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ECONOMIC DETERMINANTS OF CRIME TRENDS IN KENYA

BY

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DECLARATION

This paper is my original work and has not been submitted for academic award in any university or academic institution.

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ii

DEDICATION

To Nicole Monyenche who is my constant reminder of what I went through while writing this paper. To my late Grand mum Agnes who always wanted the best of me, but believed if you shared knowledge you lost your share. To my late Mum grace, who lost the chance of witnessing the best of her Children. To those who work tirelessly to reduce crime.

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However, I take sole responsibility for the errors, omissions and views in this paper.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

ACRONYMS/ABBREVIATIONS

GDP	Per Capita income
ADF	Augmented Dickey-Fuller
ECT	Error Correction Term
VECM	Vector Error Correction Model
OLS	Ordinary Least Squares
CVN	Annual Total Convictions
CRM	Annual Total Reported Crime
PSLO	Public expenditure safety, law and order
LN-CVN	Natural Log of annual convictions
LN_GDP	Natural log of gross per capita income
LN_CRM	Natural Log of annual crime
LN_CPI	Natural log of consumer price index
LN_PSLO	Natural Log of annual Public expenditure on safety, law and order
LCU	Local Currency Units
GSP	Gross State Product

DEFINITIONS OF TERMS

Crime against Persons these Crimes include- murders, manslaughter, rape, assault etc.

Crime against Property These crimes include -Robbery, breakings, Arson and theft related offences.

Consumer Price Index (CPI) is an index, which measures the prices of a fixed market basked of consumer goods bought by a typical consumer.

Inflation is rate is the percentage change in the CPI from one period to the next.

ABSTRACT

The paper was intended to establish the major economic causes of crime upsurge in Kenya by using the Johansen Cointegration and VEC model, using annual data from 1975-2012 of gross per capita income, public expenditure on law, order, and safety, consumer price index, and Conviction. The time series stationary properties of the data were examined through the use of augmented dickey-Fuller (ADF) test.We established the existence of negative significant long run Relationship between crime and GDP per capita. Convictions also had negative and significant relationship with crime. Public expenditure on safety, law and order (PSLO) had positive relationship with crime. Short run Granger causality was established running from Public expenditure on safety, law and order (PSLO) to crime in Kenya.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

Crime is defined as the breach of rules and laws for which some governing body can prescribe punishment. Persistence and existence of illegal or proscribed activity throughout history and some of its apparent regularity has long attracted the attention of economist. For instance, Adam smith (1776) wealth of Nations observed that accumulation of the property motivated crime and demand for protection from it. However, the tempo of economists towards the study of crime has not been as vigorous as when compared to the sociologists. In recent times, the problem of crime has attracted attention of many governments worldwide, especially those from developed countries, but the problem still thrives.

The World Bank says that Crime is an obstacles to Economic growth and poverty reduction in a country because of their negative impacts on physical, human and social capital effects in Government capacity building-These negative effects of crime leads to the reduction in Economic growth and increase in poverty.

As a result, Crime in Kenya and Africa in recent time has become a major concern in economic growth hence attracting economic investigations to its causes, effects and determinants. It is also worthy to note that, Crime in most developing countries has been rising at an alarming rate despite the enormous resources allocated to curb it. This upsurge in crime calls for an in-depth and systematic study on its determinants.

Crime in Kenya has been increasing and the government has taken various strategies meant to reduce it, but these trends remain the same. Missing from those strategies perhaps is systematic inquiry to the economic determinants of crime, confirmed with limited literature available on the same to help in policy formulation.

The literature on economics determinants of crime is rich in western and eastern countries but only few studies on crime have so far been done in Africa. There are several empirical studies carried in western and eastern countries .These include countries like USA, (Ehrlich, 1975, Freeman, 1973, 1975, 1996, Glaser, 1999, Groggier, 1995, 1998); In UK, we have (Wolfing, 1978, Machin and Meghir, 2000); In Germany, we had (Spenger, 2000); From Italy we have (Buonamo and Leonida, 2005). In Africa, we have only a few (Douglaston Omotor, 2000;Luiz,2001).

The Genesis of economic determinants of crime is traced from an ambitious contribution by Becker on his paper 'Crime and punishment', (1968) and later Ehrlich (1973) on his paper 'participation in illegitimate activities: A theoretical and empirical investigation'. The two papers changed radically the way in which economics explained criminal behaviour. Becker built an economic model of crime where he argued that individuals would commit a crime, when their expected utility of crime is higher than the expected utility from a given legal activity. He assumed agents as function maximizers ,derived from consumer maximizing utility function ;and derived an economic approach to the study of crime:-criminals behave rationally and they act rationally in choosing whether to commit crime or not.

Ehrlich (1973), in attempt to make better Becker's model developed a time allocation model where he argued that when income opportunities for legal activities is low, time allocation model will predict high crime. The salvo that Becker and Ehrlich fired moved us from believe that social and psychological factors parse do explain criminal choice. It is also an economic factor based on a rational decision made on basis of maximization framework in which its argued that, agents compare cost and benefits of illegal activities taking into account the probability of apprehension and prosecution and expected returns for community and crime.

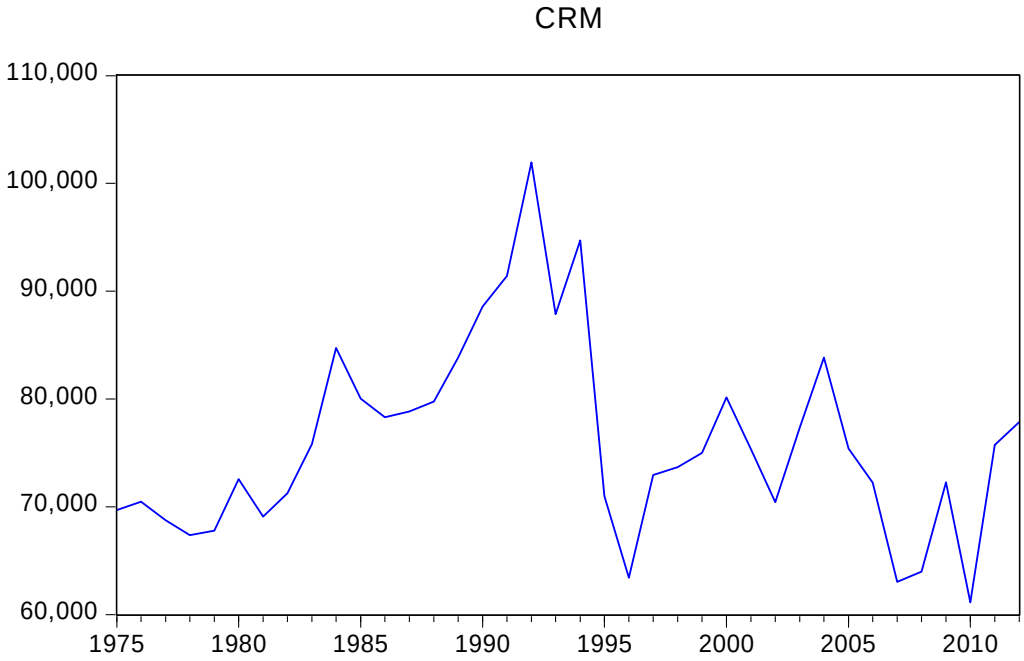
As a result, Becker and Ehrlich's papers opened a new empirical study research field in which economists were interested to investigate the social and economic demographic variables that affect crime trends. This led to the realization that crime was an activity that cut across several fields, hence its study should be both lateral and vertical or studied wholly by all fields; economics, sociology, psychology, law or geography.

Crime and it's determinants is closely related to poverty, social exclusion, income inequality, unemployment, education, age, gender, race, religion, economic growth and other economic factors that influence behavior of individual in making decision (Buonamo and Montolio, 2008, Omotor (2009) Criminal activities are an open drama that their cause is not one theme but rather a river of many factors.

In particular, Kenya as a country and in relation to many developing countries in Africa has seen a tremendous crime growth. Crime grew from 84022 reported cases in 1987 to 101966 reported cases in 1992, which was an increase of 17944 (21.35%). We had drastic reduction of total crime

reported in between years 1992 and 1996 of 63425 cases, which was 37.8% reduction. The following year 1997 there was a steady rise of total crime from 72961 cases to 80143 cases in year 2000, which was 9.85% increase. In the year 2000 and 2002, we had a reduction of total crime from 80143 cases to 70423 cases, which was about 12.13% reduction. There was an increase in crime from 70423 cases in 2002 to 83841 cases in 2004. Thereafter, crime continued to decrease steadily up to 2008 where we had 63976 cases. In 2009, we had 72225 cases before it fell again to 61120 cases in 2010.

Figure1. **Kenya crime trends (1975-2012)**



Kenya categorizes Crime reported to police as crime against poverty and crime against persons. Crime against person includes - murder, manslaughter, rape, etc .While those against property include: - Robbery, breakings, theft related offences, receiving stolen property and all other offences against penal code. Crime trends in Kenya are worrisome and perhaps unpredictable with crimes against property being the most reported one over time. Each day, new crime is reported even though the government continues to invest heavily on security agencies to promote

its prevention. Government expenditure on safety law and order has over years been increasing but the effect it is supposed to bring into crime prevention is not felt.

1.2 The problem statement.

Millions of Kenyans continue to lay blame on the Government due to the recent upsurge of crime in the country that has resulted to loss of life and property, albeit taxpayers continue to shoulder the heavy burden of taxation to meet the ever rising budgetary allocation to security organs of the state. There is a marked metamorphosis of crime in Kenya, despite the myriad strategies adopted by the security organs to manage the multifaceted illegal activities in the country. Over the past decade Kenya continues to develop economically, so do the illicit activities. Crime impacts have risen to scale and unprecedented levels. Criminal groups have acquired new technologies, appropriated complex network structures that have hindered the Government's effort to tame it.

The causes and determinants of crime have been highlighted in various media articles and journals, but limited information has been provided on its economic determinants. The spiraling crime in Kenya has generated stern warnings to criminals from the executive branch of the government and top security organs (Minister for interior & coordination of national government and inspector General of police) respectively, but still the problems thrives.

This study therefore, attempts to identify and examine some of the economic factors contributing to crime surge. Such information when documented will inform security and policy decision makers when developing strategies to fight crime other than over reliance on guesswork. The paper will also attempt to augment the empirical literature on crime existing in the country.

1.3 Research questions

The study endeavors to answer the following questions:

1. What is the crime trend in Kenya?
2. Do economic variables explain crime trends in Kenya?
3. What is the policy recommendation on crime in Kenya?

1.4 Objectives.

The main objective of this research is to study the economic determinants on crime in Kenya and come up with policy recommendations.

1.5 Specific Objective.

1. To investigate the crime trends in Kenya.
2. To investigate the economic variables that explains the crime trends in Kenya.
3. To come up with economic policy recommendations on the crime trend in Kenya.

1.6 Justification of the research.

Crime threatens human security and rights, undermines economic, political and social development of various countries worldwide. Despite vast budgetary allocations by the government to fight crime, little has been achieved so far and this has impacted the countries development agenda negatively. According to official crime data provided, there has been a drastic rise in crime in the last three decades in most developing countries, Kenya included. Indeed, Crime has recently become a major concern among security specialist and politicians, giving crucial attention to prisoners' way of living, reforming the prisons, improving rehabilitations and correction of legislative system (Lambropoulou, 2005).This aside, most

studies in developed countries show that socio-economic factors contributes immensely to crime increase. These factors range from poverty, social exclusion, education level, income inequality and family background (Buonnamo, 2003).

Indeed, Kenya has seen a tremendous growth in social, economic and political field, but unless there are clear policy guidelines to deal with issues of crime, the vision 2030 policy strategy may not be realized. Crime is a pertinent issue in Kenya and has persisted on the economic growth path- It is a real obstacle to the economy and is versatile activity, which needs a deeper study.

The heterogeneous report from the police and other law enforcement agencies leaves doubt on why such trends thrive. It is therefore, crucial to study crime, its economic determinants, not only for academic purpose but also for designing and diligently prescribing effective policies for economic growth and development. In Kenya, few studies have been done to link economics with crime and where such studies exist, they are mostly written by sociologist. This study endeavours to bring into attention some important economic factors that explain crime so that they may serve the existence of asymmetric information on economic determinants of crime.

1.7 Limitation of the Study

In the model we have only used small number of explanatory variable such as total conviction as a proxy of deterrence factor as given by Enrich1973, We have used Gross per capita is used as a proxy of well-being of individuals but this might not give the better explanation on the individuals welfare. Public expenditure on safety law and order is used as a proxy to indicate the total expenditure on the entire police and prisons and it could be more viable if the direct expenditure on prevention of crime could have been used(such as expenditure to recruit police

officers).Important economic variables such as unemployment, number of policemen, literacy level, and poverty level is left out due to lack of data.

1.8 Scope of the Study

The study covers crime trends over the period 1975-2012. Total crimes are those which violate the penal code. Economic determinants will include GDP per capita, Inflation(CPI), expenditure on safety, law ,and order(PSLO) and number of convicted persons as proxy of deterrence factor (independent variable).The time series data set comprises of annual observation of total crime trend in Kenya (Dependent Variable) as given by Kenya Bureau of Statistics and police annual reports. Those crimes include; Crime against person (Infanticides, murder, Assault and Rape) and Crimes against property (Robbery, Theft, Breaking etc).

1.9 Organization of report

Chapter one has the introduction, and organized as follows: background of the study, problem statement, research questions, objectives and justification of the study. Chapter two has a review of literature (theoretical and empirical). Chapter three methodology which describes (Potential determinants of crime and data) and Empirical procedure. Chapter four will represent the estimated results (findings).Chapter five concludes with policy recommendation and conclusion.

CHAPTER TWO

2.0 Literature Review

In this chapter, we analyze literature from a theoretical and empirical perspective with an aim to identify researchable gaps. Theoretical literature is given by (Becker, 1968, Ehrlich, 1973) and other Crime theories. The empirical review based on empirical research on its economic determinant of crime.

2.1 Theoretical Review of Literature

2.1.1 Rational Theory

Our economic model is anchored on Becker's (1968), Ehrlich, (1973) hypothesis. In his seminar, paper (1968) "Crime and punishment, Becker sets out to study economic variables that determine criminal choices and agents behavior, This assumptions was based on the premise that the agents act rationally, when an individual decides to commit crime the expected utility from the crime exceeds the expected utility from legal activities. Therefore, an individual will commit crime basing on the cost benefit analysis. If a person decides to commits crime, he/she be rationally guided, this guiding aspect often referred to as rational behavior approach is what define the study of crime. Becker argues that the economic variables, the factor will propel an individual towards commission of crime.

Ehrlich, (1973) in his paper 'participation in illegitimate activities: A theoretical and empirical investigation' Extends empirically Becker's analysis by considering how income levels and distribution affects the propensity of crime and rate of crime. Ehrlich extended the model by

measurement of deterrence factor (punishment) to the analysis of economics and socio-demographic factors of crime to estimation of an offence function by expanding the determinant of crime and incorporating time factor.

Witte, (1980, 1992) utilized a model in which time allocation between legal and illegal activities was incorporated in utility function in direct way. Witte, Block and Heinecke did this by allowing time spent in legal and illegal activities to enter utility function. Schmidt and Witte did this by expanding the number of outcomes, hence leading to unique results when such function were subjected to decreasing absolute aversion, it predicted that unemployment lowers crime and there was a positive relationship between crime and unemployment. In a way, unemployment decreases income and individual willing to engage in criminal activities.

2.1.2 Strain Theory

Even though there has been an increase in national wealth worldwide, the distribution of this Wealth is far from equitable. One manifestation of economic inequality is income inequality. The theory postulates that, areas of high inequality place poor individual with low returns from market activities next to high-income individuals who have goods and high returns, thereby increasing the chances of the income earners to allocate more time to criminal activities. This theory argues that this individuals when faced with apparent success of others around them, the unsuccessful individual gets more frustrated due differences in income between them. The greater the inequality of those individuals, the greater is the strain and therefore, the greater the push of those low-status individuals to commit crime.

This theory therefore supports the role the income inequality plays in determining the crime trends. There have also been some studies examining the correlation between violent crime and inequality.

Supporting the theory, Pablo Fajnzylber, Daniel Lederman and Norman Loayza, (2001) investigated the 'robustness and causality of the link between income inequality and violent crime across countries.' Part of their study involved examining the relationship between the Gini index (a measure of income inequality) and the rate of homicide and robberies both within and between countries. The most significant and strong determinants of homicides and robberies were the growth rate of GDP and the Gini index. They concluded that income inequality is significantly and positively related to the incidence of crime within and between countries in other words the higher the level of income inequality the higher the rate of these crimes. Their study further showed that the direction of causality flows from inequality to the rate of crime even after the other factors were controlled.

2.1.3 Conflict and Marxist Theories of Crime

The conflict theory of crime states that the motivators of crime are the "social and economic forces" functioning in society. These theorists claim that societies are made up of classes of people with different concerns and values and the government takes care of the class with the greatest influence (money and power); hence, conflict erupts between the government, trying to control the low class, when they are trying to assert themselves into a position of greater power as the other class (powerful). Marxist criminology has considered a particular type of the conflict theory where the conflict is as a result of power generated by capitalism. If the government does not ensure that those who are not financially capable benefit from necessary resources for which taxes are paid then, the feeling of being marginalized is inevitable and eventually crime will

erupt. The only way to ensure this is avoided is by proper allocation of resources and ensuring that national income is equitably distributed and also ensure justice system is fair in all classes of people(powerful and powerless).

2.2 Empirical Literature

There are several studies that have been carried out to find crime and economics nexus. These studies confirm the inseparable link between crime and economic determinants. Freeman, (1983, 1995, 1996), Groggier, (1997) and Chiricos, (1997) stressed on the fact that poor legitimate labor market opportunities are potential criminal activities.

2.2.1 Crime and Conviction as a proxy of deterrence factor

Ehrlich (1973), Levitt, (1997), Camero, (1998), stressed on the deterrent effects of apprehension and penalization, hence causing crime dynamics.

Groggier, (1995) Also says that convicted criminals have fewer opportunities of legal employment and lower expected wage.

Witte. D and R.witte (2000) using the panel data from California adult criminal justice statistical system, found out that arrest or deterrence or employment and earnings are moderate and not long lived on crime.

Erling (1999) found out that individuals may choose to engage in legal or illegal activities (crime) where others may literally mix the two. The margin increase in the probability of the sanction will eventually affect the optimality of the mix; such increase of probability of sanction may be insufficient to have an effect on persons who have specialized in one of the two activities.

Witte (1980, 1984) and Schmindt, (1980) on employing individual data on post release activities of research sample of 641 men released from prison North Carolina. The effect on crime measures on both probability and severity of punishment was more or less negative on total crime committed.

Myers (1983) using a sample of 2127 ex-prison convicts in the US federal prison found a statistically significant effect on crime. Klepper and Nagin (1989) studies on cheating, found out that the probability of conviction and severity of punishment have a negative effect on crime.

Dritsakis and Gkanas (2000) analyzed the effects of socio-economic determinants on crime in Greece using cointegrating methodologies of Johansen (1988) and error correction models found out that indeed there was convergence of short run to long run equilibrium state dynamics. The variables they used included; Total number of offences, convicted persons and socio-economic variables.

Glaeser and Sacendote (1999) found out that there is more crime in big cities compared to smaller cities and rural areas. Where the population density is high, the probability of having more crime is high-In other words returns from crime may be higher and probability of arrest may be lower in places of high population density (urban areas).

Freeman (1999), in his essay 'Economics of crime' shows empirically that the roles of incentives in criminal decision making in legitimate labour market experiences, sanctions as deterrence factor, influence decision to engage in crime.

Meera and Jayakumar (1995) employ the simultaneous equation approach to estimate the crime function for Malaysia. They found that crimes in Malaysia are influenced by three categories of determinants; namely (1) deterrence and punishment; (2) economic or incentive of crime; and (3) socio-demographic. Consistent with the notions of criminal motivational effect, they find that the effect of unemployment on crime rates in Malaysia is positive and statistically significant

2.2.2 Crime and the gross per capita Income and consumer price index

Arthur (1991) points out that there is positive correlation between crime rates and social-economic factors, such as per –capita (GDP), inequality and unemployment. More crime occurs when individuals are denied legal opportunities such as gainful employment. However, Defonso (1997) found out a direct relationship between legal welfare of recipient and crime.

Douglason (2009) using a pooled data set of Nigerian states found out that lagged crime, per capita income and population density are significant and positively correlated to all form of crime.

Paulo and M. (2005) in their paper, 'identifying the social economic determinants of crime in Spanish provinces' says that past experience in criminal activities affects in several ways decision to commit crime.

Faynzylbe et al, (2002) concluded that higher crime today is associated by higher crime tomorrow. Criminals learn how to commit crimes and finally perfect the game.

Levitt (1995, 1996, 1997) using pooled time series data found a positive relationship between unemployment and property crimes.

According to Sayed and Abid (2009).In their paper ‘unemployment, poverty, inflation and crime nexus co-integration and casualty analysis in Pakistan’found out that unemployment, poverty and price stability (inflation) causes crime. They concluded that when unemployment increases the opportunities for earning income decrease. This in return instigates individual to commit crime.

Cook and Zakin,(1985) suggested factors that connect business cycle and crime to include:- Response of criminal justice system, legitimate employment opportunities, criminal opportunities and consumption of criminogenic commodities. The criminal opportunities may rise during recession when the GDP is low and criminal justice system directly linked to the number of convictions as a deterrence factor.

Flinn (1986), Nagin and Waldfogen (1995) also described a casual dynamic economic model of crime which explained the various determinants (economic demographic of crime).
Block and Henkel,(1975) have shown that the changes in legal and illegal remuneration lead to changes in illegal activities that are composed of stochastic counterparts of the substitution and income effect of traditional supply and demand theory. There is a remote similarity assuming illegal activity to be inferior goods.

Chiricos (1987) demonstrated in his survey that unemployment in most studies increase crime. He reviewed 63 aggregate studies published in major journals of economics, sociology and criminology, containing 288 estimates of the relationship between unemployment and crime.
Thornberry and Christenson (1984) used individual level data from the 1945 Philadelphia cohort and found out that the unemployment had significant effect on crime. They focused on

unemployment and crime using deterrence factor, employment status and other social characteristics.

On the same ground Farrigton et al (1986), using data from CSDD showed that property crime rates were higher when offender was unemployed. Witte and Tauchan (1994), while using richer set of control, and utilizing panel data found the same result.

Paolo, and D.M (2005) employing general method of moments system estimation on panel data set of Spanish province for a period 1993-1999, found out that property crime are better explained by socio-economic variables e.g. (GDP growth rate, public expenditure on safety, law and order as a proxy of increased deterrence factor and population density) .

Fernado, and Nicole (2010) in their study 'economic and social demographic determinants of crime in Uruguay' analyzed 19 Uruguay departments in period1986-2006 using panel data model; Estimation included the department fixed effects capturing observable heterogeneity. Using Generalized Methods of Moments found out that population density have positive effect on crime while economic factors have no significant effect on it.

Pricing stability or inflation as a monetary policy indicator leads to the existence of unidirectional causality from crime. Uncontrolled increase in prices resulting in decrease in real income reducing purchasing power of individual who belong to low income group .Such a scenario leaves them with an alternative means of engaging in illegitimate activities to boost their well-being - These activities led to crime.

Dutti and Hussain (2009) in their paper ‘determinants of crime rate: Crime deterrence in post liberalized India’ found out that the theory of criminal behavior originated in developed countries was actually not so much applicable in the developing countries like India. They argued that economic nature of such countries and deterrence factors in developed countries get blocked or undermined in the developing countries, hence leading to casual relationship that differ from the empirical findings from developed countries. The casual relationship that they found out did not match the criminal theory, because of distortion in the judicial system of India. However, in their results Economic growth was an important determinant of crime rates.

Loe (2004),investigated the relationship between labour market conditions and various crime series of Japan , Australia and South-Korea (Asia pacific countries), using Granger causality and Johasen maximum like-hood co-integration on the time series data, in their endeavour to find whether there was a long-run equilibrium to causal relationship between crime and unemployment-They found out that such an equilibrium was strong .

Gumus (2004) used a large city data to examine empirically the determinants of crime in urban areas and he used OLS regression method. The investigation found out that per capita income and inequality and presence of black immigrants had very strong effects on explanation on crime trends.

Coomer (2003) examined the macro economic factors that influence crime on applying the OLS regression technique; they found out that inflation, unemployment, and poverty had strong influence on crime.

Ehrlich (1973) and Gleaser (1963, 1966), also considered the GDP as proxy for the level of economic prosperity, Bennett, (1991) says that the GDP growth is an important determinant of opportunities hence reduction in the chances of the engaging in crime.

Papps and Winkelmann (2000); Rapheal and Ebmer,(2001)and Edmark (2005); found out results that supported Freeman (1983), Chiricos (1987) and Wittes (1992) whereby unemployment was positively related to crime in what is referred to as 'Motivation effect', where an increase in unemployment rates leads to economic problems like reduction of household final consumption expenditure which in turn increases criminality.

Cantor and Land (1985);Britt (1994); Melick (2004) found out a negative relationship between crime and unemployment in what was referred as 'motivation effect' indicating that during the economic depression an increase in unemployment rates leads to decrease in average family income, hence discouraging a person from crime decision..

On the GDP growth and crime nexus, there exist again no consensus. Several studies show that decrease in income can cause crime through 'motivation effect'. (Groggier, 1998; Machin and Meguir 2000; Gould et al), On the other hand "opportunity effect" caused an increase in income (Levitt, 1999).

Heinecke (1978) came up with some-what different economic model in his linking it to crime. He argued that individual income is assumed equal to the sum of three elements: exogenous income, monetary, monetarized benefits and cost of legal activities (monetarization). Implicitly takes place if an individual, having to choose between actions involving nonmonetary gain and

losses act rationally according to a certain axiom. The increase in probability of conviction leads to income decrease by a factor that represents the monetary and monetarised cost of crime.

In the study carried out by Witte and Myer (1980) they found out that increase in income (income per capita), means an individual will have high legal income, which translate high income forgone when incarcerated or convicted that will have a negative effect on crime. The main problem to this study is that, the income of legal, illegal activities is highly correlated, and that is difficult to find.

2.2.3 Crime and public expenditure on safety, law and order

Some studies use public expenditure on safety, law and order as proxy of possible deterrence factor. Many of these studies show that there is a negligible and sometimes positive effects on crime (Erling 1999; Buck et al 1983) found out that such expenditure on police have a significant effect on crime.

Michael, Greenwood and Walter (1973) 'Crime rates and public expenditure for police protection' found a positive and highly significant between crime and society's authorized expenditure for protection bears a close relationship to the amount that the society is willing to pay losses due to crime.

Reza and Thomas (2000) Ran a correlation between six different independent variables such as GDP, median income, education expenditure, poverty rate, drug seizure and unemployment rates versus property crime rates. The study found out that those variables accounted for 74% of the variation in the property crime rate. The study covered between 1980-1987 .The GDP accounted

for about 28%.They found out that public expenditure on education had a negative and significant relationship with crime.

Ces, Kees and Kees, M (1999) on their analysis of crime in the Netherlands using time series analysis techniques to estimate recorded crime and demographic and economic and policy policies, found out that higher growth in consumption of households(household consumption expenditure) leads to higher crime in the motivation effect. They found out a positive and significant relationship between crime and household expenditure. They also found out that convicted persons had a negative effect on crime.

2.3 Overview of the literature

The main economic model in the studies of crime are the one given by Becker, (1968) 'crime and punishment' mostly determined by premise that individual commits crime based on the cost benefit analysis whereby they asses the expected utility from engaging in illegal activities versus expected utility from engaging in legal activities.

Ehrlich, (1973), extended Becker's model, by considering how income levels and distribution affect the propensity of crime.

Several writers ranging from Freeman (1999,1995,1983,1996 a&b) , Levitt (1998, 1996,1995), Grogger (1995), Nagin (1998),Myers (1983), Chiricos (1987) and Eide (1995) all have extended the same model basing on the same original model in-order to determine the economic determinants of crime.

Most of these writers are from countries outside Africa; In fact, most are from developed countries. Kenya has done little so far to explain the crime nexus with economics. Crime is rising at an alarming rate and the citizens lack proper explanation from the government and economists even though they continue paying heavy taxes to fund the security agents. There are a few studies on linking crime to economics factors even though we continue to receive mixed explanations from media and from politician as why we have such crime trend in Kenya. It is with this existing gap in Kenya that this research paper sought to address.

CHAPTER THREE

3.0 Methodology

This chapter presents times series data econometric model (Johansen cointegration and Error correction model) to analysis and test for economic determinants of crime. It also defines basic conceptual framework of the model that analyses the factors that affect crime (explanatory) variable versus crime (dependent variable).

3.1 Research Design

Most macroeconomics time series data are non-stationary and have unit roots which may lead to spurious and biased regressions if ordinary least squares methodology is used. It is due to reason that this study adopted the use of Johansen cointegration and Vector Error Correction Mechanism which was first introduced by Sargan and popularized by Engle and Granger in its analysis of the impact of economic determinant of crime trends and crime trends.

Luiz (2001), Syed (2009) and Dritsakis and Gkanas (2000) have all used similar model in their analysis of crime and its economic determinants.

3. 2 Theoretical framework

This paper is based on Becker (1968) and Erhlich (1973) hypothesis the extension given by Haddad and Moghadam (2008).Their papers presented the study that unravels the economic variables that determine the criminal behavior. Becker's assumption is that the cost benefit analysis of the returns from crime actually propels individual in commission of crime. The cost includes the probability of being convicted and this is also augmented by public expenditure on public judicial system and they constitute factors of consideration before crime commission

According to Becker (1968),the supply of crime **(C)** has a relationship to the probability of conviction **(CVN),**public expenditure on safety, law and order as proxy to increase in capacity of law agents to pursue crime**(PSLO)**,and other portmanteau variable (μ) .

$$C_j = C_j(CVN_j, PSLO_j, \mu)$$

Income levels and distribution affect the drive to commit crime, this extension given by Erhlich (1973), stated that an individual can participate in two market; legal and illegal activities one. The legal market net income is given by certain income $\mathbf{Y_{1(t)}}$,where **t** is time input. Activity **j** is risky and depends on the probability of conviction **(p)** and probability of not convicted **(1-p)** .When the an individual is not convicted he/she takes home the entire returns from crime$\mathbf{Y_{1(t)}}$, but if he/she is apprehended and convicted the returns from crime is discounted with the value of punishment/penalty. Erhlich assume that individuals are rational in making choices and therefore gives the following illegitimate behavioural function assuming individuals have constant characteristic and behavior;

$$G_i = Gi(CVN_i, Y_i, Y_j, R_i)$$

Where

$\mathbf{CVN_t}$= Probability of arrest (number of conviction to total reports to police **(p)**

$\mathbf{Y_i}$=illegal income opportunities

$\mathbf{Y_j}$=legal income opportunities

$\mathbf{K_i}$ = Economic determinants of crime (per capita income, expenditure)

Ehrlich, (1973, 1996) confirmed that the deterrence factors have a negative effect on crime. In that, if the probability of apprehension is high, then the rate crime will also go down.

Economic variables that are tested include Gross per capita income. We expect that when the economy is doing well in terms of its growth, we expected that there should be a negative

significant correlation between per capita and crime although other studies like Mashi and Masih, (1996) found a positive relationship, hence rendering it ambiguous. The expected positive relationship is ‘opportunity effect' when income increases it sets the opportunities for criminal offences, due to availability of large amount of stolen goods. On the other hand an income per capita decrease makes an increase in need for returns from illegal activities, known as ‘motivation effect’(Grogger,1998;machine and meguir,2000;Gould et al.2002).

Number of convicted person as a proxy of Deterrence factor is also another parameter we are testing in our model. We expect a negative relationship between crime and deterrence factor. When the rate of convictions increases then we expect number of criminals to decrease. Number of studies confirms this relation (Ehrlich, 1973; Dristakis and Gkanas 2000).

Public expenditure on safety, law and order is also our other variable under tested. When public expenditure increase crime is expected will reduce thus a negative relationship is expected with crime. This variable can be reduced further to conform to previous studies carried out to establish crime and the police expenditure. The increase in expenditure acts as a deterrence factor to crime because it augments the capacity of the judicial system to prevent crime.

3.2.1 Specification of the model

Starting from the theoretical framework based on Becker, (1968) and Ehrlich, (1973), we proposed Johansen cointegration and Vector Error Correction econometric Model and carried out granger causality to test the hypothesis of the economic model of crime trend and Economic determinants in Kenya with adjustment so that it can fit. The adjustment of the theoretical model by including the actual variables were used in the study:

CRM = ƒ (GDP, CNV, PSLO&CPI)

LN_CRM= ƒ (LN_GDP, LN_CVN, LN_PSLO ,LN-CPI)

Where

CRM *is total crime reported*

CONV *is total conviction as proxy of deterrence factor*

LN *is the natural log of the variables*

PSLO *Public expenditure on law, order and safety*

GDP *Gross per capita income*

CPI *Consumer price index*

3.2.2 Data Sources and measurement variables

This study made use of time series data of, Total annual crime, Total annual public expenditure on safety, law and order, and total annual conviction of 38 years (1975-2012).The data was collected from Kenya Bureau of statistical abstract and surveys publication of various years.. The Gross per capita income and consumer price index was collected from World Bank database.

A multivariate analysis was conducted and the data converted into their natural logs to make it normally distributed and eliminate issue of Heteroscedasticity.

3.2.3 Estimation Techniques

The co integration and Vector Error-correction methodology was used in this study. The Vector error correction modeling procedure involves first estimating the Correction Term model (residual model) for long run equilibrium and then short run relations. The VECM estimation helped to determine the way in which the short run dynamics of the time series eventually get a

stable long run equilibrium state and minimize the possibility of estimating spurious relations, while at the same time retaining the long run information. The selected data was analyzed using E-Views software and the results presented using both tables and charts.

3.3 Unit root tests

Most macroeconomics time-series data contain unit roots characterized by existence of stochastic trends (Nelson and Polser, 1982). Unit root test was essential for the existence of stationarity of time series data that was used to avoid spurious regression. We examined the stationarity of data using Augmented Dickey Fuller (1979). ADF test was defined through this general function:

$$\Delta Y_t = Y_0 + \varepsilon_t t + \Phi Y_{t-1} + \sum \Phi Y_{t-1} + \varepsilon_t$$

$$\Delta Y_t = Y_t - Y_{t-1}$$

Where

Δ =1st difference of variables

$\mathbf{Y_t}$ = Dependent variable

$\mathbf{Y_0}$= Constant term

$\mathbf{t}$ = Trend variable

$\boldsymbol{\varepsilon}_{\mathbf{t}}$= Stochastic disturbance term

Hypothesis test on series:

$H_0=\Phi=0$ (Y_t is non-Stationary)/**$H_0=\Phi\neq0$** (Y_t is Stationary)

3.4. Cointegration tests

Cointegration simply refers to variables that drift together although individually they are non-stationary in the sense they are time invariant. The common drifting of variables makes them have a linear relationship over a long time.

Crime trends and independent variables tested were all integrated at order one I (1).Therefore, applied Johansen cointegration (1988) and johansen-Juselius (1990, 1992) to determine the number of available cointegrating vectors. We will then proceeded to determine sufficient lag length required for the model estimation and then determine the number of cointegration relations. To execute Johansen's cointegration test, the vector error-correction model (VECM) was estimated took this form.

$$\Delta Y_t = \mu + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \ldots\ldots + \beta 2 \Delta Y_{t-p+1} + \beta_{p-1} \Pi Y_{t-p} + \varepsilon_{t\,t}$$

Where:

Δ *The 1st differences of the variables*

Y_t *is a 5x1 vector of stochastic variables*

μ *is a 5x1 vector intercepts*

β *(i=1, 2…p-1) is a 5x5coefficient's matrix*

Π *5x5Coeffiffient*

ε_t *5x1 Residual vector*

3.5 The Vector Error Correction Model (VECM)

After determining the cointegrating among the model variables, we used residuals as an error correction term in the Vector Error Correction Model (VECM), which is resulted for long-run equilibrium relationship and was expressed as:

$$\Delta LN\_CRN = Lagged\ \beta\ (LN\_CRM_t, LN\_CVN_t, LN\_GDP_t, LN\_PSLO_t) + \lambda \mu_{t-1} + V_t$$

Where

$\Delta$is the 1st difference of the variables in the system

($0 < \lambda > -1$) is a 5x5 coefficient matrix- is the Long run convergence coefficient, which represents the dependent variable's reaction from equilibrium state in the beginning of each time period t.

B Short run coefficients

μ_{t-1} is the residual vector-estimated residuals of co integrating regression (long run relationship) representing the deviation from the equilibrium state, during time period **t**

$\mathbf{V_t}$ is the 5x1 vector of white noise

Breusch-Pagan Godfrey LM tests was conducted to check for serial correlation in the model test and Breusch-Pagan Godfrey was used to check for the presence of heteroscedasticity. Normality of the residual was also tested.

3.6 Granger Causality Tests

Granger Representation Theorem assumes that, if the variables are cointegrated there must be Granger causality in at least one direction to hold the long run relationship. In this respect, we employed modified Wald (MWALD) causality test (Toda & Yamamoto, 1995; Dolado & Lütkepohl, 1996) to determine the causality direction between crime rate and its determinants. The causality test was compelled because the presence of cointegration does not imply causation and the causality direction is vital to envisage some useful policy implication for the Kenyan economy. We use Wald test restriction on the parameters of the VAR (k) model.

This test is assumed having an asymptotic Chi-square distribution with *k* degrees of freedom in the limit when a VAR(*k+d*)*max is* estimated where *k* is the lag order used in VAR and *d(max)*is the maximum order of integration of the series in the system. We first determine the optimal lag *k* and the maximum order of integration of the variable in the model. The level of VAR is given as *P=k+d (max)* and finally the application of Wald test to the first *K* VAR coefficient matrix to make Granger causal inference. The model is specified as below

$$Y_t = \beta_0 + \Sigma^{k+d}_{t=1} \lambda_{1i} Y_{t-i} + \Sigma^{k+d}_{t=1} \lambda_{2i} X_{t-i} + U_{yt}$$

$$X_t = \beta_0 + \Sigma^{k+d}_{t=1} \lambda_{1i} X_{t-i} + \Sigma^{k+d}_{t=1} \lambda_{2i} Y_{t-i} + U_{yt}$$

Where

Y_t *is a dependent variable against independent variable* X_t

X_t *is a dependent variable against independent variable* Y_t

k *is the optimal lag*

d *is maximal order of integration of the series in the system*

Ut *is the white noise error terms*

The Wald test is then applied using the 1st k coefficient matrices using the standard Chi square statistics and testing the null hypothesis if the variables under test granger cause crime or not either jointly or in pairs.

CHAPTER FOUR

4.0 Findings and Discussions

This Chapter presents the results that have been obtained from empirical econometric testing and discusses the meaning of the results based on the figures obtained from the tests that the data has been subjected to. The results, according to the calculated statistics show that all variables were integrated of order one. I (1), hence they were stationary after 1st difference.

4.1 Testing Variables for unit root test for

Table1. Presents the augmented Dickey-Fuller (1979) tests for variables integrated to me (0) and me (1) respectively.

Table1. Test Of unit test at Level I (0)

Variable	ADF-Test statistics	Critical value	D Watson stat
LN_CRM	-2.792965	-2.943427**	2.044916
LN_CVN	-1.087224	-2.943427**	2.52583
LN_GDP	-2.317305	-2.945842**	1.698549
LN_CPI -	0.864211	-2.943427**	1.783565
LN_PSLO	-1.330037	-2.943427**	1.689110

Table 2. Test of unit test at 1st Difference I (1)

Variable	ADF-Test statistics	Critical value	D Watson stat
LN_CRM	-7.167587	-2.945842**	2.016153
LN_CVN	-8.469025	-2.945842**	2.068127
LN_PSLO	-5.169315	-2.945842**	1.77063
LN_GDP	-3.690675	-2.94542**	1.583780
LN_CPI	-5.174016	-2.94542**	2.027789

*Mackinnon critical value at 1 percent level of significance

** Mackinnon critical value at 5 percent level of significance

The natural log of Crime was found to be stationary in their 1st differences because the ADF-test (-7.16787) which was less than the Mackinnon critical value (-2.945842**) at 5 percent level of significance and the natural log of conviction was also found to be stationary at their 1st difference because the ADF-test (-8.469025) was less than the Mackinnon critical value (-2.945842**) while the Natural log of GDP per capita had ADF statistic of (-3.690675), Mackinnon statistic of (-2.94542**) and public expenditure on safety, law and order ADF statistic was (-5.169315) and MacKinnon critical value of(-2.94542**) .Also The natural log of consumer price index had ADF statistic value of (-5.174016) which was less than the Mackinnon critical statistic value(-2.94542**) at 1st difference hence stationary. All the variables under test were stationary at 1st difference, hence conforming to Johansen criteria.

4.2 Johansen Cointegration test

Johansen cointegration requires sufficient lag length necessary for VECM model estimation We obtained the best specification that determined the number of cointergrating relations defining the long run crime with relations to independent variable by defining their significances since results showed that each of the series were integrated of order one, I(1), we carried out the Johansen's cointegration test to determine the existence of long run equilibrium relationship. We therefore started by determining the optimal lag structure of the VAR system.

The AIC, SBC, FPE and HQ information criterion were used to choose an appropriate lag structure for the VAR system. They AIC suggested 3 lags while the rest suggested lag one of VAR was the best and this is consistent with the usual empirical studies and practices that the maximum lag structure for annual data analysis should not exceed 3 years (see Enders, 2004). The results for lag selection are reported in table 3.

Table 3: lags selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	22.53280	NA	2.53e-07	-1.001874	-0.779682	-0.925174
1	209.3711	309.6177*	2.48e-11*	-10.24978	-8.916621*	-9.789571*
2	231.4159	30.23288	3.22e-11	-10.08091	-7.636790	-9.237199
3	260.4923	31.56872	3.29e-11	-10.31385*	-6.758767	-9.086635

* 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: Hannah-Quinn information criterion

The second step was to establish the number of cointegrating relations, we used both the trace values and Eigen values test and according to the results we reject the null hypothesis that there is no cointegrating vector at 0.05 percent level of significance as shown in the tables below. Hence, we concluded that there exists one cointegrating vector among (CRM, GDP, PSLO, CPI &CVN).

Cointegration test based on maximum likelihood method of Johansen (1979) suggest two test (the Trace test and the maximum Eigen values as given in table 4&5) statistic to determine the cointegrating rank. Assuming no linear deterministic trend, a lag difference of one and Mackinnon-Haug-Michelis (1999) p-values, we see that the null hypothesis of no cointegrating relationship rejected at 5 percent where trace statistic=56.47904> critical value=54.07904(p-value:0.0301) indicating two cointegrating equations. The maximum Eigen value test indicates one cointegrating equation and therefore we reject the null hypothesis that there is no cointegrating equation, maximum Eigen value=47.35106> the MacKinnon critical value=34.80587:p-value of 0.0010.

Table 4: Unrestricted Cointegration Rank Test (Trace)

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.731608	103.8301	76.97277	0.0001
At most 1 *	0.517698	56.47904	54.07904	0.0301
At most 2	0.417856	30.22841	35.19275	0.1556
At most 3	0.154429	10.75109	20.26184	0.5662
At most 4	0.122692	4.712317	9.164546	0.3164

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

* denotes rejection of the hypothesis at the 0.05 level

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

Table 5: Rank Test (Maximum Eigen value)

Unrestricted Cointegration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.731608	47.35106	34.80587	0.0010
At most 1	0.517698	26.25063	28.58808	0.0966
At most 2	0.417856	19.47732	22.29962	0.1183
At most 3	0.154429	6.038771	15.89210	0.7836
At most 4	0.122692	4.712317	9.164546	0.3164

Max-Eigen value test indicates 1 cointegrating equation (s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Table 6: Normalized cointegration equation showing long run Elasticity

1 Cointegrating Equation(s):		Log likelihood	209.8624		

Normalized cointegrating coefficients (standard error in parentheses)

LN_CRM	LN_CPI	LN_CVN	LN_GDP	LN_PSLO	C
1.000000	-0.203698	-0.440443	-9.620680	2.753016	36.79484
	(0.07123)	(0.09756)	(1.93889)	(0.39224)	(10.6239)

T-statistic CPI=2.8596, CVN=4.5146, GDP=4.96195, PSLO=7.02707

Since the variables are cointegrated, the normalized coefficients in table 6 support our views that a decrease in conviction leads to crime increase and this is consistent with the theory. Decrease in GDP per capita will lead crime rate to increase in the long run and this is consistent with (Meera and Jayakumar1995:Grogger,1998:Machin&Mehuir 2000),Moreover, CPI had a negative coefficient which was statistically significant which was contrary to the theory, according to Tang and Lean,2007a,they found out that CPI may not have immediate effect because it takes time for it to reduce the purchasing power and also depending on the wellbeing of the economy captured by the GDP per capita. On the other hand, PSLO had a positive effect on crime rate and this evidence is supported by other studies such as(Michael, Greenwood and Walter, 1973).

The long run normalized equation taken from Johansen-Cointegration test takes the following format.

LN_CRM=36.79484-0.203698LN_CPI-

0.440443LN_CVN9.620680LN_GDP+2.753016LN_PSLO

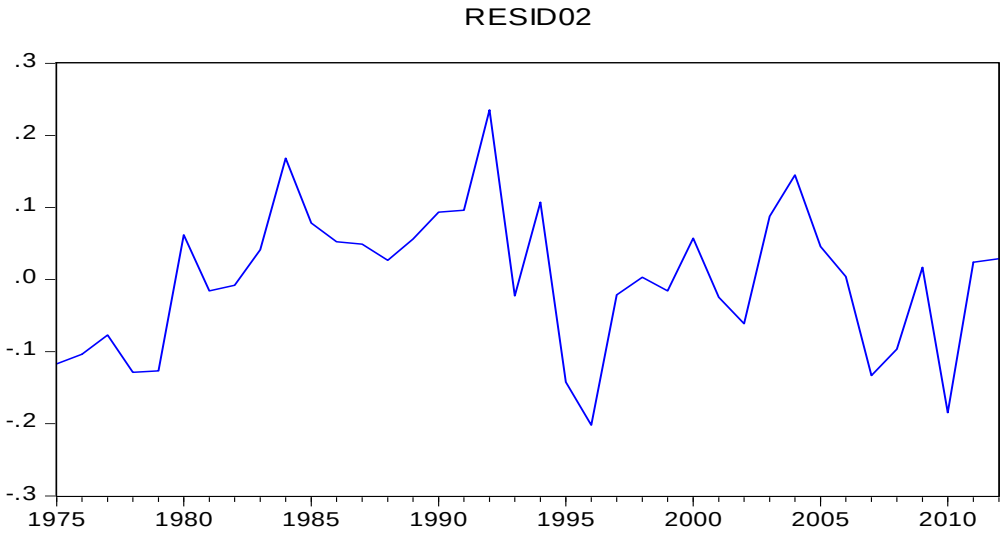
Table 7: Unit root test of Residual

Null Hypothesis: RESID01 has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.127955	0.0026
Test critical values:	1% level	-3.621023	
	5% level	-2.943427	
	10% level	-2.610263	

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

Figure 2:Normality for residual



The ADF-test of the Error term was found to be stationary at level I (0),wherby the Mackinnon critical value (-2943427) was greater than theADF-test value(-4.127955) as shown in table 7 above.The stationarity of the ECT is also shown in the line graph 2

Table 8.Vetor Error Correction Model

Dependent Variable: D(LN_CRM)

D(LN_CRM) = C(1)*(LN_CRM(-1) + 0.0349417748432*LN_CPI(-1) + 0.180595135458*LN_CVN(-1) - 1.84475998612*LN_GDP2(-1) - 0.260397104913*LN_PBC(-1) - 0.0588784808853) + C(2) *D(LN_CRM(-1)) + C(3)*D(LN_CRM(-2)) + C(4)*D(LN_CPI(-1)) + C(5) *D(LN_CPI(-2)) + C(6)*D(LN_CVN(-1)) + C(7)*D(LN_CVN(-2)) + C(8) *D(LN_GDP2(-1)) + C(9)*D(LN_GDP2(-2)) + C(10)*D(LN_PBC(-1)) + C(11)*D(LN_PBC(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.381061	0.111753	-3.409859	0.0024
C(2)	-0.272375	0.171663	-1.586687	0.1262

C(3)	-0.146755	0.199322	-0.736274	0.4690
C(4)	-0.094039	0.185722	-0.506342	0.6174
C(5)	-0.303744	0.180063	-1.686871	0.1051
C(6)	0.053510	0.047952	1.115928	0.2760
C(7)	0.082345	0.049280	1.670967	0.1083
C(8)	-0.659813	0.967574	-0.681925	0.5021
C(9)	0.329544	0.954620	0.345209	0.7331
C(10)	-0.285478	0.132321	-2.157463	0.0417
C(11)	-0.146809	0.129745	-1.131524	0.2695
C(12)	0.065891	0.034677	1.900137	0.0700

R-squared	0.588049
Adjusted R-squared	0.391029
Durbin-Watson stat	2.120327
Prob(F-statistic)	0.012998

Where

C (1) is Error correcting term

The results are reported in Table 7 shows that lagged error-correction terms C (1) has a negative sign and is statistically significant at 5 per cent level. This affirmed that the finding from Johansen (2002) test that a long run relationship exists is valid (see Kremers et al., 1992) Kenya.

PSLO lagged to one year period corrects for disequilibrium with crime at a rate of 29 percent each year. Furthermore, the coefficient on the lagged error-correction term is (–0.38), which means that the speed of convergence to the long run equilibrium is high. Crime corrects for disequilibrium in the long run at a speed of 38percent each year. The R-square value is 59% and this is quite high therefore good. The F-statistic is also statistically significant (p-value of 0.004310 which is far less than 0.05).The Durbin Watson test is 2.120327 which is close to 2 hence good.

Granger Causality Test (Wald) test for short run causality

Coefficient diagnostic

The result of causality test for combination of various independent variables was given as Tables below using the Wald test.

Table 9: CPI combined to crime

Test Statistic	Value	Df	Probability
F-statistic	1.644056	(2, 23)	0.2151
Chi-square	3.288112	2	0.1932

Null Hypothesis: C(4)=C(5)=0

CPI has short run causality or not. Wald statistics to C (4) = C(5)=0,The null hypothesis was that there was no short run causality running from CPI to crime against the alternative null

hypothesis and hence, the null hypothesis that there is no causality was not rejected at 5 percent level of significance..

Table 10: Conviction Combined to crime- Null hypothesis c (6) =c (7) =0

Wald Test:

Equation: Untitled

Test Statistic	Value	Df	Probability
F-statistic	1.908148	(2, 23)	0.1711
Chi-square	3.816295	2	0.1484

When we tested the null hypothesis c (6) =c (7) =0, that there is no short run causality running from conviction to crime. The null hypothesis is not rejected because the chi-Square statistic is more than 0.05. In our case the chi-square is 0.6272.

Table 11: GDP per capita combined to crime- Null hypothesis c (8) =c (9) =0

Wald Test:

Test Statistic	Value	Df	Probability
F-statistic	0.238067	(2, 23)	0.7901
Chi-square	0.476135	2	0.7881

Null Hypothesis: C(8)=C(9)=0

We tested if GDP per capita had short run causality on crime or not. We test the following null hypothesis c (8) =c (9) =0.The Chi-square statistic was 0.6555 which was more than 0.05 hence we did not reject the null that there was no short run causality running from GDP per capita to crime.

Table12.Public Expenditure on safety law and order combined to crime

Wald Test:

Test Statistic	Value	Df	Probability
F-statistic	2.990536	(2, 23)	0.0701
Chi-square	5.981071	2	0.0503

We tested the null hypothesis that there was no short run causality running from PSLO to crime against the alternative null hypothesis [C(10)=C(11)=0].We rejected the null hypothesis because the Chi-square p-value was less than 0.05.

Table 13: Lagged Crime combined and current crime

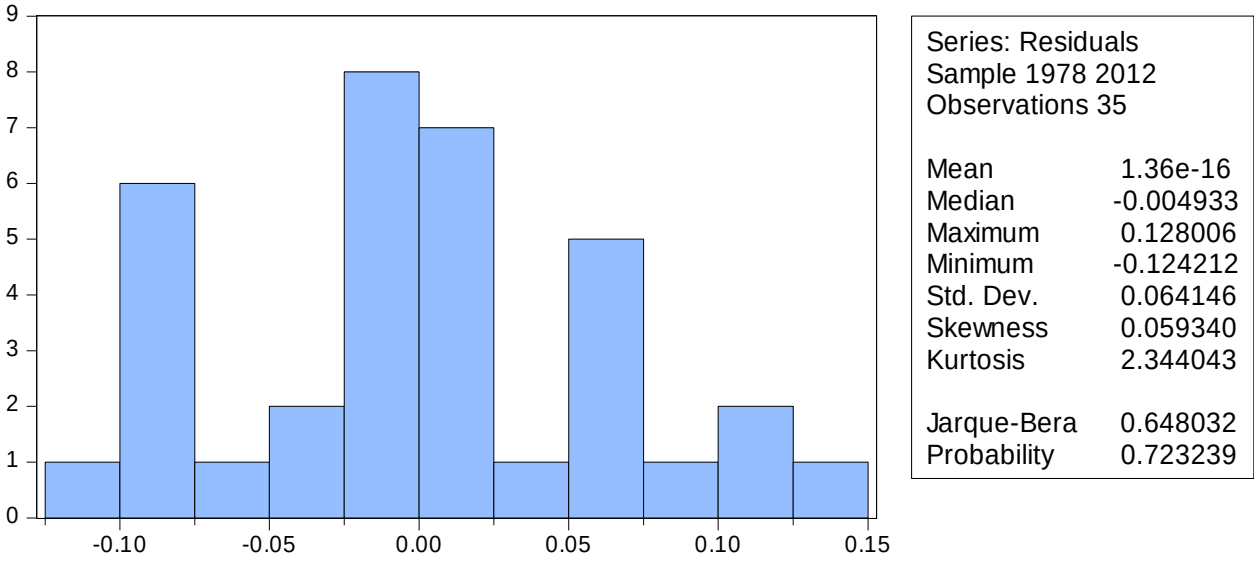
Wald Test:

Test Statistic	Value	Df	Probability
F-statistic	1.522626	(2, 23)	0.2393

Chi-square	3.045252	2	0.2181

We tested the null hypothesis that there was no short run causality running from lagged crime to current crime against the alternative null hypothesis that there was short run causality. The null hypothesis was not rejected because the Chi-Square p-value was more than 0.05.

Figure 3: Residual Diagnostic test
Normality test



We also tested whether the residual was normally distributed. We use the Jarque-Berra and probability value. In our case it was normally distributed as the Jarque-Berra value was less than probability values of 0.05.The null hypothesis were that the residuals were normally distributed against the alternative null hypothesis. The null hypothesis therefore was not rejected.

Table 14: Test for Serial correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.557695	Prob. F(2,21)	0.5808
Obs*R-squared	1.765227	Prob. Chi-Square(2)	0.4137

We also tested for serial correlation by using Breusch-Pagan Godfrey test and the null hypothesis was that there was no serial correlation against the alternative null hypothesis. In our case the Chi-square statistic value was 0.4137 meaning we did not reject the null hypothesis or there was no serial correlation in the residuals.

Table 15: Test for heteroscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.624366	Prob. F(15,19)	0.8207
Obs*R-squared	11.55602	Prob. Chi-Square(15)	0.7123
Scaled explained SS	3.353599	Prob. Chi-Square(15)	0.9992

We then moved to test for heteroscadasticity and we used Breusch-Pagan Godfrey test. The null hypothesis was that there was no heteroskedasticity against the alternative null hypothesis, if the Chi-square statistical probability value is more than 0.05.we did not reject the null hypothesis. In our case the Chi-square statistic (Obs* R-squared) value was 0.7123 meaning we did not reject the null hypothesis or therefore, there was no heteroskedasticity in the residuals.

CHAPTER FIVE

5.0 Introduction

The analysis of crime through econometric techniques is paramount for investigation of appropriate economic determinants that explain crime trends in Kenya and any other country in the world. The results may help formulate crime reduction policies.

5.1 Conclusion

The objective of the study was to examine and investigate the economic determinants of crime in Kenya and the study found out that public expenditure on safety, law and order, gross per capita and proxy of deterrent factor (convictions) are responsible for crime in Kenya. The Johansen's test reveals that the macroeconomic variables, convictions, GDP per capita, CPI and public expenditure on safety law and order were amalgamating with crime rate to achieve their steady-state equilibrium in the long run, although deviations may occur in the short run.

In this study, the normalized coefficients for GDP per capita and conviction are negatively related and PSLO are positively related to crime rate in Kenya over the period 1975 to 2012.the empirical evidence shows that Kenya's crime trend is Granger caused by PSLO, In other words there is short run causality running from PSLO to crime, meaning if there is a certain change in PSLO, there will be a unit change of crime.

The short run dynamics were established through the statistically significant signs of their P-values. The error Correction term in the VECM was negative and had statistically P-value showing the speed in which it adjusts to the long run equilibrium state.

The results show that Conviction in the long run has a negative impact on crime as given by the normalized coefficient in the cointegrating equation. This is also consistent with the economic model which uses it as a proxy for deterrence factor, but in there was no short run causality running from conviction to crime (Erhlich, 1973).

Public expenditure on safety, law and order is also supported by the economic theory and expected result in the short run is consistent with studies carried out and there was a short run causality running from PSLO to crime, the expected negative long run outcome was not achieved but turned out to be positive. However, some recent studies found out that an increase in police officers as a proxy of increase in public expenditure results in increase in measured crime rates.

One proposed explanation for this for this is that perhaps the expenditure on the law agencies performs two functions, crime detection and crime prevention. If the efficiency of the agencies in charge of crime, have higher efficiency in crime detection than crime prevention then the notion of positive relationship between crime and PSLO exist (Michael, Greenwood and Walter, 1973).In the short run the negative sign was consistent with the theory.

There are two explanations to the signs that were expected in our model, in regard to per capita income. Under the 'opportunity effect' higher per capita income leads to higher crime because opportunity increases for individuals to engage in criminal activities. When income per capita goes down leading to economic hardship and these increases the motivation to engage in criminal acts -this is known as 'motivation effect'. The long run model is consistent with the

motivation effect (Cantor and Land, 1985).The negative long run effect of CPI on crime was not conforming to the theory due to existence of trade of between the GDP per capita and realization of the existence of multicollineality of the two series.

5.2 Recommendation

In light of the results of this study, we have various recommendations to prevent the upsurge of crime in Kenya. The recommendations may help the government in formulation of policies that can be appropriate in crime prevention and move away from tradition reactionary way of crime reduction to preventive way.

Increase in conviction in the long run appear to deter crime, hence the sure way to sustain it is by strengthening of the judicial system in Kenya which ensures that persons committing crimes are convicted.

Economics of crime is new field of study in the developing countries, this is due the unavailability of literature on the same in the said countries and Kenya is not an exception. Much of the Literature used is from the countries in the west and a few from East. Therefore, there is need for more research on the field particularly in Kenya so as to fight crime through informed framework

5.3 Areas of further study research

Based on the findings of the study, the following suggestions for further research are put forward;

Further study should be done on effects of increasing the number of police officers, unemployment and increase economic growth on crime. These being the determinants the government has been hypothesizing as the main causes of crime in the country.

Due to the unavailability of time series data on unemployment, the total number of police, inequality, poverty level and literacy level, Primary studies should be encouraged to provide empirical data on the effects of those economic indicators of crime.

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Appendices

Appendix1.Annual time series Data used (1975-2012)

YEAR	CRIME	CONVICTIONS	GDP PER CAPITAL	PSLO	CPI
1975	69695	158183	477.1031	170	2.708327614
1976	70467	170155	469.6287	164	3.018404869
1977	68732	155187	495.229	240	3.465761582
1978	67368	133766	509.9975	249	4.052576794
1979	67786	130731	528.5166	284	4.375946186
1980	72555	132410	537.2676	447	4.982372749
1981	69090	135336	536.6514	406	5.560480122
1982	71259	146192	524.3027	366	6.709648682
1983	75803	140634	511.3194	328	7.474399862
1984	84720	162709	501.0386	327	8.243074484
1985	80033	160344	503.5127	312	9.315215442
1986	78286	154305	520.2735	355	9.551288711
1987	78843	162452	531.7099	377	10.37629781
1988	79758	177839	545.1316	382	11.64894691
1989	83830	186171	551.3175	365	13.25525716
1990	88582	169102	555.3262	366	15.61228239
1991	91404	175717	544.9383	336	18.74793055
1992	101966	169287	523.311	326	23.87218326
1993	87867	180282	508.8554	223	34.84834606
1994	94702	183558	506.6538	268	44.8896842
1995	70985	163408	513.8635	330	45.5874172
1996	63425	186244	520.5878	427	49.62832572
1997	72961	193272	509.3722	453	55.26701919
1998	73673	208192	512.6941	475	58.98230946
1999	74990	226631	511.1533	423	62.36907432

2000	80145	253732	500.9634	406	68.59352362
2001	75352	273928	506.2846	404	72.52983029
2002	70423	284160	495.5686	398	73.95236381
2003	77340	331173	496.493	440	81.21129906
2004	83841	395322	507.9098	462	100
2005	75400	355481	523.6138	524	90.65132933
2006	72225	326470	542.0424	612	114.4537342
2007	63028	371976	564.6668	721	125.623137
2008	63976	159653	558.1932	786	158.5864179
2009	72255	299693	558.3204	768	173.2304874
2010	61120	363016	574.8533	787	180.0928207
2011	75733	392982	574.8533	800	205.3446254
2012	77852	434400	592.9236	862	224.6026572

Group Descriptive statistics

	LN_CRM	LN_CPI	LN_CVN	LN_GDP2	LN_PBC
Mean	11.23183	3.306274	10.11559	6.261881	5.985670
Median	11.22752	3.677607	9.752542	6.254657	5.965936
Maximum	11.53239	5.414333	11.64472	6.385065	6.759255
Minimum	11.02059	0.996331	9.121400	6.151942	5.099866
Std. Dev.	0.114308	1.371883	0.826145	0.052294	0.403746
Skewness	0.489317	-0.133366	0.879836	0.322742	0.068517
Kurtosis	3.100469	1.666142	2.154149	2.720174	2.919023
Jarque-Berra	1.532382	2.929677	6.035518	0.783673	0.040115
Probability	0.464780	0.231115	0.048911	0.675815	0.980142
Sum	426.8094	125.6384	384.3923	237.9515	227.4555
Sum Sq. Dev.	0.483455	69.63629	25.25307	0.101184	6.031398
Observations	38	38	38	38	38