The Socio-economic Determinants of Violent Crime in Jamaica

Kerry Gilbert[1] and Sandra Sookram[2]

Abstract

Social and economic factors have an impact on the state of people's lives which in turn influence their behaviour. The key objective of this study is to determine which of these factors contribute to the rate of violent crime in Jamaica so that the Government can utilise more effective methods to curb the occurrence of violent crime. A vector autoregression (VAR) model is employed to ascertain the relationship among socio-economic variables (social expenditure as a percentage of GDP, the clear-up rate, the size of the police force) and the rate of violent crime over a 30-year period. Using innovation accounting, the causality and significance of the variables in relation to the rate of violent crime is attained. Results show that social expenditure as a percentage of GDP explains the variation in the violent crime rate by approximately 1% at the end of a 25-year period; however this impact is shown to be significant when the Granger Causality test is conducted. While social expenditure does not seem to influence the violent crime rate to a great extent, how it affects violent crime should be given consideration.

Keywords: violent crime, vector autogression model, Jamaica

DRAFT – DO NOT QUOTE

[1] Ministry of Planning, Housing and the Environment, Vision 2020 Office. E-mail: kerry.gilbert@gmail.com

[2] Sir Arthur Lewis Institute of Social and Economic Studies, The University of the West Indies, St. Augustine, Trinidad and Tobago. E-mail: sandra.sookram@sta.uwi.edu

Introduction

Jamaica is an English-speaking country located in the Caribbean Sea to the south of Cuba. Jamaica's potential for growth and development is immense; however, according the World Bank Country (2003), measured GDP growth over the years since 1972 has been unimpressive. Apart from its economic problems, Jamaica has a serious problem with crime. For years there have been numerous attempts, through policy and legislation, to reduce the level of crime in Jamaica. Based on international statistics, this is a country that has suffered from a high crime rate for years, being near the top of international homicide rate lists since the 1970's.

In this study an attempt will be made to provide some level of insight into the possible contributing factors to violent crime in Jamaica by employing a vector autoregressive model (VAR) for the period 1978-2008. The model employs the following variables: the clear-up rate, the size of the police force, social spending (education and health expenditure) as a percentage of GDP and the rate of violent crime and will cover a thirty-year period between 1978 and 2007. Two of the main reasons that this technique is being used are that there are no a priori restrictions and no strict economic theory underlying it.[3] In this way we will be able to determine the appropriate direction of causality among the variables and also identify the variables that actually contribute to the variance in the rate of violent crime.

The following section of the paper will briefly examine some of the stylized facts pertaining to crime in Jamaica. The paper will then examine the theories used to explain violence from the sociological and econometric points of view, followed by a look into studies specifically aimed at Jamaican society given its unique past and culture using a review of the literature. The subsequent

---

[3] Patrick Watson and Sonja Teelucksingh, *A Practical Introduction to Econometric Methods: Classical and Modern* (Barbados: University of the West Indies Press, 2002), 238.

sections consist of the methodology, results and analysis of the data and the conclusion inclusive of policy recommendations.

Stylised Facts on the Cost of Crime in Jamaica

Harriott (2002) claimed that the 'turning point' of the Jamaican violent crime situation took place in the 1976-1978 period. He felt that this may have been a consequence of the trouble that took place in the mid-1960s after which the violent crime rate kept moving upward.[4] Ellis (1991) suggested that the economic decline of the 1970's, which led the government into a relationship with the International Monetary Fund (IMF), might have also contributed to the level of violent crime in Jamaica. She posited that the extended period of economic hardship characterised by high energy costs, high interest rates on international capital markets and major capital flight mainly by the private sector, impacted the lives of every class in Jamaica. The effect, she claimed, might have been that the lower classes or less fortunate who were greatly burdened, sought ways to survive by any means necessary, which included illegitimate means. Using Merton's theory about society's response to anomic conditions referred to later on in the paper, she called this a new 'criminal innovation'.

The high crime rate has imposed large costs on the country. Alleyne and Boxill (2000) studied the impact of crime on tourism, one of the major revenue earners of Jamaica, and discovered that crime did not have a significant effect on tourist arrivals; however, in response, Harriott posited that the effect may not be visible in the short run.[5] The poor reputation may have

---

[4] Anthony Harriott, 'The Jamaican Crime Problem – Taking a New Turn and Presenting New Challenges'. Ideaz 1(2) 2002, 45.

[5] Anthony Harriott, "Editor's Overview" in *Understanding Crime in Jamaica: New Challenges for Public Policy*, ed. A. Harriott, xvi (Jamaica: University of the West Indies Press, 2003).

long run effects that discourage tourists from visiting the island, especially in times of financial crisis where tourists become even more selective when spending money.

The crime rate is also said to impact the level of foreign direct investment (FDI). According to the National Security Policy for Jamaica published by the Government of Jamaica, FDI is affected as a result of the increased cost of security, insurance, capital, and recurrent costs in addition to other costs that may be specific to each business. While policies may be in place to encourage FDI, the added cost may have a major deterrent effect on much needed investment in the Jamaican economy.

According to Harriott (2002) crime has been allowed to shape even the policy agenda. The crime level has been diverting attention and resources towards the development of new crime plans, thus causing the government to enter into new foreign debts to make implementation possible. Identifying at least some of the contributing factors of violent crime will help to focus the efforts and allow for more effective use of resources.

Literature Review

Various studies have been carried out in an attempt to identify the causes of crime. Theorists all admit that crime is a complex phenomenon and that finding the root of the problem is therefore very difficult. As Stephen Jones rightly put it "(T)he idea of a *cause* of violence must be treated with care."[6] This study in no way proposes to be able to discover 'the' cause of violent crime but only to identify some of these factors that once known may help in the fight against it.

---

[6] Stephen Jones, *Understanding Violent Crime* (Buckingham: Open University Press, 2000), xiii.

What is violent crime?

According to Jones the definition of violence is not fixed or set. He claims that the perception of what constitutes crime is a function of the society and may even vary within societies. Context is key. Jones claims that most persons would define violence in terms of the "infliction of physical injury by force", however, not too long ago the term has been used to describe significant psychological damage.[7] In addition to this, it has been said that oppression through racism or sexism, for instance, should also be considered as a form of violence.

In spite of these varied definitions this study will be looking at violent crimes as defined by shooting with intent and felonious wounding. In Jamaica these are all violations of the constitution and are punishable by law.

Major Theories of Violent Crime

There are many possible explanations of the occurrence of violent crime. We will explore a few below.

Economic Inequality and Violence

Even though there has been an increase in national wealth worldwide, the distribution of this wealth is far from equitable. There have also been some studies examining the correlation between violent crime and inequality. One manifestation of economic inequality is income inequality. Pablo Fajnzylber, Daniel Lederman and Norman Loayza investigated the 'robustness and causality of the link between income inequality and violent crime across countries.'[8] Part of their study involved examining the relationship between the Gini index (a measure of income inequality) and the rate of

---

[7] Jones, 4.

[8] Pablo Fajnzylber, Daniel Lederman and Norman Loayza, *"Inequality and Violent Crime"* Journal of Law and Economics 45 (2002): 2.

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.[9]

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.[10] These theorists claim that societies are made up of groups with different concerns and values and the government takes care of the group with the greatest influence (money and power); hence, conflict erupts between the government, trying to subdue the powerless, and the powerless, trying to assert themselves into a position of greater power.[11]

Marxist criminology has considered a particular type of the conflict theory where the conflict is as a result of power generated by capitalism, echoing the sentiments of Engels from 1845. Marx wrote very little with respect to crime however many came after and built on the platform that he laid. One such person was the criminologist Willem Bonger who believed that the capitalist system was mainly responsible for crime since it encouraged self-indulgence and self-centeredness.[12] Bonger also felt that the capitalist system as a result of the creation of selfishness would cause people to

---

[9] ibid, 1 and 25.

[10] Florida State University, Conflict, http://www.criminology.fsu.edu/crimtheory/conflict.htm (accessed June 17, 2009)

[11] Jones, 107.

[12] Jones, 108.

move away from values such as philanthropy and altruism. The conclusion: "Violence in general results from the degradation of the individual and the military ethos of capitalist societies."[13]

While it is true that greed and selfishness may be drivers of crime to some extent, there are cases in which a culture of deprivation can lead one to believe that advancement, provision for one's family and enjoyment of a good standard of living is unattainable or slow via legal means. The phrase "money talks" comes to mind. If the government does not ensure that those who are not financially capable are able to access the necessary resources for which taxes are paid (in spite of Jamaica's tax collection issues), then the feeling of being marginalized is inevitable. This leads to the frustration and disenfranchisement referred to earlier.

Anomie and Strain

One of the world's most renowned sociologists Emile Durkheim addressed the issue of strain contributing to the level of crime in a study that sought to link it to economic inequality.[14] According to Jones, Durkheim used the word 'anomie' in his writings at one point to describe a type of suicide, which he thought, was caused by significant changes to economic conditions either for the better or worse. This he said resulted in the breaking down of the boundaries that usually regulate social behaviour as well as the rule of law in daily life. Without these boundaries persons already deficient in self-control may enter a state of anomie or lawlessness. While this may be true in some cases the theory cannot be applied without acknowledging the limitations. There are countries, for example Haiti, in which economic conditions are in a very poor state; however the recorded crime rate is not as high as that of Jamaica.[15] The following example may be a testimony to this theory though: an

---

[13] ibid, 108.

[14] ibid, 108.

[15] Charles Arthur, "Murder in the Caribbean - how does Haiti compare?", *'Eye on the Caribbean', an AlterPresse service in conjunction with the Haiti Support Group,* February 3, 2006, http://www.alterpresse.org/spip.php?article4074 (accessed August 26, 2009)

article written by Bryan Robinson about the behaviour of Hurricane Katrina victims in the wake of the poor conditions, explained that as a result of the conditions, ordinary 'respectable' individuals were engaging in criminal activity including looting, rape and arson. They had to endure lack of running water, uncomfortably hot conditions and the strong unpleasant smell in the Superdome, or other facilities, as they waited for authorities to come to their rescue.

After Durkheim's death Robert Merton continued his work and theorized that the state of anomie was not reserved for times when there was a breakdown in the social parameters due to major economic change.[16] He felt that the pursuit of an ideal life filled with every material desire that one could imagine was enough to invoke that state. He recognized that the inability to attain this desire produced one of five certain responses, which depended on the availability of established ways of achieving them and the character of the individual. The first response is the socially acceptable route involving hard work, honesty and education among other things. The other four means are 'innovation', 'ritualism', 'retreatism' and 'rebellion'. With respect to this study, innovation is the response of interest. It is the preferred direction of one who feels that the honest way is not capable of ensuring that they achieve all their material goals.[17] As a result the individual finds any outlet needed to achieve it.

Control Theory

As with other theories, there were objections to the strain theory and out of this emerged the control theory. Hirschi and other control theorists claim that crime is a normal part of human behaviour as it is easier to acquire ones desires illegally than through legitimate means. They also believe that people are only discouraged from criminal activities by the controls or restraints which

---

[16] Jones, 108.

[17] ibid, 110.

are barriers to crime that they are subject to; hence the most effective way to deal with crime is to ask how to control it rather than what causes it.[18] There are three types of control referred to by theorists: direct, stake in conformity and internal.

Direct control refers to the kind that would come from family, friends, or simply very close relationships as well as effective and appropriate punishment for acts of crime. In his research, Hirschi discovered that persons who belonged to close-knit social groups such as families and schools were less prone to commit crime. This, of course, cannot operate without certain other values in place since it is well known that certain close-knit groups incite crime and violence. The research showed that this barrier was very significant in deterring acts of crime.

Having a stake in conformity mean that a person may have more to lose by committing a crime and hence will be dissuaded from such activities while internal control comes from a person's belief system and level of self-restraint.

Hirschi carried out further studies in collaboration with Gottfredson through which the theory that insufficient training at a young age will result in little self-restraint later on in life was developed. Assuming that this theory is true the education system has a very significant role to play in deterring crime and the government among other institutions should invest heavily in the optimum operation of this aspect of society.

When considered as a whole these theories are all related. They all agree that the poorer or more deprived classes are the ones most likely to commit crime especially those involving violence. Their reasoning may be slightly different but at the heart of it greed, selfishness, and inequality are common threads. To this list this study may add ill provision of necessities. There will never be one

---

[18] Law Library - American Law and Legal Information, "Crime Causation: Sociological Theories - Control Theory," Law Library, http://law.jrank.org/pages/816/Crime-Causation-Sociological-Theories-Control-theory.html (accessed July 28, 2009)

theory, which explains every situation as man, and times are changing rapidly. There are however these general similarities that can be found.

There have been some studies that examine crime in Jamaica. According to the World Bank Country Study of Jamaica (2003), the profile of the typical perpetrator is mainly a young male between the ages 14 to 24 years old who is poor and tends to also be the victim of violence. The study also used the work of Harriott (2003) to look at the possible determinants of violent crime. It discovered that the rate at which crimes are cleared up and more stringent sentences were significantly and negatively related with some forms of violent crime. It also found that higher per capita income; higher youth employment rates in addition to a greater portion of GDP used for income were also associated with less violent crime.

In a study was done by Ellis (1991) using multiple regression analysis it was found that the total number of crimes is positively related to the unemployment rate, the number of police and the age of followers 14 to 24 years while it was negatively related to the GDP, the food price index, and the arrest rate. The age of the followers was found to be the most significant factor contributing to the increase in violent crime namely robbery and shooting with intent. Meanwhile the rate of arrest showed a significant negative relationship with robbery in rural Jamaica only.

In the very extensive study of the causes of crime in Jamaica, Ellis (2001)[19] conducted interviews in a local prison. Her line of inquiry included the following views:

---

[19] Hyacinthe Ellis, 'Report on Research into the Causes of Crime and Violence in Jamaica: A Study of Prison Inmates' (2001)

- A high level of crime and violence in a society is a reflection of the actions of persons who are subject to systemic and systematic frustration and who live out the norms and codes of conduct to which they are exposed;

- The majority of these persons can be found in the areas of society that are relatively more economically deprived.

Her findings show that structural, social and psychological conditions were related to the level of crime and violence prevalent in Jamaica. The structural conditions to which she refers, speak of the way in which the social, economic and political parts of society relate. Social describes the "family life socialization and close interpersonal relationships." Economic refers to the creation of resources to meet basic material needs, the distribution of both income and income-generating capabilities. Political refers to power relationships between individuals and between groups.

The data analysis showed that violent crimes were predominantly occurring in urban communities where there were " (H)igh unemployment, low income, low educational levels, poor housing, high density per room, per house and per yard, very poor sanitation, irregular and illegal connections for water and light…" Her research also showed that some disputes that led to violence and in some cases death were often as a result of some trivial issue. This definitely speaks to the probability that frustration may be part of the reason that some individuals engage in violent criminal activity as some attacks were not premeditated but may have been as a result of a sudden release of anger. This is supported by the general strain theory mentioned before.

She did admit that the study was limited because it focused on inmates and was not inclusive of many criminals that have not been caught and the references are limited to certain types of crime. The study does not consider crimes that "do not constitute official statistics". This Ellis study, which

centered on the opinions of prison inmates, gave very good insight into the thinking patterns of some criminals in Jamaica.

The question that must then be answered should be whether or not the improvement of existing and/or the creation of new capital that enhance the standard of living in the society would help to reduce frustration and the related conflict that may contribute to the occurrence of violent crime. It is clear that this phenomenon cannot be explained by any one theory. Each perpetrator will most likely have a different reason or driving force behind his or her actions. These theories do however give some insight into some of the possible motivating factors underlying violent crime in Jamaica.

With regard to the econometric methodology chosen for this study, Corman et al. (1997) conducted a study of crime deterrence in New York using the VAR method. They claimed that in spite of the limitations of the VAR method of analysis, referred to in the methodology section, it was preferred to some other 'standard' models used to access the contributing factors of crime. They also state that VAR is a useful tool when seeking to prove the relevance of certain hypothesized relationships with respect to crime.

The study showed that the lagged values of the arrest rate had a significant effect on the current crime rate. It was shown to be exogenous to the model; in other words, in its variance decomposition it explained most of its own variation no matter the ordering. This means that it does not depend heavily on any of the other variables to determine its changes. According to the variance decomposition, the arrest rate explained more of the variation in the crime rate than the innovations in the crime rate itself. At the end of the study it was found that the arrest rate was a major deterrent of the crime rate. On the other hand the unemployment rate was shown to have very little impact on the crime rate.

Empirical testing of crime models encounters certain problems. Corman et al highlights two, namely, mutual causality between crime and the deterrence variables in a dynamic way which is not easily modeled using ordinary regression methods; and relative contributions of independent deterrence variables are not clear if multicollinearity exists among them. An alternative was therefore sought.

Corman et al claimed that by using the VAR technique one is able to estimate a dynamic structure in which all relevant variables are endogenous. This way certain identification restrictions were avoided. As a result of the need for few restrictions Spencer stated that the VAR technique did not have the problem of spurious specification assumptions and therefore specification errors that may occur in conventional macroeconomic methods.

The method has however had its share of criticism. If the data set was not large enough and the number of lags required was significant then over-parameterization would occur thus causing the number of degrees of freedom to be seriously diminished. In light of this the variables used will have to be chosen carefully. Even though limitations exist, Corman et al have said that the VAR technique is "a useful alternative to the standard models in analyzing what causes crime".

Data and Methodology

Sources of Data

Both crime and economic data are collected from the Jamaica Government publications namely the Economic and Social Survey Jamaica (ESSJ), which is published by the Planning Institute of Jamaica (PIOJ).

There was some difficulty in collecting data as the same publication changed the way data were presented or classified over time and the figures for the same variable were revised over time. When building time series models this is especially problematic, as the researcher would like to have consistent and accurate data for the entire period being studied. The most recent revised data were used, as far as was possible, to help ensure the greatest level of accuracy.

Variables Used

Crime Variables

The crime variable being used is the rate of violent crime per 100,000 where violent crime is defined as shooting with intent and felonious wounding. As Francis (2001) and Ellis (1991) highlighted, the figures obtained are those that have been reported and recorded by the police as some incidents may not actually be reported or recorded. Ellis (1991) used shooting with intent because there was always a clear victim and witness therefore the number of reports should almost be the exact number that is recorded. It is less subject to whether or not the victim trusts or has confidence in the police. Felonious wounding, which is a crime that also may be underreported, will be an indicator of the level of violence taking place in the society where the intent may not be to kill but simply to hurt out of rage or some other trivial reason.

Murder has been left out of the violent crime figure as it is suspected that the major determinants of this rate are not the same as that of the two used. Evidence of this was found in the

study conducted by Harriott et al (2003b) where the murder rate and the shooting with intent rate responded differently to six out of the nine variables used.

Social and Economic Variables

Social Expenditure as a Percentage of GDP

Social expenditure is defined here as the aggregate of spending on education and health, which are two of the most important elements of social investment. The expenditure on education is being used as an indicator of the level of investment made in the creation of opportunities for members of society to advance their knowledge and generate higher incomes. This figure also includes spending on training and cultural development, which is necessary for the development of the capacity to earn through various entrepreneurial pursuits. When combined with the policy environment, which is very supportive of this type of business development as mentioned earlier, this has the potential to boost the economy.

The expenditure on healthcare is an indicator of the government's effort to ensure that citizens are healthy and able to receive not only quality, timely healthcare but also able to pursue productive activities and earn revenue to take care of their families. In spite of the low cost at clinics and public hospitals[20], if those receiving the care are not able to get what they need in a similar fashion to those who utilise private institutions then there is room for discontent. The poor conditions that patients and staff face at public hospitals were highlighted earlier in the paper. Members of society are entitled to good and reliable service no matter their social or financial status in society.

The ratio being used is a reflection of the seriousness of the government with respect to both education and healthcare in relation to its other commitments. The downside of this figure

---

[20] The Star, "Healthcare Options," July 30, 2003, http://www.consumeraffairsjamaica.gov.jm/lowhealth_edge.htm (accessed July 2, 2009)

however, is that it does not show whether the funds are being used for worthwhile projects that are improving the educational level of those enrolled or the level of care and service given to patients or simply being wasted on projects that are not adequately addressing systemic problems in order to produce the required results.

Clear-Up Rate

The term cleared-up can be taken to mean that 'the person or persons have been arrested and charged for committing a crime'.[21] The clear-up rate is therefore the number of persons charged and is a reflection of the level of effectiveness of the law enforcement officers. The expectation, of course, is that the rate at which criminals are charged ought to serve as a deterrent to crime however this may not be the case. The clear-up rate may increase with the rate of crime; it may be summed up this way – more crimes mean more crimes to be cleared-up – hence the relationship is not a causal one but a spurious one. In Ellis' (1991) study she refers to this rate as the arrest rate and pointed out that a concern may arise when using this rate if it is calculated using the total reported crimes as the denominator given that not all committed crimes may be reported to or recorded by the police. Here the clear-up rate is calculated as a rate per 100,000 people, which eradicates this possible problem.

Size of the Police Force

The size of the police force, measured as the number of regular police officers per 100,000 persons, ought to act as a deterrent to violent crime. It is expected that the larger the size of the force, the greater the effort which in turn should reduce the incentive to criminals to commit crime. According to Ellis (1991), Ehrlich (1973) and Becker (1968) however, the relationship may be

---

[21] Peter Bunting MP, "Statement in the House of Representatives on Capital Punishment Retention" (Extract) November 2008 http://www.bunting.org.jm/pdfs/Death%20Penalty%20statement%20in%20Parliament%20PBunting.pdf (accessed July 11, 2009)

spurious and both variables are linked to the allocation of funds towards the fights against crime. As the crime rate increases the government tends to increase its attention toward the police force and seek to hire more police officers. Therefore, the crime rate may actually be influencing the number of police officers and not the other way around. Using the same reasoning put forward by Ellis (1991), this relationship must be explored, as policymakers tend to use this avenue as a means of controlling the crime rate.

The growth rate of GDP has been excluded from the study as this rate has been fairly stagnant over the period and therefore was not seen as a significant determinant. The Gini coefficient was also excluded as it has only been calculated in Jamaica as of 1989. In addition to these reasons the use of the VAR technique requires the greatest care in choosing variables so as not to create a situation where over-parameterization exists since the data set is so small. The variables chosen are the most relevant ones for this study.

Results and Analysis of Data
Testing for Unit Roots

All variables are being used in the natural log form in order to avoid problems with heteroscedasticity.[22]

Table 1
Augmented Dickey-Fuller Tests

---

[22] Sayed Hossain, "Econometrics Modelling: Frequently Asked Questions", (lecture, Multimedia University, Cyberjaya, Malaysia, n.d.). http://docs.google.com/gview?a=v&q=cache:3ly8LCVBmJoJ:www.sayedhossain.com/files/Econometrics.FAQ.pdf+optimal+lag+length+using+Eviews&hl=en&gl=jm (accessed July 14, 2009)

Variable	Violent Crime Rate	Social Exp/GDP	Clear-up Rate	Size of Police Force
ADF Level	-2.5405	-3.4942	-1.991	-0.9989
ADF 1st diff	-6.1627	-5.4241	-5.618	-4.8985

95% critical value for the Dickey-Fuller statistic (level) = -3.5742
95% critical value for the Dickey-Fuller statistic (1st diff) = -2.9810
90% critical value for the Dickey-Fuller statistic (level) = -3.2217
90% critical value for the Dickey-Fuller statistic (1st diff) = -2.6299

All four variables were tested for unit roots and the above (Table 1) were the results obtained. It is clear that they are all I(1). The test for variables in levels includes a constant and a trend term and the test in first differences includes a constant term only.

In spite of this, the paper will use the level variables since we do not want to lose the actual variables that are being tested. For the results to be understood in terms of the question being asked we will look at the variables as they are and not the differenced variables.

The VAR Model

The model will consist of 4 variables in total namely the clear-up rate, social expenditure as a percentage of GDP, the size of the police force and the violent crime rate.

$$Violent\ Crime\ Rate_t = \beta_1\ Clear\text{-}up\ Rate_t + \beta_2\ Size\ of\ Police\ Force_t + \beta_3\ Social$$

$$Expenditure\ as\ a\ Percentage\ of\ GDP_t + e_t$$

Estimating the VAR

The AIC indicated that the optimal lag length should be 5 lags while the SBC pointed to an optimal lag length of 1.

Table 2

18

Statistics used in determining appropriate lag length for 4-variable VAR

Order of VAR	5	4	3	2	1
AIC	-12.703*	-11.412	-10.374	-10.046	-10.440
SBC	-8.607	-8.097	-7.839	-8.291	-9.464*
LR	10.281	18.549	19.296	14.179	63.933*

The values followed by an asterisk are the lag orders indicated by the particular criterion. As stated earlier the SBC criterion is being used for the purpose of this paper hence the VAR was run using a lag order of 1.

The standard form VAR model will therefore look as follows:

$\textbf{VCrate}_t = a_1 \, VCrate_{t-1} + b_1 \, CLrate_{t-1} + c_1 \, No\_Police_{t-1} + d_1 \, Soc\_GDP_{t-1} + \varepsilon_{1t}$

$\textbf{CLrate}_t = f_1 \, VCrate_{t-1} + g_1 \, CLrate_{t-1} + h_1 \, No\_Police_{t-1} + k_1 \, Soc\_GDP_{t-1} + \varepsilon_{2t}$

$\textbf{No\_Police}_t = l_1 \, VCrate_{t-1} + m_1 \, CLrate_{t-1} + n_1 \, No\_Police_{t-1} + p_1 \, Soc\_GDP_{t-1} + \varepsilon_{3t}$

$\textbf{Soc\_GDP}_t = q_1 \, VCrate_{t-1} + r_1 \, CLrate_{t-1} + s_1 \, No\_Police_{t-1} + w_1 \, Soc\_GDP_{t-1} + \varepsilon_{4t}$

This model has four possible endogenous variables as far as the literature is concerned, which are $VCrate_t$, $CLrate_t$, No_Police_t and Soc_GDP_t. After the model has been estimated again using the lag length selected by the SBC criterion, innovation accounting is conducted in order to evaluate the results of the VAR. Firstly we will carry out the impulse response showing us the response of a variable to a shock in itself or in another variable. We will then conduct forecast error variance decomposition, which will reveal the level or the variance that is explained by itself and the other variables. This will help to ascertain the level of exogeneity or endogeneity of the variables; their correct ordering; and to establish the model.

Evaluation of VAR

Correlation Matrix

The correlation matrix was then obtained in order to help establish the best order of the variables before carrying out the Forecast Variance Decomposition whose results are dependent on the order of the variables. The most exogenous variables will be placed first then the 'target' variable will be placed last.[23] The variable, which is most highly correlated with the target variable, goes first in the ordering. Another way of possibly determining the best ordering is to use various orderings and look for the trends, which variable(s) seem to explain itself no matter which ordering.[24]

Table 3
Correlation Matrix

	Clear-up Rate	Size of Police Force	Social Expenditure/GDP	Violent Crime Rate
Clear-up Rate	1	0.1316	0.1216	0.8876
Size of Police Force	0.1316	1	0.5468	-0.0202
Social Expenditure/GDP	0.1216	0.5468	1	0.0524
Violent Crime Rate	0.8876	-0.0202	0.0524	1

Forecast Error Variance Decomposition

Based on the theory that the ordering may be derived using the correlation matrix, the following order was used: clear-up rate, social expenditure/GDP, size of police force, violent crime. We will look at the forecast error variance decomposition for the rate of violent crime first, as we

---

[23] Hossain,12.

[24] David E. Spencer, "Does Money Matter? The Robustness of Evidence from Vector Autoregressions" *Journal of Money, Credit and Banking*, Vol. 21, No. 4 (Nov., 1989) Blackwell Publishing via JSTOR http://www.jstor.org/stable/1992352 (accessed July, 14, 2009)

are mostly interested in the effect that the other variables have on this variable for the purpose of

this study.

Table 4
Forecast Error Variance Decomposition of the Violent Crime Rate (1)
Order: Clear-up Rate, Size of Police Force, Social Expenditure/GDP, Violent Crime Rate

Period	Violent Crime Rate	Clear-up Rate	Size of Police Force	Social Expenditure/GDP
1	19.25981	78.78064	1.646683	0.312871
2	18.43217	71.14022	5.044699	5.382910
3	18.63988	63.35274	11.27998	6.727399
4	19.00926	57.54291	17.00832	6.439516
5	19.16810	53.40780	21.61645	5.807643
6	19.09076	50.47304	25.23957	5.196638
7	18.85674	48.35444	28.11567	4.673146
8	18.54457	46.78064	30.44086	4.233936
9	18.20704	45.57212	32.35657	3.864264
10	17.87403	44.61354	33.96216	3.550274
11	17.56026	43.83102	35.32785	3.280879
12	17.27162	43.17668	36.50420	3.047507
13	17.00932	42.61871	37.52843	2.843545
14	16.77223	42.13541	38.42850	2.663855
15	16.55827	41.71146	39.22586	2.504402
16	16.36502	41.33576	39.93723	2.361986
17	16.19012	40.99999	40.57585	2.234038
18	16.03137	40.69779	41.15237	2.118474
19	15.88682	40.42416	41.67542	2.013593
20	15.75478	40.17512	42.15212	1.917986
21	15.63375	39.94742	42.58834	1.830483
22	15.52247	39.73840	42.98903	1.750100
23	15.41983	39.54582	43.35835	1.676007
24	15.32488	39.36780	43.69982	1.607497
25	15.23682	39.20276	44.01646	1.543966

It was seen that social spending/GDP was the most exogenous variable and hence should be at the

front of the ordering. Next in line was the size of the police force followed by the clear-up rate then

the target variable, violent crime rate. The following order was then tested: social expenditure/GDP, clear-up rate, size of the police then violent crime to ensure the accuracy of the ordering. After attempting a few more orderings it was discovered that the following ordering was the most appropriate.

Table 5
Forecast Error Variance Decomposition of the Violent Crime Rate (2)
New Order: Social Expenditure/GDP, Size of Police Force, Clear-up Rate, Violent Crime Rate

Period	Violent Crime Rate	Clear-up Rate	Size of Police Force	Social Expenditure/GDP
1	19.25981	80.12454	0.341077	0.274578
2	18.43217	72.69315	5.671045	3.203637
3	18.63988	64.32437	12.97262	4.063117
4	19.00926	57.83191	19.35344	3.805385
5	19.16810	53.04550	24.43297	3.353424
6	19.09076	49.51903	28.43417	2.956042
7	18.85674	46.87593	31.62767	2.639654
8	18.54457	44.84352	34.22399	2.387921
9	18.20704	43.23632	36.37308	2.183560
10	17.87403	41.93126	38.18061	2.014095
11	17.56026	40.84680	39.72195	1.870992
12	17.27162	39.92811	41.05194	1.748331
13	17.00932	39.13747	42.21133	1.641888
14	16.77223	38.44819	43.23102	1.548559
15	16.55827	37.84088	44.13484	1.466007
16	16.36502	37.30106	44.94148	1.392436
17	16.19012	36.81763	45.66582	1.326434
18	16.03137	36.38193	46.31982	1.266880
19	15.88682	35.98707	46.91324	1.212865
20	15.75478	35.62747	47.45410	1.163648
21	15.63375	35.29856	47.94907	1.118615
22	15.52247	34.99654	48.40374	1.077255
23	15.41983	34.71823	48.82281	1.039135
24	15.32488	34.46094	49.21029	1.003892
25	15.23682	34.22238	49.56960	0.971211

After the re-ordering however the variance of the rate of violent crime is mainly explained by the size of the police force at just below 50%. The clear-up rate was the major source of variation in the first part of the period up to about the 11th year. It does not follow too far behind explaining 34.22% after 25 years. Social spending/GDP explains 0.97% of it by the end of 25 years not having varied very much throughout. The violent crime rate explains approximately 15% of the variance in its own forecast error.

The table (Appendix A) is showing that the clear-up rate is very dependent on the size of the police force. The size of the police force explains almost 50% of its variation by the end of the period being examined. It follows explaining just below 40% of its own variance meaning that this variable is fairly exogenous. The impact of the violent crime rate on this rate began at zero and rose to 10.57%. Social expenditure has a negligible effect on this variable never rising above 1.5%.

The size of the police force is the most exogenous variable explaining 57.84% of its own variation by the end of the 25-year period (See Appendix B). Social expenditure/GDP seemed to have a strong impact on this variable during the first few years staying near to 30%. As time progressed its influence waned significantly. An emphasis on this type of spending may affect the size of the police force if it formed part of a drive by the government to provide better all-round service to the society through the investment in all aspects of life.   This explanation seems feasible however given the limited resources it may or may not be the case.

The clear-up rate seemed to be moving counter to the social spending /GDP as over the period its impact grew significantly from none to 27.65%. This is certainly in line with the expectations of theory; the rate at which the crimes are being solved ought to influence the size of the police force as the government seeks to deter violent crime at all costs. This reasoning is similar

to that of the impact of the violent crime rate on the variable being considered. It explains approximately 10% of the variation in the size of the police force.

The emphasis of the government on social spending is the most exogenous of the variables according to the causal orderings tried (See Appendix C). It accounts for over 80% of its own variation for the majority of the period, followed by the clear-up rate, which accounted for 9.65% of the variation by the end of the period under study. This is strange, as one would not usually link these two variables. Social spending may be affected by the clear-up rate as a result of the shift in government focus away from security toward education and health. The influence of the other two variables has not increased very much over the 25-year period. By the end they each account for approximately 5% of the total variance. This is not very high. Perhaps it should be higher in the case of the violent crime rate as this should encourage the government to invest more heavily in this aspect of the society's development and growth.

Impulse Response Function

Firstly let us consider the response of the violent crime rate to a shock in the clear-up rate during the first 10 years (See Figure 1). The violent crime rate clearly moves downward which is consistent with the literature, which claims that an increase in the clear-up rate (also called the arrest rate by Ellis, 1991) should cause a drop in the rate of violent crime. This makes sense intuitively as well. Interestingly enough, according to the graph, during the same period the clear-up rate responds to an increase in violent crime by increasing as well. This may bring to question whether or not the increase in the clear-up rate is simply a reflection of the increasing crime. The clear-up rate increased in response to the shock in the size of the police force. This is expected, as the more police officers on duty should aid in crime solving.

Next we look into the response of the violent crime rate to a shock in size of the police force over the first 10 years. The graph shows that initially violent crime jumped before settling at a higher level. This result is counter-intuitive, as the size of the police force should lower the number of incidents of violent crime. This result however is supported by previous studies such as Ellis (1991). On the other hand, as expected, there was an increase in the size of the police force in response to a shock in the rate of violent crime. The usual response of policymakers when crime levels rise is to invest in the recruitment of more police officers. Jamaica is no exception. The increase took place gradually as many a time the number of recruits has been below the target amount.

The next shock to consider is the shock to social expenditure/GDP and its impact on the violent crime rate during the first 10 years. The graph suggests that violent crime actually falls within the first two years before steadily rising again back to the steady state level. The shift in spending once used to improve access and service may create such an impact. During that period, according to the graph, a shock to the violent crime rate caused a reduction in social spending/GDP. This may be a reflection of the shift in focus of the government as it allocates more funds toward fighting crime seen at least partially in the increase in the size of the JCF. One of the graphs also indicates that an increase in the clear-up rate allow the government some room to divert their attention back to the basic needs of the society by an increase in the social spending percentage of GDP.

The violent crime rate responds to itself as expected; after the shock it settles at a higher rate than before. This can be explained by the Harriott's (2002) position that violence begets violence. This he claimed was born out of Jamaica's culture of violence starting with the occurrence of self-

administered punishment thus excluding the government from the process; a point which is corroborated by Ellis (1991). This may contribute the sense of impunity with respect to violence.

Together they are Granger causing the violent crime rate since the p-value is below the 5% level of significance. This result is expected and corroborates the hypothesis of this paper. These variables according to the literature should help reduce the violent crime rate in Jamaica.

Granger Causality Test

The results of the test are as follows:

Table 6

VAR Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: Violent Crime Rate			
Excluded	Chi-Square	DF	Prob. Value
Clear-up Rate	0.022080	1	0.8819
Size of Police Force	6.704381	1	0.0096
Social Expenditure/GDP	4.920973	1	0.0265
All	8.810334	3	0.0319

The null hypothesis of the test is that the variables are not causing the violent crime rate and based on the results we see that the clear-up rate is not Granger causing the violent crime rate. The p-value is way above any acceptable level of significance. This result is surprising as previous studies mentioned earlier (Ellis, 1991; Francis and Campbell, 2001) found that the clear-up rate was a definite deterrent to crime. This may be as a result of the fact that there is a lack of confidence in the JCF as a result of the reported corruption, in spite of any increase in the clear-up rate. This is also confirming that the reactionary approach to crime is not the best way to manage it.

The results indicating that the size of the police force is a major deterrent does however agree with results obtained by Ellis (1991). According to the results the level of emphasis the government

places on the social spending is also a significant factor contributing to the violent crime rate. It has

a short-term deterrent effect according to the impulse responses.

Conclusion

As has been proven before, the standard of living in Jamaica does have an impact on the rate of violent crime. The clear-up rate, size of the police force and social spending as a percentage of GDP have all proven to impact the rate of violent crime to varying extents. Since the size of the police force has the greatest deterring effect on the violent crime rate the previously made plans to improve the JCF through the reduction of corruption, increasing accountability and improving the way that police officers are viewed in the society will have a positive impact. While the impact of social spending is not as great as previously expected, its effect is significant nevertheless and hence should be taken seriously.

Some incidents of crime are not explained by the model and will happen whether or not the standard of living is improved as a result of factors outside of this model's purview. The model has considered, however, those incidents that may be avoided once those in power, in partnership with the society as a whole, engage in activities and projects that enhance life for all citizens rather than allow the feeling of marginalization or inequality to occur in any sector especially critical ones such as education or healthcare. The government must therefore continue its attempts to improve these systems among others so that future generations interact with a better way of life thus reducing the number of incidents of violent crime in the future.

Recommendations

Each ministry must have a clear understanding that they have a role to play in the fight against crime, as the real way to deal with it is not solely using a reactionary approach as we have seen but through the use of more preventative measures as well. Once the standard of living is improved (an effort that all ministries are responsible for) the rate of violent crime may be reduced.

Citizens are entitled to the best possible service from those whom they have elected and must not be allowed to feel marginalized no matter what.

There must also be greater investment in education and healthcare that will increase access to, improve the delivery of and reduce the cost of these key elements of a well functioning society. They should be seen as a means of wrestling violent crime. The crime problem must be tackled with the next generation in mind. There are criminals who have not yet committed crime but have the potential to, which may be found on the streets and in our schools. Through retraining and the provision of a better way of life, new more optimistic expectations may be created. Resources must therefore be poured into ensuring that they do not meet the same conditions as past and current generations.

There also needs to be more coordination among the ministries and other stakeholders to improve government performance. Jamaica has implemented some of the principles founded in the New Public Management model, which involves the decentralisation of systems in an effort to achieve more efficient performance and more effective service to the public. One example of this effort is the formation of Executive Agencies, which are semi-autonomous government bodies responsible for the enhancement of customer satisfaction and given more authority to manage their resources.[25] Even though these principles have been applied in part there is room for improvement. As discussed earlier the healthcare system has not benefitted as expected from decentralisation. There continues to be major inefficiencies and hence customer dissatisfaction.

Perhaps the government should focus more closely on enhancing coordination between ministries. Collaboration and communication are key since the resources available continue to be scarce and in very high demand. It will not only improve the use of resources but also allow for the

---

[25] Jamaica Information Service, "Executive Agencies", http://www.jis.gov.jm/Departments&Agencies/index.asp (accessed July 20, 2009)

citizens to interact with a different way of living. Once the tangible benefits such as greater levels of efficiency and more customer satisfaction are accomplished, other groups in society may be encouraged to move away from selfish practices. This would lessen the competition for the resources. This interdependency between government ministries may actually create a new culture in Jamaica. It has to start at the leadership level in order to be effective.

Future Research

Further research into this area should consider the link between the perception of corruption at the level of government/leadership and the rate of crime in the country. The question being answered is whether or not a link between the image projected by leadership and the behaviour of those being led exists. If a poor example is being perceived by the society with respect to those in authority then the people may learn to disrespect the laws, as they believe their leaders are doing. This is especially significant because no matter what measures are put in place to fight crime, the existence of a problem such as this one will negate them all. The purpose of such a study would be to draw attention to the responsibility of leadership to conduct of their affairs in an honest and respectable way in order to see real change in the behaviour and circumstances of citizens. The younger generation needs to find patterns of ethical and moral behaviour to follow or things will continue to progress along the current downward spiral.

Reference List

A Dynamic Analysis of Organized Crime in Jamaica
http://systemdynamics.org/conferences/2007/proceed/papers/WILKS382.pdf Accessed
June 18, 2009

Agnew's General Strain Theory
http://www.criminology.fsu.edu/crimtheory/agnew.htm Accessed June 24, 2009

Agung, I. Gusti N. 2009. *Time Series Data Analysis Using EViews.* Singapore: John Wiley and Sons
(Asia)

Americas Quarterly, "*AQ* talks to Jamaica's Carolyn Gomes, winner of the 2008 UN Human Rights
Prize." http://www.americasquarterly.org/interview-carolyn-gomes Accessed June 30, 2009

Arthur, Charles "Murder in the Caribbean - how does Haiti compare?" *'Eye on the Caribbean', an
AlterPresse service in conjunction with the Haiti Support Group,* February 3, 2006.
http://www.alterpresse.org/spip.php?article4074 Accessed August 26, 2009

Causes of Crime. www.preventingcrime.net/library/Causes_of_Crime.pdf Accessed June 10, 2009

Corman, H., Theodore Joyce, and Norman Lovitch. 1997. Crime, Deterrence and the Business Cycle
in New York City: A VAR Approach. *The Review of Economics and Statistics* 69 (4) (Nov.,
1987):695-700 via JSTOR http://www.jstor.org/stable/1935965 Accessed July 4, 2009

'Draconian laws' - Human-rights lobbyist outs Golding's anti-crime plan, *Jamaica Gleaner*, July 21,
2008 http://www.jamaicalabourparty.com/home/content/draconian-laws-human-rights-
lobbyist-outs-goldings-anti-crime-plan Accessed November 2008

Ellis, Hyacinthe. 2001. *Report on Research into the Causes of Crime and Violence in Jamaica: A Study
of Prison Inmates*.

Ellis, Hyacinthe. 1991. *Identifying Crime Correlates in a Developing Society: A study of socio-economic
and socio-demographic contributions to crime in Jamaica, 1950-1984.* New York: P. Lang

Executive Agencies, http://www.jis.gov.jm/Departments&Agencies/index.asp Accessed July 20,
2009

Fajnzylber, P., D. Lederman and N. Loayza. 1998. *Determinants of Crime Rates in Latin America and
the World: An Empirical Assessment.* Washington D.C.:Library of Congress Cataloging-in-
Publication Data.

Fajnzylber, P., D. Lederman and N. Loayza. 2002. Inequality and Violent Crime. *Journal of Law and
Economics* 45, 1-25.

Florida State University, Robert Agnew's General Strain Theory,
http://www.criminology.fsu.edu/crimtheory/agnew.htm Accessed June 24, 2009

Florida State University, Conflict, http://www.criminology.fsu.edu/crimtheory/conflict.htm
Accessed June 17, 2009

Harriott, Anthony. 2002. The Jamaican Crime Problem – Taking a New Turn and Presenting New
Challenges. *Ideaz* 1(2), 44-52.

Harriott, Anthony. 2003a. "Editor's Overview." In *Understanding Crime in Jamaica: New Challenges
for Public Policy*, ed. A. Harriott, i- xvi. Jamaica: University of the West Indies Press.

Harriott, A., A. Francis, C. Kirton, and G. Gibbison. 2003b. "Crime and Development: The Jamaican
Experience." Background paper prepared for World Bank report. University of the West
Indies, Kingston.

Jones, Stephen. 2000. *Understanding Violent Crime*. Buckingham: Open University Press.

Law Library - American Law and Legal Information. Crime Causation: Sociological Theories -

Control Theory. Law Library. http://law.jrank.org/pages/816/Crime-Causation-Sociological-Theories-Control-theory.html Accessed July 28, 2009

Litterman, Robert B. 1986. A Statistical Approach to Economic Forecasting. *Journal of Business and Economic Statistics* 4 (1) (Jan.,1986):1-4 via JSTOR http://www.jstor.org/stable/1391378 Accessed August 4, 2009

Neumayer, Eric. 2005. Inequality and Violent Crime: Evidence from Data on Robbery and Violent Theft. *Journal of Peace Research* 42 (1) (Jan., 2005):101-112 via JSTOR http://www.jstor.org/stable/30042245 Accessed June 1, 2009

Ozcicek, Omer and McMillin, W.D. *Lag Length Selection in Vector Autoregressive Models: Symmetric and Asymmetric Lags.* http://www.bus.lsu.edu/economics/papers/pap97_27.pdf Accessed July 14, 2009

Pudney, Stephen, Derek Deadman and David Pyle. 2000. The Relationship between Crime, Punishment and Economic Conditions: Is Reliable Inference Possible When Crimes Are Under-Recorded? *Journal of the Royal Statistical Society. Series A (Statistics in Society* 163 (1):81-97 Blackwell Publishing for the Royal Statistical Society via JSTOR http://www.jstor.org/stable/2680510 Accessed July 10, 2009

Robinson, Bryan. 2005. The Psychology of Looting: What's Behind the Lawlessness in Wake of Hurricane Katrina? http://abcnews.go.com/Health/HurricaneKatrina/Story?id=1087898&page=1

Sims, Christopher A. 1980. Macroeconomics and Reality. *Econometrica* 48 (1) (Jan., 1980):1-48. The Econometric Society via JSTOR http://www.jstor.org/stable/1912017 Accessed July 15, 2009

Spencer, David E. 1989. Does Money Matter? The Robustness of Evidence from Vector Autoregressions. *Journal of Money, Credit and Banking* 21 (4) (Nov., 1989):442-454 Blackwell Publishing via JSTOR http://www.jstor.org/stable/1992352 Accessed July 14, 2009

Stone, Michael. 2006. "Influences of a Positive Attitude in the Community Policing Officer: A Quantitative Analysis of Qualitative Concepts"(Abstract) *Paper presented at the annual meeting of the American Society of Criminology (ASC), Los Angeles Convention Center, Los Angeles, CA*, Nov 1, 2006 http://www.allacademic.com/meta/p_mla_apa_research_citation/1/2/6/5/9/p126593_index.html Accessed August 20, 2009

"The Police Executive Research Forum Violent Crime and Murder Reduction in Kingston Executive Summary and Strategies". 2001. Police Executive Research Forum, Washington D.C., http://www.farquharsoninstitute.org/current/jcf_perf_exec_summary_c.pdf Accessed August 20, 2009

The Report of the National Committee on Crime and Violence. 2002. http://www.jis.gov.jm/EXECUTIVE%20SUMMARY.pdf Accessed June 10, 2009

The World Bank. 2004. *A World Bank Country Study: The Road to Sustained Growth in Jamaica.* Washington D.C.: Library of Congress

University of Washington, "Multivariate Time Series", http://faculty.washington.edu/ezivot/econ584/notes/multivariatetimeseries.pdf Accessed July 3, 2009.

Watson, Patrick and Sonja Teelucksingh. 2002. *A Practical Introduction to Econometric Methods: Classical and Modern* Barbados: University of the West Indies Press.

Figure 1

Graphs of Impulse Responses to one-standard-error shocks in each variable
(95% confidence bands are shown)

Response to Cholesky One S.D. Innovations ± 2 S.E.
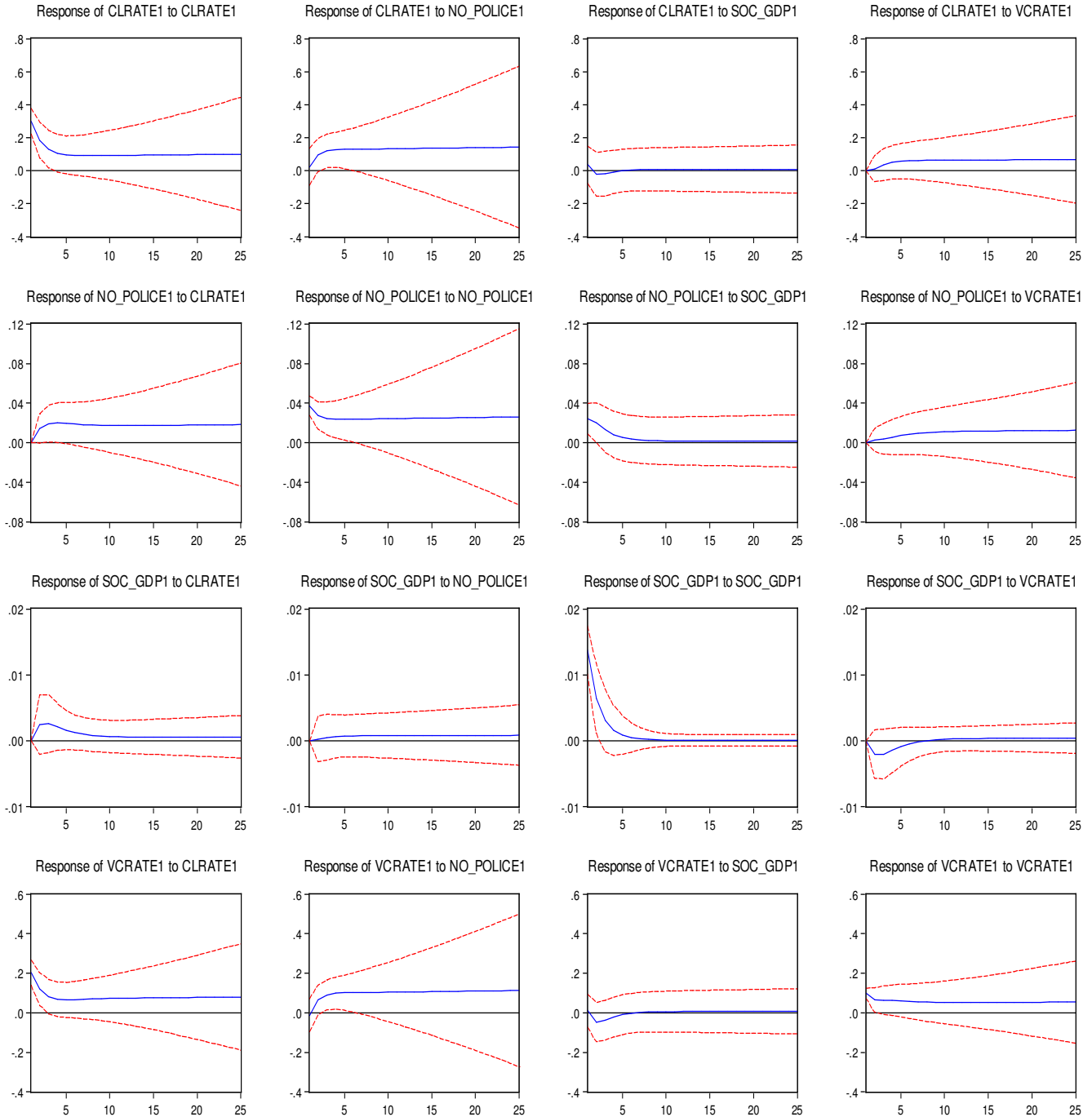
APPENDICES
Appendix A
Forecast Error Variance Decomposition of the Clear-up Rate

Period	Violent Crime Rate	Clear-up Rate	Size of Police Force	Social Expenditure/GDP
1	0.000000	97.91738	0.604243	1.478376
2	0.109683	91.46129	7.050622	1.378400
3	0.833181	83.78773	14.05113	1.327955
4	1.982999	76.86445	19.99182	1.160729
5	3.190409	71.07602	24.72066	1.012908
6	4.272201	66.35083	28.47169	0.905281
7	5.186616	62.49352	31.49356	0.826303
8	5.948351	59.31179	33.97457	0.765289
9	6.585335	56.65123	36.04747	0.715963
10	7.123656	54.39591	37.80561	0.674817
11	7.584119	52.46023	39.31589	0.639770
12	7.982533	50.78062	40.62738	0.609473
13	8.330809	49.30926	41.77695	0.582986
14	8.637990	48.00956	42.79283	0.559616
15	8.911040	46.85308	43.69704	0.538836
16	9.155409	45.81736	44.50700	0.520235
17	9.375426	44.88441	45.23668	0.503485
18	9.574577	44.03967	45.89743	0.488322
19	9.755705	43.27122	46.49854	0.474530
20	9.921153	42.56920	47.04771	0.461932
21	10.07287	41.92537	47.55138	0.450378
22	10.21250	41.33282	48.01494	0.439745
23	10.34143	40.78567	48.44298	0.429928

24	10.46083	40.27892	48.83941	0.420835
25	10.57172	39.80829	49.20760	0.412390

Appendix B
Forecast Error Variance Decomposition of the Size of the Police Force

Period	Violent Crime Rate	Clear-up Rate	Size of Police Force	Social Expenditure/GDP
1	0.000000	0.000000	70.10350	29.89650
2	0.219720	6.190092	63.81285	29.77734
3	0.507164	12.95707	60.61162	25.92414
4	0.942604	17.86198	59.05585	22.13957
5	1.542758	21.01527	58.33136	19.11061
6	2.258567	22.98419	58.00544	16.75181
7	3.021455	24.22620	57.86300	14.88934
8	3.775506	25.03389	57.80332	13.38729
9	4.486354	25.58130	57.78077	12.15158
10	5.137768	25.96983	57.77491	11.11749
11	5.725323	26.25861	57.77653	10.23954
12	6.251109	26.48256	57.78137	9.484970
13	6.720265	26.66273	57.78744	8.829563
14	7.138977	26.81216	57.79381	8.255051
15	7.513439	26.93913	57.80005	7.747384
16	7.849373	27.04910	57.80594	7.295584
17	8.151851	27.14577	57.81143	6.890946
18	8.425268	27.23175	57.81650	6.526481
19	8.673392	27.30894	57.82116	6.196513
20	8.899431	27.37874	57.82544	5.896386
21	9.106114	27.44226	57.82938	5.622244

22	9.295765	27.50036	57.83301	5.370868
23	9.470364	27.55373	57.83636	5.139547
24	9.631607	27.60295	57.83946	4.925985
25	9.780949	27.64849	57.84233	4.728223

Appendix C
<u>**Forecast Error Variance Decomposition of the Social Expenditure/GDP**</u>

Period	Violent Crime Rate	Clear-up Rate	Size of Police Force	Social Expenditure/GDP
1	0.000000	0.000000	0.000000	100.0000
2	1.749550	2.566668	0.028745	95.65504
3	3.189857	4.899037	0.127008	91.78410
4	3.880682	6.340425	0.281275	89.49762
5	4.116666	7.162358	0.466952	88.25402
6	4.161005	7.642488	0.667457	87.52905
7	4.147183	7.942891	0.874293	87.03563
8	4.127740	8.147558	1.083714	86.64099
9	4.118462	8.299502	1.294251	86.28778
10	4.121335	8.421368	1.505406	85.95189
11	4.134227	8.525568	1.717045	85.62316
12	4.154414	8.619174	1.929159	85.29725
13	4.179619	8.706348	2.141764	84.97227
14	4.208183	8.789601	2.354878	84.64734
15	4.238965	8.870471	2.568515	84.32205
16	4.271209	8.949914	2.782679	83.99620
17	4.304421	9.028525	2.997370	83.66968
18	4.338281	9.106678	3.212585	83.34246
19	4.372584	9.184608	3.428318	83.01449

20	4.407197	9.262462	3.644561	82.68578
21	4.442037	9.340331	3.861307	82.35632
22	4.477049	9.418273	4.078546	82.02613
23	4.512198	9.496323	4.296269	81.69521
24	4.547461	9.574500	4.514467	81.36357
25	4.582822	9.652817	4.733130	81.03123