions and standards of the poor in South Africa. Many people continue to live in shacks and informal dwellings strewn across all cities in the country, in sharp contrast to the vibrant and bustling economic hub usually seen from across the street or town. The nature of this marked difference underscores the question of the legal right not to be poor. Violent protests by communities are an indication of the extent of indignity and outrage experienced by the poor. In fact, the situation highlights the importance of going beyond policies and regarding non-poverty a right to be claimed by individuals and that demands accountability from Government, civil society and the international community at large.

The policy makers should also consider employment creation strategies. In line with the New Growth Path, there are six priority areas which are targeted in a bid to create more jobs, namely: infrastructure development, agriculture, mining and beneficiation, manufacturing, the "green" economy, and tourism. The private sector should be key in the country’s efforts to create more jobs and that business, labour and communities need to work together to beat unemployment.

In addition to the above measures for poverty alleviation and job creation, it is important for policy makers not to lose focus on macroeconomic variables, namely GDP, interest rates and exchange rates. Job creation and poverty alleviation result from a good and sound macroeconomic environment. Macroeconomic stability can be achieved through maintaining a stable interest rate and exchange rate regimes. A high interest rate environment destroys domestic investment and job creation. Similarly a very weak currency as well as a very strong currency can impact negatively in the economy. A stable macroeconomic environment will lead to job creation and poverty reduction and ultimately eradication of crime. It is therefore
important to maintain a healthy equilibrium in the economy to ensure economic stability. A stable economy will go a long way in addressing issues of poverty and unemployment in order to mitigate criminal activities in the society.

6.7 Limitations of the study

Despite the fact that crime statistics before 2003 could not be found, the police crime statistics could also have been inaccurate due to under-reporting and/or under-recording. Also, the period 2003 to 2011 is a short period. Nevertheless using a quarterly data provided sufficient data points for observations. Crime statistics used in this report were aggregated and therefore could not differentiate between serious violent crimes and minor crimes.

6.8 Recommendations for future research

It is recommended that an economic impact assessment of crime on economic growth be conducted using a data of at least more than 20 years. It is also recommended that future research should test the various types of crimes and their impacts on economic growth in South Africa.
List of References


## APPENDIX A: Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Crime</th>
<th>Ue</th>
<th>GDP</th>
<th>Poverty</th>
<th>RIR</th>
<th>REER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003Q1</td>
<td>646296</td>
<td>9.3</td>
<td>1 416 210</td>
<td>12</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>2003Q2</td>
<td>646296</td>
<td>9.3</td>
<td>1 423 126</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>2003Q3</td>
<td>646296</td>
<td>9.3</td>
<td>1 430 849</td>
<td>12</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>2003Q4</td>
<td>646296</td>
<td>9.3</td>
<td>1 439 103</td>
<td>12</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>2004Q1</td>
<td>604002</td>
<td>6.6</td>
<td>1 460 889</td>
<td>12</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>2004Q2</td>
<td>604002</td>
<td>6.6</td>
<td>1 481 304</td>
<td>12</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>2004Q3</td>
<td>604002</td>
<td>6.6</td>
<td>1 505 525</td>
<td>12</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>2004Q4</td>
<td>604002</td>
<td>6.6</td>
<td>1 521 602</td>
<td>12</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2005Q1</td>
<td>550238</td>
<td>6.7</td>
<td>1 537 071</td>
<td>11</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2005Q2</td>
<td>550238</td>
<td>6.7</td>
<td>1 564 655</td>
<td>11</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>2005Q3</td>
<td>550238</td>
<td>6.7</td>
<td>1 585 991</td>
<td>11</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>2005Q4</td>
<td>550238</td>
<td>6.7</td>
<td>1 596 611</td>
<td>11</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>2006Q1</td>
<td>540745</td>
<td>6.4</td>
<td>1 620 881</td>
<td>11</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>2006Q2</td>
<td>540745</td>
<td>6.4</td>
<td>1 647 548</td>
<td>11</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>2006Q3</td>
<td>540745</td>
<td>6.4</td>
<td>1 671 028</td>
<td>11</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>2006Q4</td>
<td>540745</td>
<td>6.4</td>
<td>1 697 027</td>
<td>11</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>2007Q1</td>
<td>524336</td>
<td>6.4</td>
<td>1 723 976</td>
<td>10</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>2007Q2</td>
<td>524336</td>
<td>6.4</td>
<td>1 737 298</td>
<td>10</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>2007Q3</td>
<td>524336</td>
<td>6.4</td>
<td>1 758 806</td>
<td>10</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>2007Q4</td>
<td>524336</td>
<td>6.4</td>
<td>1 784 580</td>
<td>10</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>2008Q1</td>
<td>536610</td>
<td>6.4</td>
<td>1 797 349</td>
<td>10</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>2008Q2</td>
<td>536610</td>
<td>6.4</td>
<td>1 817 440</td>
<td>10</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>2008Q3</td>
<td>536610</td>
<td>6.4</td>
<td>1 825 568</td>
<td>10</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>2008Q4</td>
<td>536610</td>
<td>6.4</td>
<td>1 817 771</td>
<td>10</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>2009Q1</td>
<td>542743</td>
<td>6.4</td>
<td>1 788 410</td>
<td>9</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>2009Q2</td>
<td>542743</td>
<td>6.4</td>
<td>1 775 683</td>
<td>9</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>2009Q3</td>
<td>542743</td>
<td>6.4</td>
<td>1 783 569</td>
<td>9</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>2009Q4</td>
<td>542743</td>
<td>6.4</td>
<td>1 798 886</td>
<td>9</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>2010Q1</td>
<td>528750</td>
<td>6.4</td>
<td>1 816 688</td>
<td>9</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>2010Q2</td>
<td>528750</td>
<td>6.4</td>
<td>1 829 347</td>
<td>9</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>2010Q3</td>
<td>528750</td>
<td>6.4</td>
<td>1 843 316</td>
<td>9</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>2010Q4</td>
<td>528750</td>
<td>6.4</td>
<td>1 863 701</td>
<td>9</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>2011Q1</td>
<td>537750</td>
<td>6.4</td>
<td>1 884 700</td>
<td>9</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>2011Q2</td>
<td>537750</td>
<td>6.4</td>
<td>1 890 573</td>
<td>9</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>2011Q3</td>
<td>537750</td>
<td>6.4</td>
<td>1 897 382</td>
<td>9</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2011Q4</td>
<td>537750</td>
<td>6.4</td>
<td>1 911 890</td>
<td>9</td>
<td>11</td>
<td>19</td>
</tr>
</tbody>
</table>